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SMARTPHONE AND PRIVACY CONCERNS: NOT SO SMART

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Smartphones and Privacy

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RESUMO

O smartphone é um dos mais importantes dispositivos de tecnologia da informação e, por isso, os indivíduos sentem o desejo de se adaptar a este de modo a acompanhar os desenvolvimentos tecnológicos (Lee, Chang, Lin & Cheng, 2014).

Apesar de estudos recentes terem tentado desvendar as intenções comportamentais da adoção de smartphones (e.g. Bruner & Kumar, 2005; Liu & Yu, 2017), analisando diferentes fatores, há uma lacuna na análise da dimensão axiológica deste processo de decisão (Chun, Lee & Kim, 2012). A preocupação com a privacidade é um dos elementos mais relevantes (Pew Research Center, 2014) e por isso, o presente estudo procura testar em que medida a privacidade, enquanto expressão axiológica, se sobrepõe aos fatores hedónicos associados à intenção comportamental do uso do smartphone.

Com uma amostra de 211 utilizadores de smartphones procurámos compreender em que medida a importância da privacidade opera como moderadora num modelo que integra a facilidade de uso, a utilidade, e a diversão enquanto preditoras da intenção comportamental de uso do smartphone. Os resultados mostram que a privacidade é um elemento-chave da intenção comportamental de usar o smartphone, com ênfase particular nas aplicações relacionadas com a saúde.

Palavras-chave: Smartphone; Privacidade; Facilidade de Uso; Utilidade; Diversão; Intenção Comportamental

ABSTRACT

Smartphone is one of the most important information technology devices, so people feel the desire to adapt to it in order to keep up with technological developments (Lee, Chang, Lin & Cheng, 2014). Although recent studies have attempted to unravel the behavioral intentions to use smartphones (e.g. Bruner & Kumar, 2005; Liu & Yu, 2017) by analyzing different factors, there is a gap in the axiological dimension of this decision process (Chun, Lee & Kim, 2012). Privacy concern is one of the most relevant issues (Pew Research Center, 2014) and, consequently, this study is set to test in which measure privacy, as an axiological expression, override the hedonic factors associated with the behavioral intention of using smartphones.

With a sample of 211 smartphone users we tested in which measure the importance given to privacy acts as a moderator variable in a model that comprehens ease of use, usefulness, and fun as predictors of behavioral intention to use smartphones. Findings show privacy is a key-driver in the behavioral intention of using smartphone, with particular emphasis health-related apps.

Keywords: Smartphone; Privacy; Ease of Use; Usefulness; Fun; Behavioral Intention

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List of acronyms

MMS – Multimedia Messsaging Service

TAM – Technology Acceptance Model

EoU – Ease of Use

BI – Behavioral Intention

IT – Information Technology

c-TAM – Consumer Technology Acceptance Model

GDPR – General Data Protection Regulation

MDSP - Moral Development Scale for Professionals

CFI – Comparative Fit Index

TLI - Tucker-Lewis Index

RMSEA – Root Mean Square Error of Approximation

EVA – Average Extraction Variance

CR – Composite Reliability

CFA – Confirmatory Factor Analysis

AI – Artificial Intelligence

Introduction

The informatization of society has spread to all spheres of life and is inherent in all age groups. As such, it becomes difficult to imagine an individual acquiring knowledge without resorting to modern devices, among them, the smartphone (Naydenova & Shaposhnikova, 2016; Zhitomirsky-Geffet & Blau, 2016). In fact, people are becoming increasingly technology-dependent in various aspects of their lives and daily functioning, and smartphones are the spearhead of this process (Zhitomirsky-Geffet & Blau, 2016). As such, the smartphone is one of the most important information technology devices, so people feel the desire to adapt to it to keep up with technological developments (Lee, Chang, Lin & Cheng, 2014).

Recent studies have attempted to unravel the behavioral intentions to use smartphones (e.g., Bruner & Kumar, 2005) by analyzing different factors. However, there is a gap in the axiological aspect of this intention (Chun, Lee & Kim, 2012). Thus, the question arises: How central are human values in the buying and feature use decision of AI enhanced smartphones? This is yet an unexplored territory as most the AI technology use has been studied from perceived utility and pleasure.

First, the structure of this thesis will consist of a review of the state of the art about the smartphone and its factors that influence the behavioral intention of use of this type of technological device. In addition, topics related to the axiological aspects will be approached in order to understand if they influence this intention. As such, to explore the perceptions of individuals it is necessary to understand the terms of human values. Taking into account that human values are the basis of individuals' attitudes, a contextualization on privacy will be presented as an emerging value of the technological age. Considering the literature gap related to this topic, this section ends with the hypotheses associated with the study. The next section concerns methodological options for the strategy of data analysis, sampling, measures and procedures. Forward, the findings will be presented and these will be discussed in concert with the set of hypotheses. Finally, the thesis concludes and recognizes limitations and suggestions are presented for future studies.

Chapter 1 – Literature Review

1.1. Smartphones

In modern world, communication is one of the most important and discussed topics. There are numerous devices that speed up the process of communicating and learning, among them, the smartphone (de Reuver, Nikou & Bouwman, 2015; Montag et al., 2015). A smart device, like the smartphone, refers to "devices that automatically gather information about users or their environment to assist them in gaining knowledge about themselves and/or taking action" (Lazar, Koehler, Tanenbaum & Nguyen, 2015, p.635).

Several market researchs has shown an increase in the average penetration rate of smartphones (Lee et al., 2014) given that smartphones are among the fastest growing categories of consumer goods in recent years (Røpke, 2003). In commercial terms, smartphones are increasingly available (Lazar et al., 2015) and the adoption rate of smartphones is higher than the rates of other portable digital devices (Chun et al., 2012). In fact, recent studies about smartphones show that they can be in use for 2.5 hours a day, or even more (Oulasvirta, Rattenbury, Ma & Raita, 2012; Deursen, Bolle, Hegner & Kommers, 2015). In Portugal, penetration of smartphones continues to increase. A recent market study showed that 6.9 million Portuguese had smartphones, representing a penetration of 75.1% of this type of product, and these percentages have doubled compared to previous years (Marketeer, 2018). Moreover, the penetration rate of smartphones is highest among male individuals, the youngest and the highest social classes. But the main differences are in the various age groups with the use of smartphones to surpass 99.0% among young people between 10 and 24 years (Marketeer, 2018).

Smartphones and their applications have significant advantages for their users, namely in terms of portability, location awareness and accessibility (Zhitomirsky-Geffet & Blau, 2016). In fact, smartphone users have to constantly deal with the form and availability of their accessibility, since this device has a variety of tools that allow you to communicate anytime, anywhere and even delay communication (Røpke, 2003).

These are not only high-tech communication devices, but also a necessity in people's lives. Generally speaking, the smartphone is the first thing we observed in the morning and the last thing we see before bed. The introduction of technologies in everyday life has led to a change in the organization of users' social lives, as well as their routines. Several authors have

explored ways in which smartphones can be adopted in routines from a wide range of areas, including ecological purposes, home surveillance and health domain (Lazar et al., 2015). However, the way each individual intends to use the smartphone and how it interprets it varies from individual to individual, so the user can use the smartphone differently than the manufacturers had idealized (Røpke, 2003).

Simplistically, smartphones can be perceived as task-oriented or entertainment-oriented devices (Chun et al., 2012). The main reasons for the use of smartphones are the development of routines that include this device, the perception of usefulness and the presentation of potential benefits (Lazar et al., 2015). In addition to being considered a reliable and efficient device, smartphones allows us to express feelings, get easier and faster to others and can be used as a working tool (Naydenova & Shaposhnikova, 2016; Zhitomirsky-Geffet & Blau, 2016). More specifically, smartphone allows us to access certain services, such as email, text messaging, MMS (multimedia messaging service), internet access, audio and video, short range wireless communications (e.g., Bluetooth), gaming, health applications, money-related applications, among others (Naydenova & Shaposhnikova, 2016; Zhitomirsky-Geffet & Blau, 2016).

Management between the public and private domains is an increasingly emerging issue, especially when people are increasingly accessible (Haddon, 1998). Defining what can and can not be publicly exposed becomes increasingly difficult because of this lifestyle associated with the smartphone, since people tend to work and maintain social contacts everywhere (Røpke, 2003). Supposedly, smartphones aim to improve our lives by collecting large amounts of information, making users more aware of themselves and their activities. However, there is empirical evidence that this does not happen because users perceive the data collection as useless because the level of information is not interesting (Lazar et al., 2015). In addition, users showed little interest in the collected data because most of the time the information collected is already known to the user, that is, the individual does not need the smartphone to have access to this information (Lazar et al., 2015). Another reason for individuals to consider the data collection useless is that the information provided is not processed, so users do not know how to interpret them (Lazar et al., 2015).

This raises several questions: Are smartphone users aware of the amount and quality of the information they make about themselves daily? Are they aware of how the data they provide can be beneficial or harmful to themselves?

For several years we have seen that new technologies are a constant and crucial element in everyday life (Røpke, 2003). The adoption behavior of a particular technology is dependent on the utility perceived by the user. Consequently, this utility varies depending on whether the individual perceives technology as instrumental or non-instrumental. The first is related to useful and second to enjoyable. We also have hedonic technologies that are characterized by low instrumental gains. When we talk about this type of technology, productivity-oriented utility becomes less relevant and intrinsic factors gain more importance (Hong & Tam, 2006).

1.2. Behavioral intention of smartphone use

The decision to buy or use a particular product is influenced by many factors, which is also true for smartphones. As such, consumer behavior can be affected by different variables, such as, personal motivations, needs, personality characteristics, socio-economic and cultural background, age, gender, and professional status to social influences of various kinds exerted by family, friends, colleagues and society as a whole (de Reuver et al., 2015).

The understanding of the factors that affect the acceptance and behavioral intention of smartphone use can be obtained through the Technology Acceptance Model (TAM) (Davis, 1985), being this one of the most accepted models (Bruner & Kumar, 2005). Initially, TAM aimed to predict employees' attitudes and behaviors as new technologies were introduced in the workplace (e.g,. Davis, 1986) and the model postulates that the usefulness and ease of use (EoU) of a device affect a person's intentions to use this device. Several versions of the model have been proposed over time in different contexts, however, the main difference between the workplace and consumer contexts in relation to TAM is that, in the second, a hedonic factor can be an important addition to the model (Childers, Carr, Peck & Carson, 2001; Dabholkar & Bagozzi, 2002).

The central idea underlying TAM is that a person's behavioral intention (BI) to use a technological device is determined primarily by two assessments: its usefulness and its EoU (Bruner & Kumar, 2005). However, the reasons for buying and using smartphones have been changing as this type of technology is modernized (Røpke, 2003). The argument most often used to buy a smartphone was related to decreased concern, anxiety and insecurity regarding the whereabouts of family members (Røpke, 2003). More recently, the state of the art indicates that there are two main reasons for acquiring technological products: functional and non functional needs, which involve social, emotional and epistemic values and these motifs also apply to Information Technology (IT) domains (Arnold & Reynolds, 2003; Lin, Sher & Shih,

2005). In this sense, users adopt informed consumption behaviors, taking into account intrinsic and extrinsic motives (Kim, Chan & Gupta, 2007).

As far as hedonic technology products are concerned, the perception, attitude and intention to purchase and use these products depend on their nature and the user's perception of the associated values, which may be hedonic or utilitarian (Batra & Ahtola, 1991; Dhar & Wertenbroch, 2000). In addition, this process of acquiring and using certain technologies implies cognitive efforts and emotional involvement (Turel, Serenko & Bontis, 2010). It is also necessary to take into account that, prior to the decision to purchase a smartphone, the consumer searches for information about the product. This assessment of available alternatives is also important in consumer choice (Laroche, Kim & Matsui, 2003). Moreover, this decision is also influenced by past experiences (Moorthy, Ratchford & Talukdar, 1997), which limits the detailed assessment of all possible alternatives (Chernev, 2003). In addition, this choice is also influenced by personal preferences and the purchase perspective may have a greater effect on brand choice if the user has little knowledge about the smartphone (de Reuver et al., 2015).

Due to the emergence of new forms of technology, most of the studies that have emerged in this direction focus on the usefulness and EoU of the smartphone (Agrebi & Jallais, 2015). Studies that focus on the behavioral intention of smartphone use focus primarily on the perception individuals have of the product itself and the underlying benefits (e.g., Wang and Liao, 2008). Does this perception go against individual values?

As previously mentioned, the most accepted model for understanding the factors influencing the adoption of technologies is TAM (Davis, 1985) and, in this model, usefulness is the predominant factor of the intention to adopt technology. Bruner and Kumar (2005) created a new version of the model, the Consumer Technology Acceptance Model (c-TAM) which has added a hedonic factor - fun - that applies to the case of smartphones.

1.2.1. Usefulness

The perceived usefulness corresponds to the individuals' perception regarding the improvement of the tasks performed through the smartphone (Davis et al., 1989; Gefen & Straub, 2003; Hsu & Lu, 2004). Usefulness is one of the main predictors of technology adoption and is associated with the degree of belief that the individual has about the ease of performing a given task through a given technology (Bruner & Kumar, 2005). Also, several authors have shown that usefulness is positively correlated with the BI (Davis, 1989; Gefen & Straub, 2003;

Venkatesh & Davis, 2000). In non-hedonic contexts, usefulness is a more preponderant factor than fun (e.g., Davis, 1989).

1.2.2. Fun

As mentioned aboved, the decision to use and purchase smartphone is based on a variety of factors, like emotional factors – fun, pleasure and excitement (Batra & Ahtola, 1990). As such, this intention to use and purchase a hedonic technology is strongly influenced by the perceived fun. In addition, in the concrete case of the adoption of personal devices, Van der Heijden (2004) concluded that usefulness is a weaker indicator than hedonic enjoyment. This means that the adoption decision is strongly motivated by intrinsic factors, like sense of pleasure and relaxation. In this sense, at high levels of fun are associated more favorable attitudes in the intention to adopt technologies (e.g., Sheppard, Hartwick & Warshaw, 1988). In hedonic contexts, usefulness continues to be a determining factor in the adoption of technologies, however, the fun is the most powerful factor (Bruner & Kumar, 2005).

1.2.3. Ease of Use

Previous studies based on the original TAM have found that the EoU influences BI in work environments (Childers et al., 2001; Dabholkar and Bagozzi, 2002), however, this measure has not yet been studied in a hedonic context or taking into account the axiological aspect associated with BI of smartphone use. According to Bruner and Kumar (2005), when consumers believe that smartphones are easier to use, they also perceive them more useful as they can take the time to do other tasks instead of wasting time figuring out how to use the devices. Likewise, perceived smartphones as easier to use are also perceived as more fun compared to those that are more frustrating to use (Bruner & Kumar, 2005). In other words, consumers get more entertaining when performing a certain task on a device that is easier to use han on a device that is more complicated to use. As systems become easier to use, they provide users with a greater sense of ownership which, in turn, leads to greater enjoyment and fun (Bruner & Kumar, 2005).

1.3. Human Values

Human values are a crucial factor in the exploration of phenomena of various indoles, namely, psychological, social, political and economic phenomena (Cheng & Fleischmann, 2010; Hitlin, 2003). There are several definitions for this construct (Zheng, 2015) however, most researchers describe values as abstract, rooted, and influencing individuals' lives both

socially and individually. As such, they are a central element that guides, explains and justifies norms, actions, attitudes and opinions (Granjo & Peixoto, 2013; Tuulik, Ounapuu, Kuimet & Titov, 2016; Zheng, 2015).

In this investigation, this construct is based on Rokeach's theory that defines values as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973, p.5). It further states that when a value is internalized, it is consciously or unconsciously transformed into patterns or criteria that guide actions to develop and maintain attitudes towards relevant objects and situations, to morally judge others, and to compare others. This helps to describe and explain the similarities and differences between people, groups, nations and cultures.

Based on the above, human values are among the most important evaluative beliefs, as they are crucial in the organization of individual belief systems and occupy a central position at the cognitive level (Feather, 1990; Gouveia, Andrade, Milfont, Queiroga & Santos, 2003; Pereira, Camino & Costa, 2005, Rokeach, 1973). Cognitive development entails the awareness and characterization of demanadas as values that, through interaction with others, allow individuals to become aware of the sharing of their culturally framed values (Rokeach, 1973; Schwartz, & Bilsky, 1987).

As individuals develop and evolve in a social context, human values begin to be seen as an association between the individual himself and the individual relationship with society (Cheng & Fleischmann 2010; Rokeach, 1973). In other words, human values are conceptions of judgment that provide results relative to desirable or undesirable and good or bad actions, thus revealing beliefs and patterns that characterize the value of the individual or group values (Al-Kahtani & Allam, 2013; Granjo & Peixoto, 2013; Sagiv, Roccas, Cleciuch & Schwartz, 2017; Schwartz & Bilsky 1987). In this sense, this psychological construction manifests a predictive and explanatory potential of behavior, attitudes and decision making (Al-Kahtani & Allam, 2013; Hitlin, 2003; Rokeach, 1973).

The awareness of values in the individual orienting him to organized actions according to his axiological prioritization (Al-Kahtani & Allam, 2013; Costa, 2012; Granjo & Peixoto, 2013; Schwartz, 1994), which means that each individual has different values priorities and a unique value system.

Attitudes and behaviors are usually not guided by an absolute value, but by priority and antagonistic values. In this way, the organization of values refers to the structure and association of these in a single value system (Costa, 2012; Pereira et al., 2005; Rokeach, 1973; Schwartz, 1994). Based on these premises, Rokeach created the Rokeach Value Survey in 1973, which contains a list of 36 values and the participants should classify them as guiding principles for their lives. These values are divided into two categories: 18 instrumental values – ambitious, broadminded, capable, cheerful, clean, corageous, forgiving, helpful, honest, imaginative, independent, intellectual, logical, loving, obedient, polite and responsible - and 18 terminal values – a comfortable life, a sense of accomplishment, a peaceful world, a world of beauty, an exciting life, equality, family security, freedom, happiness, inner harmony, mature love, national security, pleasure, salvation, self-respect, social recognition, true friendship and wisdom. The former refer to desirable modes of conduct or the means used to achieve individual preferences and the latter represent the final states of existence.

It should be noted that the order of values may change due to changes in culture, society and personal experience of individuals (Prati, Pietrantoni & Albanesi, 2005; Rokeach, 1973). Thus, individual differences regarding their organization and stability of values should be emphasized, depending on variables such as identification with gender roles, among others (Prati et al., 2005; Schwartz, 1994), so Rokeach (1973) has developed a cross-cultural research following an order that can be reasonably comprehensive and universally applicable which, consequently, allows comparisons of values between countries.

1.3.1. Privacy as an emergent value

Privacy is a recurring theme due to recent scandals related to the misuse of data (e.g., Cambridge Analytica). In this sense, the General Data Protection Regulation (GDPR) was recently approved (april 2016) with the aim of standardizing data privacy laws across Europe to protect the privacy of data of all citizens of the European Union and to reshape how organizations treat data privacy. Therefore, it seems important to consider this concept as a central human value, since we are dealing permanently with technological devices.

Privacy is a limitation of access to self, which comprises a means of control or autonomy over significant personal matters (Kokolakis, 2017; Parent, 1983). There are three distinct aspects of privacy - personal, territorial and informational. The first concerns individual protection against improper interference; the second corresponds to the physical area around an

individual and the latter is associated with the control of the disclosure of the data, namely, to the processing, storage, assembly and disclosure of the data (Holvast, 1993; Kokolakis, 2017).

According to Searing (1979), privacy avoids intrusion and publicity that may be subtly violated by technological devices. Smartphone is a device that facilitates this phenomenon since large amounts of personal data are collected, sometimes subconsciously (Cath, Wachter, Mittelstadt, Taddeo & Floridi, 2018; Jin, 2018; Li, Dai, Ming & Qiu, 2015). In this way, the dimension of risk associated with possible damages caused by the violation of privacy may be directly or indirectly related to technological devices (Cath et al., 2018; Jin, 2018). An example of such risk is the expected increase in corporate data collection through smartphones, regardless of their use, which will also become a target for hackers (Jin, 2018).

A study revealed that individuals demonstrate extreme concern with the collection and use of their personal data which, consequently, compromises their privacy (Pew Research Center, 2014). However, other studies show that despite this concern, individuals are willing to give up some privacy to gain benefits - called the privacy paradox (Brown, 2001; Hsu, Chang & Yen, 2011; Kokolakis, 2017; Sayre & Horne, 2000). So privacy proves to be an important added value in Rokeach's list of technological impacts on individuals' daily lives.

In this study, we will try to understand if the axiological aspect - where the privacy construct is inscribed - overlaps with the hedonic factors associated with the behavioral intention of use of the smartphone.

1.4. Research model and hypotheses

Initially, the benefits of technology were related to organizational productivity. However, over time, technological services for personal and individual use have been developed that aim to provide pleasure and satisfaction to the user, as well as intrinsic stimuli and that is why we increasingly consume technological services because we hope to obtain benefits, amongst them, usefulness and fun (Turel et al., 2010).

With the increase in the purchase and use of the smartphone (Chun et al., 2012; Røpke, 2003), it is necessary to explain the factors that attract and lead individuals to adopt this type of device. In this sense, we will try to understand if values are facilitators or obstacles to the behavioral intentions of smartphone use. So the question arises: to what extent is privacy an element that works against the ease of adopting technology?

The hypotheses and the suggested model are presented taking into account the literature review presented previously:

H1: Ease of use will positively associate with behavioral intention to use the smartphone applications.

H2: Usefulness will positively associate with behavioral intention to use the smartphone applications.

H3: Fun will positively associate with behavioral intention to use the smartphone apps.

H4: Privacy negatively moderates the relationship between ease of use and behavioral intention.

H5: Privacy negatively moderates the relationship between usefulness and behavioral intention.

H6: Privacy negatively moderates the relationship between fun and behavioral intention.

H7: The combined effects of ease of use, usefulness, and fun, will positively associate with behavioral intention.

H8: Privacy negatively moderates the relationship between combined effects of ease of use, usefulness, and fun and behavioral intention.

Figure 1.1 – Proposed Model
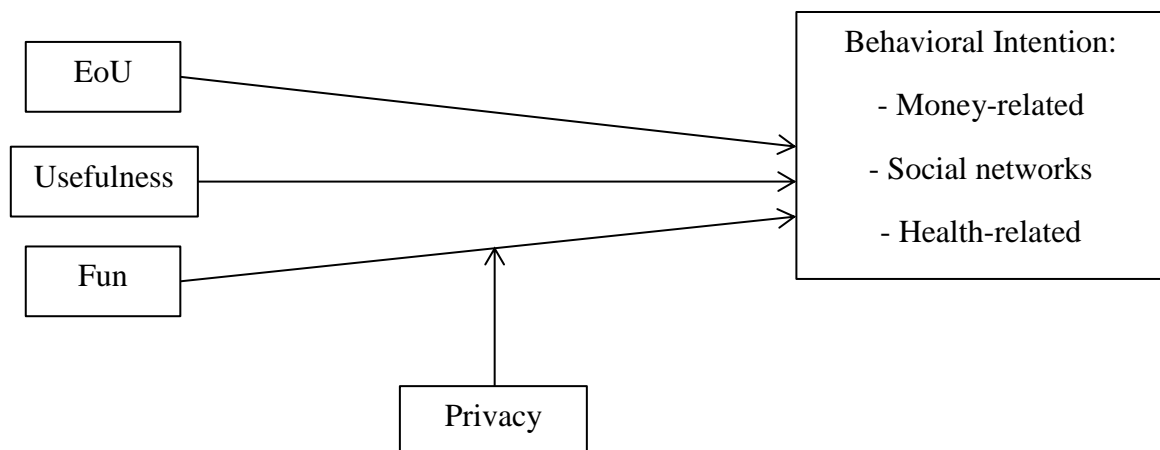
Chapter II – Method

2.1. Procedure

The questionnaire (Annex A) of this research was released online through social networks such as Facebook, professional networks like LinkedIn and shared in academic groups for due effect. First, a brief introduction is presented about the study and its conditions and information relevant to the participant. If he agrees with them, he gives his informed consent, otherwise the study ends. Next, there are questions about possible control variables (e.g., "Do you have a smartphone?", "How long have you had a smartphone?"; "Among the people closest to you, what percentage use smartphone?"; "To what extent do you consider that your smartphone incorporates artificial intelligence?"). Forward, follow the moral reasoning items that are measured through the Moral Development Scale for Professionals (MDSP) (Söderhamn, Bjørnestad, Skisland & Cliffordson, 2011) on a Likert scale (1 = "*Strongly Disagree*"; 5 = "*Strongly Agree*"). Then follow the behavioral intention of use items. These are measured through the c-TAM (Bruner & Kumar, 2005) on a Likert scale equal to the MDSP which comprise Usefulness, EoU and Fun. Finally, with respect to human values, an ipsative scale appears with eight alphabetically ordered values - true friendship, self-respect, equality, freedom, privacy, health, national security and a peaceful world - and the participant is asked to ordering them from the most important to the least important. In a final phase, sociodemographic questions arise in order to characterize the sample, such as, age, gender, literacy, marital status and profession relate dor not to IT area. Finally, a thank-you note is presented to the participant and the questionnaire ends.

2.2. Sample

The current study comprehends a sample of 211 individuals, of which 70.8% are female. The ages of the participants range between 18-69 years-old, averaging 30.16 years-old (sd=11.73). The larger number of individuals are single, representing 72.8% of the total sample.

Some variables were included in the study in order to determine if they have an effect on the relationship between the independent variable and the dependent variable. One of them relates to the IT related occupation (dummy coded 1=Yes and 2=No), which 79.2% do not have a profession related to this technological area. Another variable is the smartphone use (dummy coded 1=Yes, and 2=No), which participants use from 1 until 24 year averaging 6.9 years (sd=3.5). In addition, we found that the average percentage of individuals using a smartphone

around the participant is 69.9% (sd=11.73). On the other hand, the awareness of AI use in own smartphone was measured using a Likert scale (1=does not incorporate anything close to AI" to 7 "Incorporates a lot of Ai, even more than people think"), and the mean was 4.98 (sd=1.46).

To profile participants' human values priorities we asked to rank them. The frequency table below shows that the less important values for the majority of the participants were "national security" and "privacy", on the other hand the most important values ranked were "health" and "freedom":

Table 2.1. Human Values Ranking

	Min-Max	Mean	Std. Dev.	% 1st place	% last place
Health	1-8	2.78	2.025	39.7%	1.5%
Freedom	1-8	3.58	1.784	14.7%	0,5%
Self-respect	1-8	4.14	2.120	9.3%	6.4%
A world at peace	1-8	4.46	2.695	23.5%	19.1%
Equality	1-8	4.58	1.767	3.4%	5.9%
True friendship	1-8	4.91	2.119	5.4%	15.7%
Privacy	1-8	5.37	1.883	2.0%	14.7%
National security	1-8	6.18	2.075	2.0%	36.3%
Valid N (listwise)	204				

2.3. Data analysis strategy

For the analysis of the data, we chose to follow a double strategy and the psychometric quality of the variables was tested to ensure that they are valid and reliable. After ensuring these conditions, we focused on the hypothesis test.

For this investigation, we considered that a certain measure is sound in psychometric terms when it presents good indexes of fit in a confirmatory factorial analysis and, cumulatively, has convergent and (when applicable) divergent validity. This confirmatory factor adjustment analysis is judged according to the indexes proposed by Hair, Black, Babin and Anderson (2014) as follows: $\chi2$ / df below 0.3 and with a non-significant *p-value*, Comparative Fit Index (CFI) above .92, Tucker-Lewis Index (TLI) above .92, Root Mean Square Error of Approximation (RMSEA) below 0.06. These indices indicate that there is constructive validity.

In addition, it is expected that the measures used will comprise factors that have convergent validity, that is, where the average load of items reaches at least 50% of variation, which means that the Average Extraction Variance (EVA) should be .50 or higher. Moreover, whenever the factorial solution contains more than one factor, the divergent validity must be tested. In this case, a solution with divergent validity is expected to present higher average factor loads in each factor than the respective interfacing correlations. Finally, it is expected that the measurements are reliable, i.e., they show a Cronbach's alpha or a Composite Reliability of .70 or higher. According to Fornell and Larcker (1981, pp. 46) whenever the AVE does not reach the desired value, we can judge the adequacy of the factor based on the CR's threshold.

To test the moderation effects we used PROCESS macro (Hayes, 2013) which allows for bootstrapping tests. In the case of the research model, as stated at the end of literature review, we are dealing with a moderation of privacy between the c-TAM dimensions and BI dimensions. This Macro conducts a bootstrapping procedure to compute a confidence interval that has a lower bound and an upper bound. Whenever the bounds do not cross the value "zero" it means the effect is statistically significant. We have conducted the bootstrapping with 5000 repetitions for a confidence interval of 95% as recommended by Hayes (2013). Because PROCESS Macro does not allow the simultaneous test of more than one criterion variable, and ours comprehend three dimensions (money related, social networks related, and health related) we conducted three times the same analysis varying the criterion variable. Whenever a significant interaction effect is found, it is useful to consult the Johnson-Neyman table that shows the conditional effect of the focal predictor at values of the moderator, in our case, privacy. Although the computation of the interaction terms is done with the centered means, for interpretation clarity we opted to generate the Johnson-Neyman table showing true values of the variables in play. It is important to keep in mind that the moderator in this study is perceived by respondents as utmost critical when it reaches value 1, and the less valued when reaching the 8 (meaning, the least important of all listed social values).

2.4. Measures

2.4.1. Behavioral Intention of Use

This measure was built based on a focus group that explored the possible application uses in smartphones. Originally, this measure covers 15 items distributed by five factors related to the use of smartphone applications. Among them: 1) money-related (3 items, e.g., online

banking); 2) social contacts related (4 items, e.g., social networks); 3) health-related (2 items, e.g., health status monitoring); 4) biometrics related (4 items, e.g., fingerprint access) and; 5) GPS related (2 items, e.g., tracking on base of GPS). For this solution, we conducted a CFA and found inadequate adjustment indexes ($\chi 2 / 82 = 2.237$, $p <0.001$, CFI $= .897$, TLI $= .849$, RMSEA $= .077$). Using the Lagrange multipliers and applying rules to ensure the psychometric quality of the measure, taking into account the section "Data analysis strategy", we excluded several items. The final factorial solution maintained only four of the five initial factors to find a model that had good adjustment indexes ($\chi 2 / 31 = 1.323$, $p =.108$; CFI $=.984$, TLI $=.972$, RMSEA $=.039$). The factor structure is as follows: 1) money-related (3 items, " Putting my personal data in a smartphone application", " Access my bank account", and "Use applications that require a credit card ", AVE $=.468$, CR $=.72$); 2) social contacts related (3 items," Access to personal email "," Access to a social network " and " Save personal photos", AVE $=.43$, CR $=.70$); 3) health-related (2 items, " Save or allow a monitoring of my sleep" and " Use health or food monitoring applications", AVE$=.52$, CR$=.69$); and 4) biometrics related (2 items, " Use retinal or iris biometric identification" and " Use face recognition", AVE $=.89$, CR $=.94$). From ensuing discussion on the contents of each factor, we concluded that biometrics was not of the same semantical value of the remaining factors as it does not pertain true application. It is but a means to grant access to the software in the smartphone. Therefore, we conducted a new CFA with the remaining three factors. Albeit of lesser fit, it still holds to the requirements and thus we opted to retain this solution ($\chi 2 / 18 = 1.903$, $p =.012$; CFI $=.952$, TLI $=.903$, RMSEA $=.066$).

Figure 2.1. CFA for Behavioral Intention
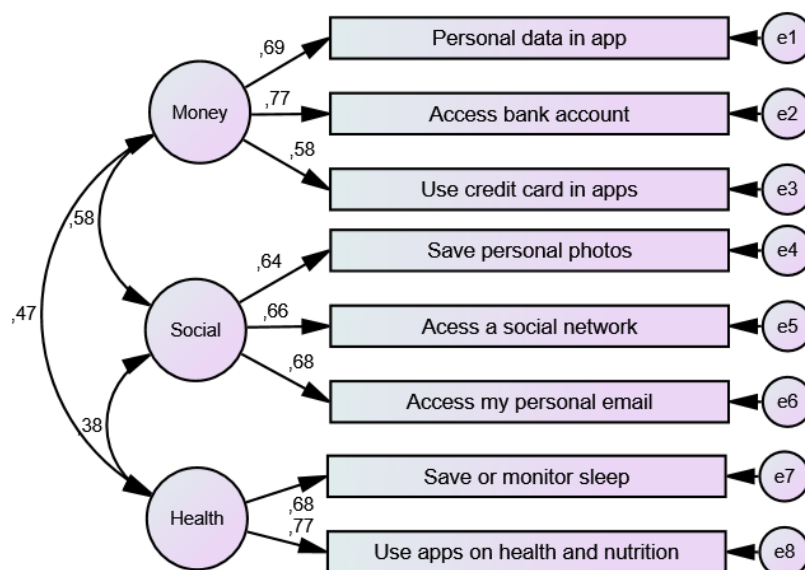
2.4.2. Technology Acceptance

Technology acceptance was measured with c-TAM that comprehends three dimensions: ease of use (EoU, 5 items, e.g., "It was easy to use", "I learned to use it quickly", "It was simple to use", "I easily remember how to use it" and "It was easy to learn to use it"), usefulness (5 items, e.g., "It helped me be more effective", "It helped me be more productive", "It saved me time to use it", "It required the fewest steps to accomplish what I wanted to do with it" and "It made the task I wanted to accomplish easier to get done"), and Fun (6 items, e.g., "Happy/Unhappy", "Pleased/Annoyed", "Satisfied/Unsatisfied", "Contented/Melancholic", "Hopeful/Despairing" and "Relaxed/Bored"). The CFA showed unsuitable fit indices ($\chi 2/101=2.493$, $p<.001$; CFI=.898, TLI=.862, RMSEA=.084). By using Lagrange multipliers as well as applying rules for psychometric quality as stated in section "Data analysis strategy" we excluded three items (one per dimension). The resulting model showed good fit indices ($\chi 2/62=1.649$, $p<.001$; CFI=.966, TLI=.957, RMSEA=.056). The solution has convergent validity (for all factors): $AVE_{EoU}=.436$, $CRE_{oU}=.754$; $AVE_{Usefulness}=.671$, $CR_{Usefulness}=.889$; $AVE_{Fun}=.550$, $CR_{Fun}=.859$).

Figure 2.2. CFA for Technology Acceptance
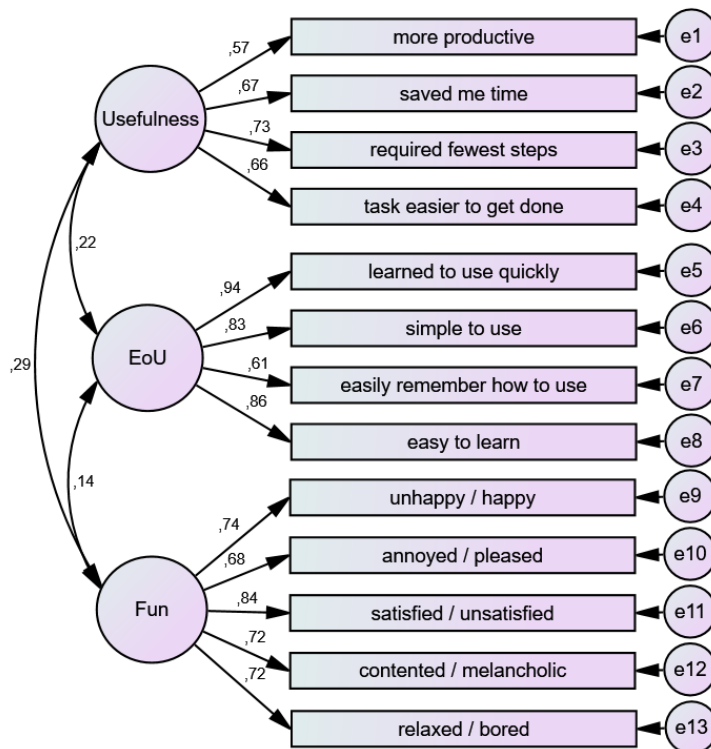
2.4.3. Human Values

The human values were measured through an adaptation of the Rokeach's Value Survey (1973) of a study that focused on the area of Artificial Intelligence (AI) (Couto, 2018). Considering the subject of the present investigation, we focused only on instrumental values. Due to its extension, previous analysis was performed, and the value of privacy was added because for its relevance in the literature review on AI and smartphones. Resulting from this adaptation, 10 human values were maintained, but as two were shared, the final list comprises eight human values: health, national security, world at peace, self-respect, true friendship, privacy, freedom, and equality. It should be noted that the retention option of up to 10 items took into account the standard capacity of short-term memory retention. As this measure was treated as an ipsative scale, no additional psychometric analysis is required. We only ask the participants to order the values in order to understand how privacy is positioned in the ranking.

Chapter III – Results

This chapter starts by showing the descriptive and bivariate statistics, some conclusions about the human values ranking and then proceeds with hypothesis testing. Table 3.1 shows the main findings concerning descriptive and bivariate statistics.

Descriptive statistics report the sample number, minimum and maximum responses registered, average and standard deviation. The variables covered are the socio-demographics (age, gender, familiarity and awareness), c-TAM, moral reasoning, human values and behavioral intention of use the smartphone. All descriptive and bivariate findings are reported in the Table 3.1 As showed the bivariate statistics evidenced some relevant patterns. With regard to sociodemographic data, more precisely to age, we verified the existence of several significant negative correlations: familiarity ($r=-.304$, $p<0.01$), EoU ($r=-.487$, $p<0.01$), $BI_{money-related}$ ($r=-.314$, $p<0.01$) and $BI_{Social-networks}$ ($r=-.415$, $p<0.01$). This means that older people report being less familiar with smartphone technology, they also perceive the smartphone as being less easy to use and their intention to use applications linked to banking/financial or social applications/tools is smaller. We also found moderate negative correlations between age and value of true friendship ($r=-.272$, $p<0.01$) and $BI_{health-related}$ ($r=.202$, $p<0.01$), and a moderate positive correlation with national security ($r=.169$, $p<0.05$). With regards to gender, there is a clear predominance of male participants that has had professional experience in IT related domain. Likewise female participants seem to report being less familiar with smartphone technology than males. In education, we found moderate positive correlations with awareness ($r=.251$, $p<0.01$), usefulness ($r=.240$, $p<0.01$) and $BI_{Social-networks}$ ($r=.219$, $p<0.01$). In other words, individuals with more literacy tend to be more aware of the AI level of the smartphone, perceive it as more useful and tend to use the smartphone for social purposes. Regarding familiarity, we found that there is a significant positive correlation with EoU ($r=.362$, $p<0.01$), which means that individuals more familiar with the smartphone tend to perceive it as easier to use. We have also found other moderate positive correlations with usefulness ($r=.175$, $p<0.05$), $BI_{Money-related}$ ($r=.251$, $p<0.01$) and $BI_{Social-networks}$ ($r=.219$, $p<0.01$), which shows that the interaction of others with their smartphones enhances the individual's own BI for banking and social issues. Finally, smartphone AI awareness correlates positively and moderately with the banking and social domain BI ($r=.235$, $p<0.01$; $r=.217$, $p<0.01$, respectively).

Table 3.1. Descriptives and bivariate statistics

	Min-max	mean	sd	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Age	18-69	30.16	11.73	1																			
2. Gender	1-2	70.8%fem	-	-.029	1																		
3. Education	-	-	-	-.169*	.077	1																	
4. Marital status	-	-	-	.692**	.047	-.232**	1																
5. ITprofessional	1-2	79.2% no	-	.047	.342**	.080	.024	1															
6. Familiarity	0-100	69.9%	11.73%	-.304**	-.194**	.174*	-.326**	-.236**	1														
7. Awareness	1-7	4.98	1.46	-.118	.002	.251**	-.170*	-.099	.123	1													
8. CTAM_Usefulness	1-5	3.82	.73	-.037	-.032	.240**	-.035	-.163*	.175*	.094	1												
9. CTAM_EoU	2.5-5	4.66	.55	-.487**	.107	-.021	-.233**	-.109	.362**	.118	.190**	1											
10. CTAM_Fun	1-8	5.97	1.53	-.084	.023	.118	-.089	-.123	.046	.106	.244**	.103	1										
11. True-friendship	1-8	4.91	2.11	-.272**	.186**	.100	-.181**	.103	.047	.045	-.075	.026	.073	1									
12. Self-respect	1-8	4.14	2.12	-.034	-.095	-.058	-.098	-.063	-.012	.007	.054	-.043	-.098	.211**	1								
13. Equality	1-8	4.58	1.76	.115	.093	-.126	.267**	-.032	-.027	.047	-.031	-.071	-.011	-.080	-.189**	1							
14. Freedom	1-8	3.58	1.78	-.017	.155*	-.099	.083	-.016	-.020	-.052	-.133	-.050	.058	-.166*	-.154*	.280**	1						
15. Privacy	1-8	5.37	1.88	.070	-.034	.011	-.013	.025	.005	.027	-.038	-.130	-.088	-.173*	.009	-.100	-.028	1					
16. Health	1-8	2.78	2.02	-.081	-.014	.054	-.042	.022	-.079	-.056	.097	.057	.070	-.099	-.106	-.254**	-.245**	-.153*	1				
17. Nation-Security	1-8	6.18	2.07	.169*	-.179*	.037	.050	-.019	-.013	-.014	.074	.102	-.027	-.469**	-.271**	-.277**	-.234**	-.048	.013	1			
18. World-peace	1-8	4.46	2.69	.059	-.062	.037	-.008	-.019	.069	-.002	.022	.063	.018	-.234**	-.446**	-.156*	-.210**	-.334**	-.165*	.173*	1		
19. BI_moneyrelated	1-5	2.65	1.01	-.314**	-.142	.099	-.185*	-.197**	.251**	.235**	.217**	.274**	.117	.004	.021	-.009	.067	.080	-.034	-.076	-.030	1	
20. BI_socialnetwork	1.33-5	4.32	.77	-.415**	.128	.219**	-.312**	-.007	.219**	.217**	.233**	.299**	.091	-.002	.008	-.023	-.007	.143	.076	-.011	-.134	.422**	1
21. BI_healthrelated	1-5	2.14	1.16	-.202**	-.025	.006	-.111	-.107	.129	.123	.179*	.180*	.076	.140	-.033	-.023	.013	-.097	-.002	-.072	.047	.338**	.277**

* $p < 0.05$; ** $p < 0.01$

For nominal variables statistics were computed with either Pearson χ^2, φ coefficient, Cramer's V, or η value.

Regarding the dimensions of c-TAM, we found that usefulness correlated positively and moderately with the EoU (r=.190, p<0.01), Fun (r=.244, p<0.01), and with BI of a banking, social and health nature (r=.217, p<0.01; r=.233, p<0.01; r=.179, p<0.05, respectively). Therefore, individuals who perceive the smartphone as useful tend to perceive it as more easy to use, more funny, and BI is higher for banking, social and health applications/tools. On the other hand, the EoU correlates positively and moderately with the banking, social and healthcare BI (r=.274, p<0.01; r=.299, p<0.01; r=.180, p<0.05, respectively), that is, people who perceive the smartphone as easy to use tend to use more banking, social and of health applications/tools.

Regarding the ranking of human values, health was the most often chosen in first place (39.7%), followed by the world at peace (23.5%) and freedom (14.7%). In turn, national security was the highest value placed in the last place (30.3%), followed by the world at peace (19.1%) and true friendship (15.7%). This means that the value of the world at peace is a divisive value, with an average of 4.46 at the ranking. In the specific case of privacy, the average of the ranking position was 5.37 and 2.0% of the sample considered this value as the most important of all on the list, while 14.7% considered the least important value.

Overall, there are some associations between some sociodemographic variables and constructs under study, which imply that ensuing analyses should control for these variables, namely, age and familiarity due to their strong associations with EoU and two of the BI dimensions; and awareness of AI incorporation due to its association with these two BI dimensions.

As stated, to proceed to the hypotheses testing, we have resourced to PROCESS Macro available in SPSS 24 (from Hayes, 2013). Table 3.2 reports the direct and interaction terms and CI95 lower and upper bound statistics for each case.

*Table 3.2. Path coefficients and interactions*

Predictor	Criterion variable	Moderator variable	Direct effect	Interaction effect	R^2
EoU	Money	Privacy	n.s.	n.s.	0%
EoU	Socialnetworks	Privacy	.231 CI95 [.008; .455]	n.s.	26.7%
EoU	Health	Privacy	n.s.	n.s.	0%
Usefulness	Money	Privacy	n.s.	n.s.	0%
Usefulness	Socialnetworks	Privacy	.206 CI95 [.072; .339]	-.074 CI95 [-.138; -.010]	30.1%
Usefulness	Health	Privacy	.264 CI95 [.035; .493]	n.s.	9.6%
Fun	Money	Privacy	n.s.	n.s.	0%
Fun	Socialnetworks	Privacy	n.s.	n.s.	0%
Fun	Health	Privacy	n.s.	n.s.	0%
EoU&Usefulness	Money	Privacy	n.s.	n.s.	0%
EoU&Usefulness	Socialnetworks	Privacy	.045 CI95 [.020; .069]	-.016 CI95 [-.027; -.005]	31.6%
EoU&Usefulness	Health	Privacy	.053 CI95 [.011; .095]	n.s.	10.2%
EoU&Fun	Money	Privacy	n.s.	n.s.	0%
EoU&Fun	Socialnetworks	Privacy	n.s.	n.s.	0%
EoU&Fun	Health	Privacy	n.s.	-.014 CI95 [-.028; -.001]	9.4%
Fun&Usefulness	Money	Privacy	n.s.	n.s.	0%
Fun&Usefulness	Socialnetworks	Privacy	n.s.	n.s.	0%
Fun&Usefulness	Health	Privacy	.026 CI95 [.005; .047]	-.016 CI95 [-.028; -.004]	11.9%
EoU&Usefulness&Funn	Money	Privacy	n.s.	n.s.	0%
EoU&Usefulness&Fun	Socialnetworks	Privacy	n.s.	n.s.	0%
EoU&Usefulness&Fun	Health	Privacy	.005 CI95 [.001; .009]	-.003 CI95 [-.005; -.001]	12.6%

According to the results obtained, we verified that there is a significant interaction in the following model:

Figure 3.1. Moderation of privacy in the relationship between EoU and BI$_{Social\text{-}networks}$
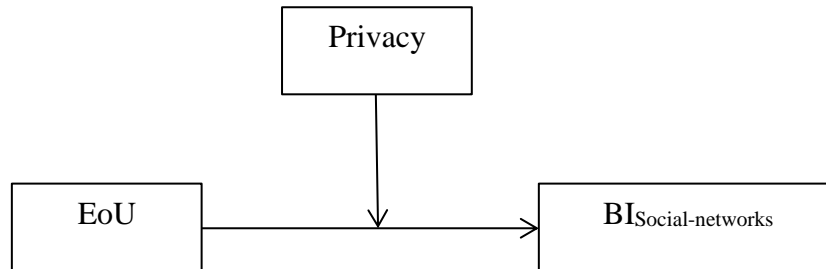
The model explains 26.7% of the variation of behavioral intention to use social apps of the smartphone and there is a significant direct effect between EoU and BI$_{social\text{-}networks}$ (B=.231, 95%IC=.008, .455), which means that individuals who perceive the smartphone as easier to use, tend to use it more for social purposes.

Still in the domain of BI$_{Social\text{-}networks}$, we found another significant model:

Figure 3.2. Moderation of privacy in the relationship between usefulness and BI$_{Social\text{-}networks}$
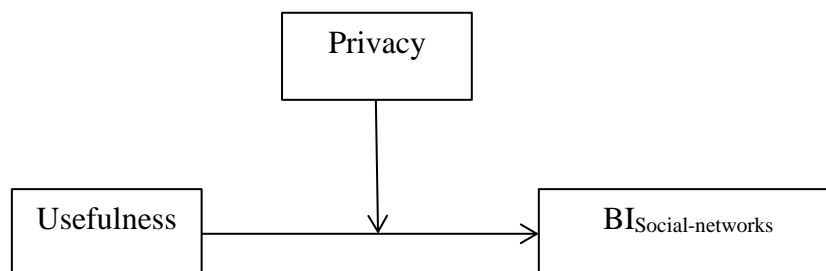

The model explains 30.1% of the variation of the behavioral intention to use social apps of the smartphone and there is a significant direct effect between usefulness and BI$_{social\text{-}networks}$ (B=.206, 95%IC=.072, .339), which means that individuals who tend to perceive the smartphone as useful, tend to use it more in social apps. We also verified that privacy moderates significantly this relation (B=-074, 95%IC=-.138, -.010).

According to graphic 3.2., we found that the effect of usefulness on the intention to use the smartphone for social purposes changes with the value given to privacy. Among

individuals that perceive low usefulness in the smartphone, those that value privacy will show a much lower BI for social purposes than those that have lesser concerns with privacy. For those that see usefulness in the smartphone, privacy makes no difference at all. Overall, this means, privacy concerns matter in the relationship between usefulness and BI for social purposes.

*Graphic 3.1. Moderation of privacy in usefulness on BI$_{Social-networks}$*
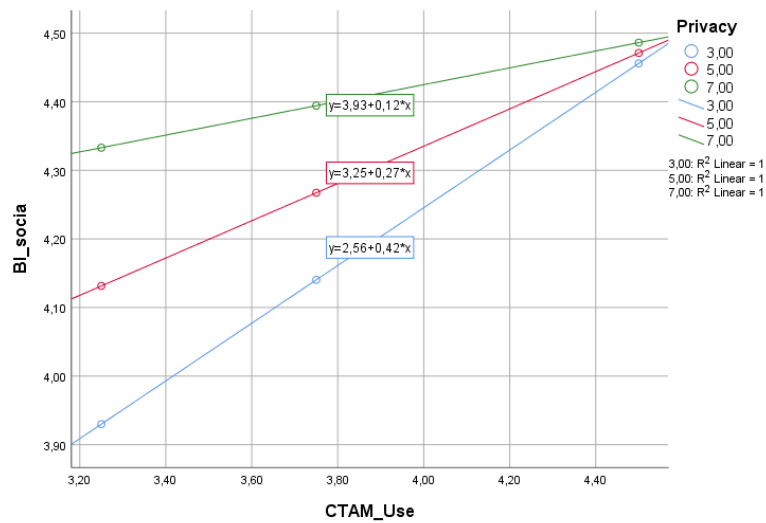
Table 3.3. - Conditional effect of Usefulness at values of Privacy

Moderator value(s) defining Johnson-Neyman significance region(s):		
Value	% below	% above
6.1800	68.4492	31.5508

Conditional effect of focal predictor at values of the moderator:						
Privacy	Effect	se	t	p	LLCI	ULCI
1.0000	.5295	.1550	3.4156	.0008	.2236	.8353
1.3500	.5034	.1449	3.4738	.0006	.2175	.7894
1.7000	.4774	.1350	3.5356	.0005	.2110	.7439
2.0500	.4514	.1254	3.6003	.0004	.2040	.6988
2.4000	.4254	.1160	3.6663	.0003	.1964	.6543
2.7500	.3994	.1070	3.7307	.0003	.1881	.6106
3.1000	.3733	.0985	3.7884	.0002	.1789	.5678
3.4500	.3473	.0907	3.8309	.0002	.1684	.5262
3.8000	.3213	.0836	3.8448	.0002	.1564	.4862
4.1500	.2953	.0775	3.8112	.0002	.1424	.4482
4.5000	.2693	.0726	3.7065	.0003	.1259	.4126
4.8500	.2432	.0693	3.5081	.0006	.1064	.3801
5.2000	.2172	.0678	3.2051	.0016	.0835	.3510
5.5500	.1912	.0681	2.8086	.0055	.0569	.3255
5.9000	.1652	.0702	2.3522	.0197	.0266	.3037
6.1800	.1444	.0732	1.9732	.0500	.0000	.2887
6.2500	.1392	.0741	1.8793	.0618	-.0070	.2853
6.6000	.1131	.0793	1.4264	.1555	-.0434	.2697
6.9500	.0871	.0858	1.0159	.3110	-.0821	.2563
7.3000	.0611	.0931	.6561	.5126	-.1227	.2449
7.6500	.0351	.1012	.3465	.7293	-.1647	.2348
8.0000	.0091	.1099	.0824	.9344	-.2078	.2259

Finally, in the field of $BI_{Social-networks}$, we combined EoU and usefulness to create a single variable and we obtained the following model:

Figure 3.3. Moderation of privacy in the relationship

between usefulness combined with EoU and BI$_{Social-networks}$
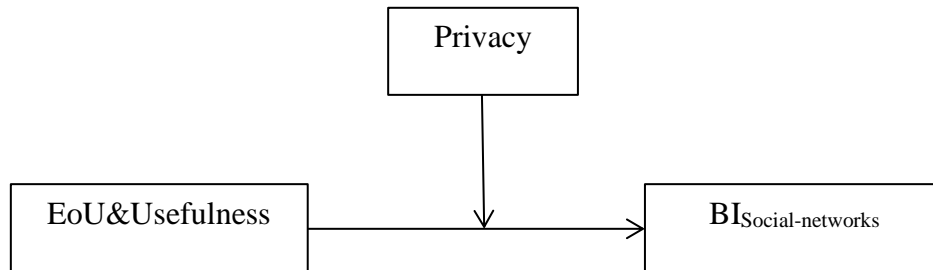
The model explains 31.6% of the variation of behavioral intention to use social apps of the smartphone and there is a significant direct effect between the combination of EoU and usefulness and BI$_{Social-networks}$ (B=.045, 95%IC=.020, .069), which means that individuals who tend to perceive the smartphone as useful and easy to use tend to use it more for social purposes. Also, we found that privacy significantly moderates this relation (B=-.016, 95%IC=-.027, -.005).

Graphic 3.2. and table 3.4 show that, similarly to the previous graphic, the effect of the combined usefulness and fun of the smartphone in the BI for social purposes increases as the value of privacy decreases. However, it is possible to observe that there is a turnaround when individuals devalue privacy, more precisely, from position 7.6 onwards of the ranking when this effect is no longer significant.

Graphic 3.2. Moderation of privacy in combined usefulness - EoU on BI$_{Social-networks}$
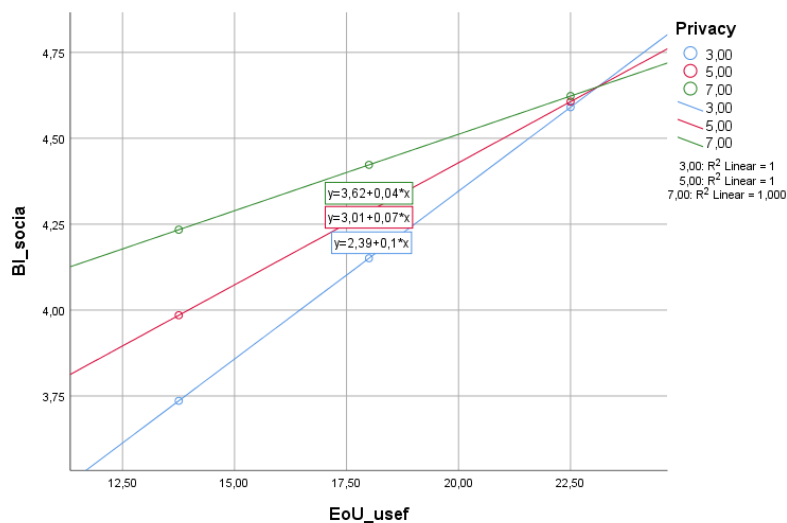
Table 3.4. Conditional effect of interaction between Usefulness and Ease of Use at values of Privacy

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
7.6428	85.0267	14.9733

Conditional effect of focal predictor at values of the moderator:

Privacy	Effect	se	t	p	LLCI	ULCI
1.0000	.1243	.0309	4.0258	.0001	.0634	.1853
1.3500	.1197	.0289	4.1398	.0001	.0626	.1767
1.7000	.1150	.0270	4.2656	.0000	.0618	.1682
2.0500	.1104	.0251	4.4042	.0000	.0609	.1598
2.4000	.1057	.0232	4.5561	.0000	.0599	.1515
2.7500	.1010	.0214	4.7210	.0000	.0588	.1433
3.1000	.0964	.0197	4.8968	.0000	.0576	.1352
3.4500	.0917	.0181	5.0782	.0000	.0561	.1274
3.8000	.0871	.0166	5.2542	.0000	.0544	.1198
4.1500	.0824	.0152	5.4054	.0000	.0523	.1125
4.5000	.0778	.0141	5.5012	.0000	.0499	.1056
4.8500	.0731	.0133	5.5005	.0000	.0469	.0993
5.2000	.0684	.0128	5.3619	.0000	.0433	.0936
5.5500	.0638	.0126	5.0626	.0000	.0389	.0886
5.9000	.0591	.0128	4.6164	.0000	.0339	.0844
6.2500	.0545	.0134	4.0731	.0001	.0281	.0809
6.6000	.0498	.0143	3.4951	.0006	.0217	.0779
6.9500	.0452	.0154	2.9337	.0038	.0148	.0755
7.3000	.0405	.0167	2.4195	.0165	.0075	.0735
7.6428	.0359	.0182	1.9730	.0500	.0000	.0719
7.6500	.0358	.0182	1.9643	.0510	-.0002	.0719
8.0000	.0312	.0199	1.5687	.1184	-.0080	.0704

Moving on to the domain of smartphone applications for health domain, we have found several significant results, among them:
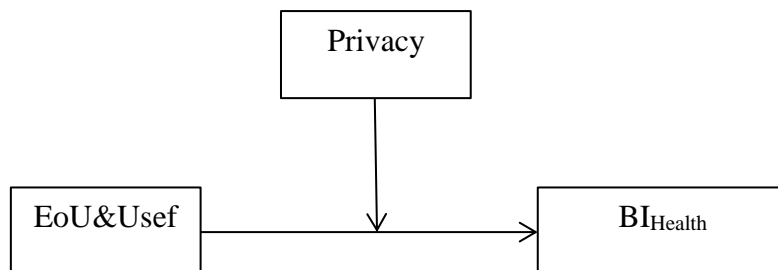
Figure 3.4. Moderation of privacy in the relationship between usefulness and BI_{Health}
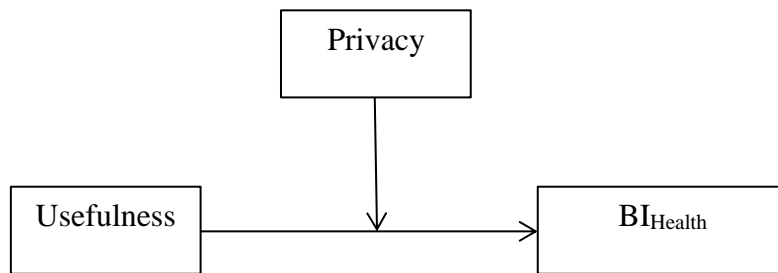
In the first, the model explains 9.6% of the variation of the behavioral intention to use health-related applications of the smartphone and there is a significant direct effect between usefulness and BI_{Health} (B=.264, 95% IC= .035, .493), which means that the more individuals perceive the smartphone as useful, the more likely it is to use it for health purposes.
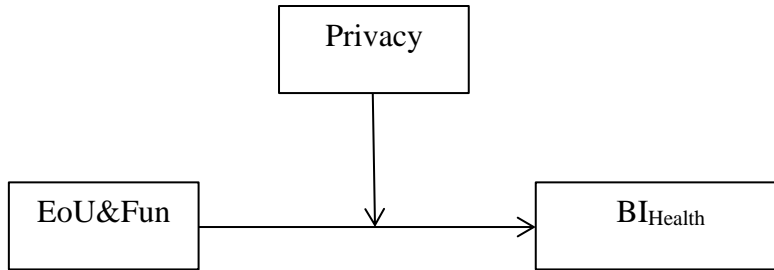
Similarly, when we combine usefulness with EoU, we get a significant interaction:

*Figure 3.5. Moderation of privacy in the relationship between usefulness combined with EoU and BI_{Health}*

The model explains 10.2% of the variation of behavioral intention to use health-related appications of the smartphone and there is a significant direct effect between usefulness and ease of use with BI_{Health} (B =.053 95% IC =.011, .095), which means that the more people perceive the smartphone as useful and fun, the more likely it is to use it for health purposes. Combining EoU with fun, we found another significant interaction:

Figure 3.6. Moderation of privacy in the relationship
between EoU combined with fun and BI$_{Health}$

```
        ┌──────────────┐
        │   Privacy    │
        └──────────────┘
               │
               ▼
┌──────────┐         ┌──────────────┐
│ EoU&Fun  │────────▶│  BI$_{Health}$  │
└──────────┘         └──────────────┘
```

In this case, the model explains 9.4% of the variation of behavioral intention to use health-related applications of the smartphone and there is no significant direct effect between ease of use and fun with BI$_{Health}$ but the interaction effect is significant (B=-.014, 95%IC=-.028, -.001). This means that privacy strongly changes the valence of the association contrasting a negative coefficient in a low privacy valuing population with a positive coefficient in a high privacy valuing population. In other words, when individuals do value privacy and think using the smartphone is both fun and easy, they tend to report higher probability of using smartphones for health purposes although still falling the rejection side of the scale. Conversely, when individuals do not value so much privacy (namely, after average 5.2), there is no relationship at all between BI for health purposes and the judgment that it is both easy of use and funny. It is worth noting that when individuals value privacy, health related apps that are taken as neither fun nor easy to use, will be the most strongly rejected.

Graphic 3.3 Moderation of privacy in combined EoU - Fun on BI$_{Health}$


27
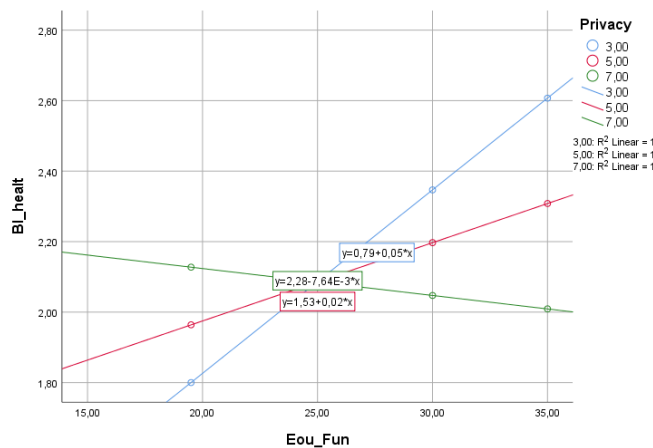
Table 3.5. Conditional effect of interaction
between Ease of Use and Fun at values of Privacy

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
4.8628	32.6203	67.3797

Conditional effect of focal predictor at values of the moderator:

Privacy	Effect	se	t	p	LLCI	ULCI
1.0000	.0819	.0331	2.4709	.0144	.0165	.1473
1.3500	.0767	.0310	2.4766	.0142	.0156	.1378
1.7000	.0715	.0288	2.4813	.0140	.0146	.1283
2.0500	.0662	.0267	2.4842	.0139	.0136	.1188
2.4000	.0610	.0246	2.4842	.0139	.0125	.1095
2.7500	.0558	.0225	2.4793	.0141	.0114	.1002
3.1000	.0506	.0205	2.4665	.0146	.0101	.0910
3.4500	.0453	.0186	2.4411	.0156	.0087	.0820
3.8000	.0401	.0167	2.3951	.0176	.0071	.0732
4.1500	.0349	.0151	2.3164	.0217	.0052	.0646
4.5000	.0297	.0136	2.1868	.0300	.0029	.0564
4.8500	.0244	.0123	1.9824	.0490	.0001	.0488
4.8628	.0243	.0123	1.9732	.0500	.0000	.0485
5.2000	.0192	.0114	1.6805	.0946	-.0033	.0418
5.5500	.0140	.0110	1.2757	.2037	-.0077	.0357
5.9000	.0088	.0110	.7985	.4257	-.0129	.0305
6.2500	.0036	.0115	.3094	.7574	-.0191	.0262
6.6000	-.0017	.0124	-.1343	.8933	-.0262	.0228
6.9500	-.0069	.0137	-.5039	.6150	-.0339	.0201
7.3000	-.0121	.0152	-.7976	.4261	-.0421	.0179
7.6500	-.0173	.0169	-1.0268	.3059	-.0506	.0160
8.0000	-.0226	.0187	-1.2053	.2297	-.0595	.0144

On the other hand, and still in the field of health applications of the smartphones, we found two significant models:

Figure 3.7. Moderation of privacy in the relationship
between usefulness combined with fun and BI$_{Health}$
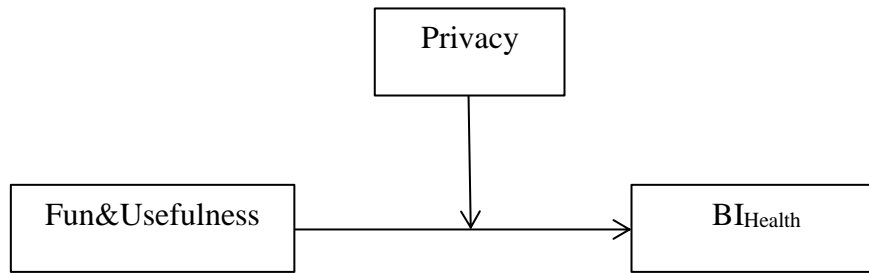
The model explains 11.9% of the variation of behavioral intention to use health-related applications of the smartphone and there is a significant direct effect between the combination of fun and usefulness and BI$_{Health}$ (B=.026, 95%IC = .005, .047), which means that individuals who tend to perceive the smartphone as fun and useful tend to use it more in health apps. Also, we found that privacy significantly moderates the relation (B=-.016, 95%IC = -.028, -.004).

According to graphic 3.4 and table 3.6, we can observe that when individuals think using the smartphone is both fun and useful and they have high concern with privacy they will show higher probability of using it for health related purposes although they fall in the negative side of the scale (they still reject using it). Conversely, when they do not value privacy (when they rank it in the 6th or lower position), being fun and useful has no impact on the BI for health purposes and they also continue reject using it. Individuals that value privacy will be the ones that most strongly reject using related health apps when they see it as being neither funny nor useful.

Graphic 3.4. Moderation of privacy in combined usefulness - fun on BI$_{Health}$
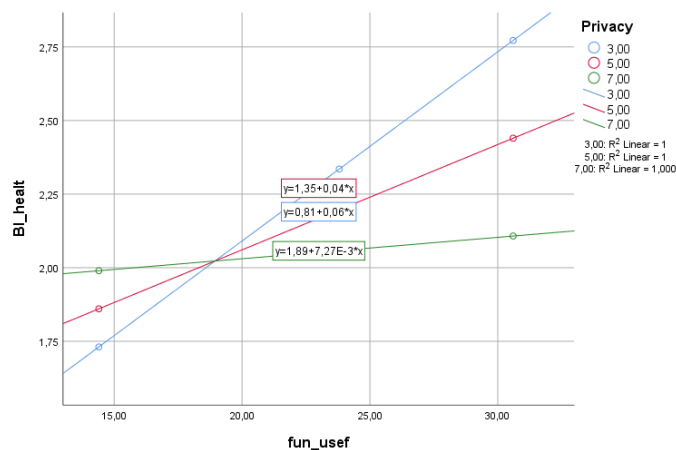
Table 3.6. Conditional effect of interaction
between Fun and Usefulness at values of Privacy

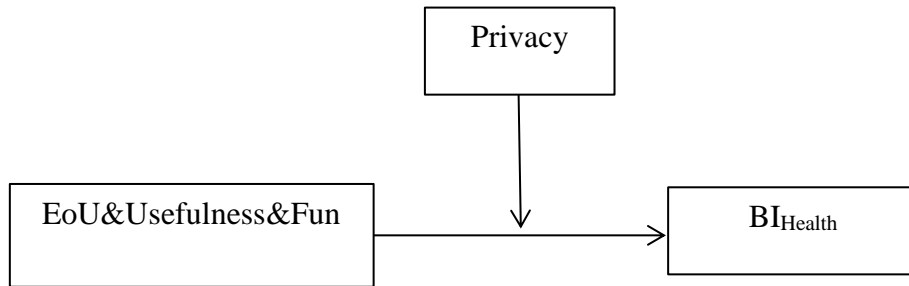Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
5.6979	50.8021	49.1979

Conditional effect of focal predictor at values of the moderator:

Privacy	Effect	se	t	p	LLCI	ULCI
1.0000	.0964	.0299	3.2290	.0015	.0375	.1553
1.3500	.0908	.0279	3.2561	.0013	.0358	.1458
1.7000	.0851	.0259	3.2843	.0012	.0340	.1363
2.0500	.0795	.0240	3.3131	.0011	.0322	.1269
2.4000	.0739	.0221	3.3414	.0010	.0303	.1175
2.7500	.0683	.0203	3.3672	.0009	.0283	.1083
3.1000	.0626	.0185	3.3870	.0009	.0261	.0991
3.4500	.0570	.0168	3.3947	.0008	.0239	.0901
3.8000	.0514	.0152	3.3802	.0009	.0214	.0814
4.1500	.0458	.0138	3.3271	.0011	.0186	.0729
4.5000	.0401	.0125	3.2106	.0016	.0155	.0648
4.8500	.0345	.0115	2.9993	.0031	.0118	.0572
5.2000	.0289	.0108	2.6642	.0084	.0075	.0502
5.5500	.0232	.0106	2.2004	.0290	.0024	.0441
5.6979	.0209	.0106	1.9732	.0500	.0000	.0417
5.9000	.0176	.0107	1.6444	.1018	-.0035	.0387
6.2500	.0120	.0113	1.0638	.2888	-.0102	.0342
6.6000	.0064	.0122	.5222	.6021	-.0177	.0304
6.9500	.0007	.0134	.0545	.9566	-.0256	.0271
7.3000	-.0049	.0148	-.3322	.7401	-.0340	.0242
7.6500	-.0105	.0163	-.6458	.5193	-.0427	.0216
8.0000	-.0162	.0180	-.8988	.3700	-.0516	.0193

Finally, we found another significant model but this time we combined EoU, usefulness and fun:

*Figure 3.8. Moderation of privacy in the relationship*
between usefulness-fun-EoU and BI_{Health}

```
                    ┌──────────────┐
                    │   Privacy    │
                    └──────┬───────┘
                           │
                           ↓
┌──────────────────────┐       ┌──────────────┐
│ EoU&Usefulness&Fun   │──────→│  BI_{Health} │
└──────────────────────┘       └──────────────┘
```

The model explains 12.6% of the variation of the behavioral intention to use health-related applications of the smartphone and there is a significant direct effect between the combination of EoU, usefulness and fun with BI_{Health} (B=.005, 95%IC=. 001, .009), which means that individuals who tend to perceive the smartphone as easy to use, useful and fun tend to use it more in health-related applications. Also, we found that privacy significantly moderates this relation (B=-.003, 95%IC=-.005, -.001).

According to graphic 3.5. and table 3.7. we can observe that when an health related app in the smartphone is both easy to use, useful and funny, individuals that value privacy will tend to reject it, but not so strongly as those that do not value privacy. But the same individuals that value privacy will reject it more strongly when the apps fail to be easy, funny, and useful.

Graphic 3.5. Moderation of privacy in
combined usefulness – Fun - EoU on BI_{Health}

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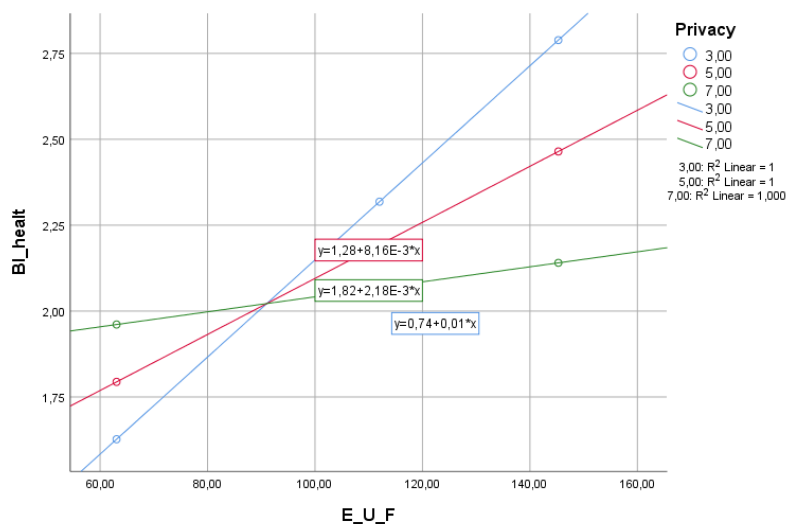
Table 3.7. Conditional effect of interaction
between Ease of Use, Usefulness and Fun at values of Privacy

Moderator value(s) defining Johnson-Neyman significance region(s):

Value	% below	% above
6.2960	68.4492	31.5508

Conditional effect of focal predictor at values of the moderator:

Privacy	Effect	se	t	p	LLCI	ULCI
1.0000	.0201	.0058	3.4496	.0007	.0086	.0316
1.3500	.0191	.0054	3.4986	.0006	.0083	.0298
1.7000	.0180	.0051	3.5519	.0005	.0080	.0280
2.0500	.0170	.0047	3.6096	.0004	.0077	.0262
2.4000	.0159	.0043	3.6714	.0003	.0074	.0245
2.7500	.0149	.0040	3.7364	.0002	.0070	.0227
3.1000	.0138	.0036	3.8025	.0002	.0067	.0210
3.4500	.0128	.0033	3.8652	.0002	.0063	.0193
3.8000	.0117	.0030	3.9162	.0001	.0058	.0177
4.1500	.0107	.0027	3.9405	.0001	.0053	.0161
4.5000	.0096	.0025	3.9138	.0001	.0048	.0145
4.8500	.0086	.0023	3.8009	.0002	.0041	.0131
5.2000	.0076	.0021	3.5617	.0005	.0034	.0117
5.5500	.0065	.0021	3.1720	.0018	.0025	.0106
5.9000	.0055	.0021	2.6484	.0088	.0014	.0095
6.2500	.0044	.0022	2.0527	.0415	.0002	.0087
6.2960	.0043	.0022	1.9730	.0500	.0000	.0086
6.6000	.0034	.0023	1.4594	.1462	-.0012	.0079
6.9500	.0023	.0025	.9217	.3579	-.0027	.0073
7.3000	.0013	.0028	.4613	.6452	-.0042	.0068
7.6500	.0002	.0031	.0784	.9376	-.0058	.0063
8.0000	-.0008	.0034	-.2366	.8132	-.0075	.0059

Chapter IV – Discussion

Smartphone topic is a relevant topic due to its widespread and recurrent use, being transversal to gender, age and social class (Lazar et al., 2015; Lee et al., 2014; Marketeer, 2018; Oulasvirta et al., 2012). This topic is comprehended in the larger issue of information management between the public and private domains (Cath et al., 2018; Jin, 1998; Pew Research Center, 2014). Therefore, we contend this topic is critical in understanding the role privacy plays in the intention to use this device. With this study, we tried to understand whether privacy as a human value is a facilitator or an obstacle in the intention of using smartphones. Privacy has been chosen due to its emerging role highly associated with intrusiveness (Mani & Chouk, 2017).

Literature review suggested a set of hypotheses that linked key concepts in technology acceptance models with the behavioral intention to use smartphones while incorporating privacy as a boundary condition (moderator). Hypotheses H1 and H2 were corroborated, that is, usefulness and EoU correlate positively with BI to use the smartphone applications, which is a consistent finding with previous research (e.g. Bruner & Kumar, 2005; Davis, 1989; Gefen & Straub, 2003; Venkatesh & Davis, 2000). In contrast, H3 that established a positive association between fun with BI was not corroborated in this investigation.

The set of simple moderation hypotheses, H4, H5 and H6, established interaction effects of privacy in the previously established relationships in H1 to H3 hypotheses. Findings did not support H4 – privacy negatively moderates the EoU and BI – and only supported partially H5 (privacy negatively moderates the relationship between usefulness and BI) as it was only supported for social domain apps. H6 also established a negative moderation of privacy in the relationship between fun and BI. This was not supported by our findings.

The set of combined moderation hypotheses comprehends H7 and H8. Both were supported as in both cases significant interaction effects were found but only for the case of health related apps. Findings showed a non-significant interaction for the remaining types of app use (social networks, money related apps). Overall, H7 ansd H8 were only partially corroborated.

The hedonic component of the smartphone - fun - did not produce significant results because none of the applications or tools of the social, health or money-related domain of the smartphone were considered funny as evidenced by its means. This imples, our results do not preclude Batra and Ahtola (1990) statement that using smartphones is funny as it very much depends on the type of app and explains why, conversely to van der Heijden (2004), we found hedonic dimension is never correlated with any of BI dimensions while usefulness is. This may be attributed to the questions related to this category were phrased in a general way without giving examples or that apps are intended to be instrumental and not really funny.

As far as privacy is concerned, it influences BI in a social context, since the perception of usefulness counters privacy, that is, when individuals perceive the smartphone as a useful device, they tend to devalue privacy and be more open to use social network applications (Hsu, Chang & Yen, 2011). Combined usefulness and fun, offered similar results. Unexpectedly, we have seen significant results in the field of smartphone applications for health purposes. As such, we have found that individuals who value privacy and find that using smartphones is both fun and easy, tend to report a higher probability of using smartphones for health purposes, although they continue to fall on the rejection side of the scale. This may be related with the criticality of health for individual well-being and in the domain of intimacy. It means that individuals who value privacy and consider non-fun and non-easy-to-use health-related applications are those that most strongly reject BI in this domain. Similarly, when individuals find that using the smartphone is fun and useful and are concerned about privacy, they will be more likely to use it for health purposes, although they fall on the negative side of the scale, meaning they still reject using it. This means that individuals who value privacy will be those who will most reject the use of related health applications when they realize that they are not funny or useful. Similarly, when a health-related application on the smartphone is easy to use, useful and fun, individuals who value privacy tend to reject it, but not as strongly as those who do not value privacy. But the same individuals who value privacy will reject it more strongly when applications are not easy, fun, and useful. It is worthwhile to highlight that privacy overdrives the joint effects of usefulness, easy of use and fun.

The above findings have significant implications for smartphone manufacturers, merchants and consumers. This research reinforces the importance of understanding the

factors that influence the behavioral intention of smartphone use since this is a value-based decision. More specifically, we have found that the value of privacy is important to individuals when they perceive the smartphone as useless and not easy-to-use device. In general terms, we have seen that privacy is a crucial factor in BI intention, and the features associated with smartphone can appease the preponderance of privacy in the use of smartphone.

Based on this logic, we can conclude that smartphone manufacturers should pay attention and invest in the functionalities of the smartphone in order to make it easy and its use essential and, in this way, decrease the value of privacy as an obstacle to this intention. Nevertheless, we can see that the tools and apps aimed at the health of the user have revealed great importance in this study, so there are implications that may be useful in the area of medicine and healthcare that contribute to the well-being of individuals.

After a critical reflection on this study, we realized that there are some limitations. There is no homogeneity in the sample with regard to gender. Age range is also large (18-69 years). On the other hand, the smartphone brand should be a variable to control because the buying decision may be influenced by the preference or symbolic aversion associated with some brands (Dorsch, Grove & Darden, 2000). As an example, a recent scandal has hit the Huawei brand (Forbes, 2019), which led some countries to bar the Chinese company from providing the infrastructure for the 5G mobile internet network. On the other hand, some western countries fear that through Huawei's 5G network, espionage capacity will be expanded, although the company insists that there is no government control. These changes resulting from the scandal lead users to question the privacy of this brand's smartphone which may influence the behavioral intention of smartphone use. Another limiting factor in this study is that it has not been determined exactly what specific aspects of the smartphone influence EoU and fun (e.g., applications, tools, menu layout). It should be noted that this is a limitation of most investigations in this area that use TAM (Davis et al., 1989). On the other hand, the lack of homogeneity of the sample relative to gender is a limiting factor since there is divergent evidence on this subject. For example, there are studies that show that gender differences in technology use are small since women spend as much time as men on IT devices (Deursen et al., 2015). However, there are other studies that show that girls are less likely to use new technologies, since IT is traditionally associated with males (e.g., Wilska, 2003). In the present study we

found that men are more familiar with IT as the proportion of men with occupations linked to this area is higher.

As far as human values are concerned, the values identified by Rokeach are highly desirable. In order to make the questionnaire appealing, we decided that individuals should select a limited number of values, many of which are almost equally desirable and may not be the most valued by individuals. However, according to Homant (1969) we opted for technique of ranking values since it has the advantage of forcing the individual to generate a value system. This means that BI was determined by the relative (not absolute) value of the participant's values.

Finally, with respect to BI dimensions, by not specifying smartphone applications in each area we may have led participants to perceive and imagine different tools that may alter their perceived usefulness, EoU and privacy. As an example, in the health field there are several apps with different purposes such as apps that monitor the number of steps walked daily or applications that monitor sleep, namely, that encourage the individual to sleep at a certain time. Finally, probably the perception of fun and privacy in these applications is different and our results may have been affected by this lack of specification.

Based on the limitations pointed out, for future studies we suggest the specification of BI dimensions with respective examples of various applications and tools, since there are several applications with different levels of invasion of privacy. Similarly, it would be relevant to define privacy taking into account the different contexts and also to specify the fun and EoU variables. Furthermore, it would also be interesting to see if the smartphone brand is a variable that influences privacy and BI.

In addition, it would be interesting to compare the professional activities to which the smartphone is intended for use. This is because the adoption of smartphones among college students stimulates social media and entertainment, and tends to serve as a multipurpose environment for social and entertainment activities, rather than work-related activities. Gu et al. (2010) found differences in the understanding of the hedonic and utilitarian nature of information devices due to occupation. On the other hand, the authors found that workers are more likely to be influenced by usefulness, while students are more likely to be significantly influenced by the hedonic component of the smartphone (Gu et al., 2010). Additionally, cultural differences in our study may have

been overlooked. According to Campbell (2007), there are several issues that influence the use of the smartphone, namely, perceiving the smartphone as a trendy device, attitudes about use in public environments, the use of the smartphone for safety issues and use for instrumental purposes, so this should be considered in research.

In conclusion, we believe this research offers contributions to human behavior in its relation to technology. This topic becomes relevant since we are in the digital age and use the smartphone daily for professional and social purposes. More specifically, the results obtained will be useful for smartphone manufacturers and consumers as well as for those who study the relationship between man and technology. By understanding the extent to which privacy is a deterrent to smartphone use, telecommunications companies can take advantage of other features - in this case, fun, EoU and usefulness - to counter this influence and thereby increase the intended use and smartphone purchase. Citizens, one the other hand, can also gain conscience on the variables that are in play and condition their ability to uphold privacy as a fundament of individual freedom.

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Annex A

No âmbito do Mestrado em Psicologia Social e das Organizações, no ISCTE-IUL Instituto Universitário de Lisboa, foi criada uma equipa de investigação com o objetivo de estudar a utilização de smartphones. Gostaríamos que nos ajudasse, respondendo a um pequeno questionário que lhe toma, aproximadamente, 10 a 15 minutos.

O questionário é anónimo, com o fim de assegurar a confidencialidade e imparcialidade dos participantes e não lhe trará nenhuma despesa, nem riscos, No mesmo, não existem respostas certas, nem erradas. É a sua opinião, verdadeira, sincera e espontânea que realmente importa. Além disso, a sua participação é totalmente voluntária. Os dados recolhidos destinam-se exclusivamente para fins académicos da presente investigação, juntamente com os dos restantes participantes. Caso pretenda informações adicionais e/ou esclarecimentos de dúvidas relativas ao estudo, contacte o professor responsável através do seguinte e-mail: nelson.ramalho@iscte-iul.pt

Caso aceite participar no presente estudo, por favor, preencha o espaço abaixo indicado.
Os dados só serão guardados quando, no final, clicar em submeter, pelo que é muito importante que não desista antes de chegar a este passo.

Gratos pela sua colaboração,

Filipa Matias

- Ao avançar, declaro que tomei conhecimento dos objetivos e procedimentos previstos para a minha colaboração neste estudo e aceito participar.

- Atualmente tem smartphone?

◯ Sim

◯ Não

- Há quanto tempo tem um smartphone? (anos)

_____

- Entre as pessoas mais próximas de si, que percentagem usa smartphone?

_____

- Em que medida considera que o seu smartphone incorpora inteligência artificial?

	1	2	3	4	5	6	7	
Não incorpora nada sequer parecido com inteligência artificial,	◯	◯	◯	◯	◯	◯	◯	Incorpora bastante inteligência artificial, até mais do que as pessoas pensam,

- **Pense na utilidade do seu smartphone.** Indique em que medida concorda ou discorda com as seguintes afirmações.

	Discordo totalmente (1)	Discordo parcialmente (2)	Não concordo nem discordo (3)	Concordo parcialmente (4)	Concordo totalmente (5)
Ajuda-me a ser mais eficaz. (1)	○	○	○	○	○
Ajuda-me a ser mais produtivo. (2)	○	○	○	○	○
Poupa-me tempo por usá-lo. (3)	○	○	○	○	○
Requer um menor número de etapas para realizar o que eu queria fazer. (4)	○	○	○	○	○
Facilitou a tarefa que eu queria realizar. (5)	○	○	○	○	○

- **Pense na facilidade de uso do seu smartphone**. Indique em que medida concorda ou discorda com as seguintes afirmações.

Smartphones and Privacy

	Discordo totalmente (1)	Discordo parcialmente (2)	Não concordo nem discordo (3)	Concordo parcialmente (4)	Concordo totalmente (5)
É fácil de usar. (1)	○	○	○	○	○
Eu aprendi a usá-lo rapidamente. (2)	○	○	○	○	○
É simples de usar. (3)	○	○	○	○	○
Eu facilmente me lembro como usá-lo. (4)	○	○	○	○	○
Foi fácil aprender a usá-lo. (5)	○	○	○	○	○

- Considerando as possibilidades que um smartphone pode oferecer hoje, em que medida utiliza ou utilizaria as seguintes funcionalidades?

Smartphones and Privacy

	Nunca (1)	Algumas vezes (2)	Cerca de metade das vezes (3)	A maioria das vezes (4)	Sempre (5)
Colocar os meus dados pessoais numa aplicação do smartphone. (1)	○	○	○	○	○
Aceder à minha conta bancária. (2)	○	○	○	○	○
Guardar fotos pessoais. (3)	○	○	○	○	○
Guardar ou permitir a monitorização do meu sono. (4)	○	○	○	○	○
Dar a conhecer a minha localização através do GPS. (5)	○	○	○	○	○
Usar aplicações de monitorização da minha saúde ou alimentação. (6)	○	○	○	○	○
Aceder a uma rede social. (7)	○	○	○	○	○
Aceder ao email pessoal. (8)	○	○	○	○	○
Permitir a integração de toda a informação num browser. (9)	○	○	○	○	○
Usar aplicações de GPS para chegar a um endereço. (10)	○	○	○	○	○

Usar aplicações que exigem um cartão de crédito. (11)	○	○	○	○	○
Usar mecanismos de bloqueio do tipo password. (12)	○	○	○	○	○
Usar impressão digital. (13)	○	○	○	○	○
Usar identificação biométrica pela retina ou iris. (14)	○	○	○	○	○
Usar reconhecimento facial. (15)	○	○	○	○	○

- Em que medida usar o seu smartphone a/o deixa:

	1	2	3	4	5	
Infeliz	○	○	○	○	○	Feliz
Irritado/a	○	○	○	○	○	Calmo/a
Insatisfeito/a	○	○	○	○	○	Satisfeito/a
Melancólico/a	○	○	○	○	○	Contente
Desesperado/a	○	○	○	○	○	Esperançoso/a
Aborrecido/a	○	○	○	○	○	Relaxado/a

- **Ordene, do mais importante para o menos importante, os seguintes valores:**
(carregue e arraste para a posição que reflete a sua posição). Note que a ordenação que se apresenta apenas segue uma ordem alfabética.

Amizade verdadeira
Auto-respeito
Igualdade
Liberdade
Privacidade
Saúde
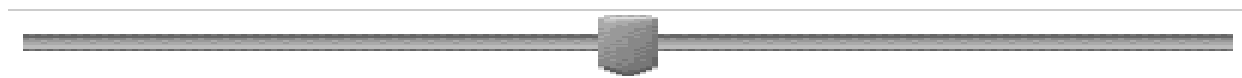Segurança nacional
Um mundo em paz

- Em que medida está familiarizado com as tecnologias de um smartphone?

| Nada familiarizado(a). Não conheço nada. | | | | | | | | | | Perfeitamente. Conheço bem as tecnologias usadas. |

| 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

- Para terminarmos segue-se um pequeno conjunto de questões de natureza sociodemográfica apenas para caracterização agregada dos participantes. Recordamos que todo o inquérito tem natureza confidencial e a sua participação é anónima.

- Idade _____

- Sexo:

○ Masculino

○ Feminino

- Habilitações literárias:

○ Até ao 9º ano

○ 9º ano completo

○ 12º ano completo

○ Licenciatura ou equivalente

○ Mestrado

○ Doutoramento

- Estado Civil:

○ Solteiro/a

○ Casado/a ou em união de facto

○ Divorciado/a

○ Viúvo/a

- Exerce atualmente ou exerceu uma profissão ligada às Tecnologias de Informação?

○ Sim

○ Não

Agradecemos a sua participação neste inquérito.
A sua resposta foi registada.