

# **Interactivity in Mobile Applications: A study of Continuance Intention**

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## **Publications**

*“How does the Interactivity Effects Model influence Continuance Intention in mobile applications?”* submitted to a journal of quartile one of Scimago index.

## **Abstract**

In the information and technology society we live in today, the number of mobile applications made available gives users the opportunity and need to create criteria and adopt ways to select what they will continue using in so many areas of life. This happens in mobile applications, which are information systems the markets for which have grown exponentially in the last two decades.

With this growth, the users' demands and expectations also grew, and with that, the desire to be able to interact with the systems themselves. In order to contribute to this field of science, we developed research that creates a model combining the Expectation Confirmation Model, presented by Bhattacharjee, and the Interactivity Effects Model, introduced by Shyam Sundar in 2015, through the concepts of modality interactivity, message interactivity, and source interactivity. The use of these concepts in the study of continuance intention, as well as their use on mobile applications as a platform, proved to be important to explore for both this current research and future ones.

A mixed methods approach was used, creating an online survey to obtain the quantitative data necessary for the research, followed by a series of interviews made with the goal of confirming and explaining the quantitative data, always supported by the literature on the subject.

Of a total of eleven hypotheses, eight were supported by our results, with modality interactivity proving to have a greater positive influence over satisfaction and continuance intention than perceived usefulness. The influence of message interactivity on satisfaction, message interactivity on continuance intention, and source interactivity on continuance intention were not supported by the results.

The interviews suggest explanations of these results and allowed the perception that message interactivity tends to include techniques that are harder to recognize, which could justify the poor results obtained when evaluating the quantitative data. This conclusion, apart from its scientific importance, also demonstrates the importance of

confirming and further explaining quantitative results when developing scientific research.

**Keywords:** *Mobile Applications; Continuance Intention; Modality Interactivity; Message Interactivity; Source Interactivity.*

## Resumo

Na sociedade tecnológica e de informação em que vivemos hoje, a quantidade de aplicações móveis disponíveis exige que os utilizadores criem critérios e adotem formas de selecionar o que continuarão a utilizar em todas as vertentes do seu dia-a-dia. Isto acontece com aplicações móveis, sendo sistemas de informação que viram o seu mercado crescer exponencialmente nas duas últimas décadas.

Com este crescimento, as exigências e expectativas dos utilizadores cresceram também, e, com isso, o desejo de poder interagir com os próprios sistemas. Para contribuir para este campo da ciência, decidimos desenvolver um estudo com a criação de um modelo que conjuga o conhecido *Expectation Confirmation Model*, desenvolvido por Bhattacharjee, e o *Interactivity Effects Model*, que surge em 2015 com Shyam Sundar, através dos conceitos de interatividade de meio (*modality interactivity*), interatividade de mensagem (*message interactivity*) e interatividade de fonte (*source interactivity*). A utilização destes conceitos no estudo da intenção de continuação de uso, assim como os mesmo tendo as aplicações móveis como plataforma, provaram ser um tema digno de exploração, tanto na presente pesquisa, como noutras futuras.

Foi utilizada uma conjugação de métodos de recolha de dados, com a criação de um questionário online para obter os dados quantitativos necessários, seguido pela realização de entrevistas feitas com o objetivo de confirmar e explicar os resultados obtidos através do questionário, sempre com o suporte da literatura existente sobre o tema.

De um total de onze hipóteses, oito foram suportadas pelo nosso estudo, com a interatividade de meio (*modality interactivity*) a provar ter maior influência positiva sobre a satisfação (*satisfaction*) e a intenção de continuação de uso (*continuance intention*) do que a variável de utilidade percebida (*perceived usefulness*), ainda que fossem confirmadas todas as hipóteses relativas ao *expectation-confirmation model*. A influência da interatividade de mensagem (*message interactivity*) na satisfação (*satisfaction*), assim como da interatividade de mensagem (*message interactivity*) na intenção de continuação de uso (*continuance intention*), e da interatividade de fonte

(*source interactivity*) na intenção de continuação de uso (*continuance intention*) não foram hipóteses confirmadas pelos resultados obtidos.

As entrevistas permitiram a explicação destes resultados e a percepção de que a interatividade de mensagem (*message interactivity*) tem tendência a ser uma ferramenta mais difícil de reconhecer e perceber, apesar de os utilizadores expressarem que sentem satisfação pela sua existência. Esta conclusão provou também a importância da realização de entrevistas, ou, em geral, da confirmação e explicação dos dados quantitativos no desenvolvimento de uma pesquisa científica.

**Palavras-chave:** Aplicações Móveis; *Continuance Intention*; *Modality Interactivity*; *Message Interactivity*; *Source Interactivity*.



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## 1. Introduction

Mobile applications (apps) are present in our daily life at every turn. We use them to send messages, to share our life with others, to execute payments and manage our accounts, to listen to music, and watch movies. It has become difficult to let a day go by without using a multitude of mobile apps, and the growth in the market has accompanied an enormous increase in the number of apps available for download in recent years. There were over 2.7 million applications available for download on the Google Play Store in July of 2021, while in the same month 10 years earlier the total number of apps stood at only a quarter of a million (Ceci, 2021). Because of this past growth and its near certain persistence, studying this theme has also become increasingly important for the market, the developers, and anyone and any company associated with these information systems (IS).

Mobile apps have been studied in regard to their evolution (Phongtraychack & Dolgaya, 2018), and their adoption (Frey et al., 2017; Xu et al., 2016), with some studies also being developed in the users' continuance intention (CI) of use (for example: X. Chen & Li, 2017; Franque et al., 2021; C. Y. Li & Fang, 2019; Tam et al., 2018; Yan et al., 2021). Our goal is to study continuance intention in the mobile applications realm, because more than knowing how the market is evolving and what makes people want to have a certain mobile app, it is essential to know what makes someone want to continue using it and what the drivers are that lead to the continuance intention of this use.

While the studies mentioned above, and others, have investigated CI on mobile apps, the introduction of interactivity is still a growing field. Interactivity has been studied as a concept by Kiousis (2002), applied to a relationship between user or customer with brand or system by Ting, Abbasi, and Ahmed (2020), studied in a customer engagement context by Kang, Lu, Guo, and Li (2021) having live streaming commerce platforms as a base for their study. Although it has also been studied in relation to continuance intention (Jiang et al., 2022; S. Yang et al., 2018; Zhao and Lu,

2012), the influence of modality, message, and source interactivity, as defined by Sundar et al. (2015) on the continuance of intention to use mobile applications as a whole has, to be the best of our knowledge, yet to be studied.

That gap in literature is what motivates the main research question of this study: Can modality, message, and source interactivity be motivating factors for continuance intention of usage of mobile applications? And if so, how?

The aim of this study will be answering the research question, as well as fulfilling a set of goals, namely the integration of interactivity, in the forms described in the interactivity effects model (IEM) (Sundar et al., 2015), in the expectation confirmation model (ECM) (Bhattacharjee, 2001), and, following this, the creation of a concept model that allows this integration. Additionally, and accordingly, we intend to evaluate the importance of interactivity in mobile applications according to their users, through the development of a survey that will provide us with quantitative results for the hypotheses that were created, as well as through interviews that will afford a better understanding of users' extended opinions and experiences.

We therefore hope to investigate the work that has already been developed on the subject, studying some of the drivers that lead to the continuance intention of usage of mobile applications and to advance the knowledge in the field, confirming propositions and conclusions presented in previous scientific research. This research could represent an evolution for information sciences by filling a small gap that exists in the literature, therefore allowing the development and maintenance of mobile applications to be more suitable for the majority of their users, with the knowledge that a study on an information system is already an advance as well for others, given that the factors that positively or negatively affect users' attitudes toward different platforms could be similar, if not the same.

The contributions of this research are focused on the combination of the expectation-confirmation model (Bhattacharjee, 2001) and interactivity effects model (Sundar et al., 2015). The joint use of these two individually established models allows for the confirmation of the already studied principles and hypotheses of the first, while also relating them to various concepts of interactivity. This leads to a better

understanding of the effect modality, message, and source interactivity have on both satisfaction and continuance intention, and therefore the influence of IEM on continuance intention, which, to the best of our knowledge, has yet to be done.

In a broader sense, this research will also contribute to the development of knowledge and research about CI in mobile apps, which has been a topic of interest for various scientific advancements, but never with the variables and propositions here developed and tested. This will hopefully allow and contribute for the progress of knowledge for both scientific research and information system development, given that the findings can influence how mobile applications are designed and developed taking into account users' perception of what better pleases them in the use of a mobile app.

To begin our study, throughout the second section the concepts of mobile applications, continuance intention in the context of ECM (Bhattacharjee, 2001), interactivity and its different forms and tools according to IEM, as part of the theory of interactive media effects (Sundar et al., 2015), will be discussed. In the same section we also mention some of the studies that focused their research on these areas, in an effort to assess the literature that already exists in this field, recognize the gap regarding modality, message, and source interactivity relating to continuance intention, and expose the need to fill the gap detected.

Following this concept introduction and literature review, a conceptual model is presented in section three, along with the hypotheses proposed to provide an answer to the goals and research question mentioned above. Section four then provides an overview and analysis of our sample collection methodology, which, as mentioned, consists of a survey and interviews. Section five presents the results from both components of the study. Section six discusses the results, namely the quantitative data achieved from the online surveys, qualitative data collected through interviews that will serve as confirmation and justification, and the comparison with the literature about the themes at hand. Theoretical and practical implications will also be indicated, showing the influence we hope the research can have on the theories and models at hand and their influence on possible future studies, as well as effects on the development and creation of mobile applications or information systems in general. Lastly, section seven

addresses limitations found during the phases of this research, as well as propositions for future research in this field.



## **2. Context and Literature Review**

### **2.1 Mobile Apps**

In 2016 there were more than 3 billion subscriptions to smartphones, a number that almost doubled by 2021 and is estimated to reach more than 7.5 billion by 2027 (Statistica, 2022), which comfortably surpasses 90% of the number of people in the world. The devices have become essential in people's self-expression and their connection and relationships with others, allowing them to maintain communication, express emotions, and obtain information, and can even be considered a technology of intimacy (Lasén, 2004). Users have been proven to feel an emotional attachment to their phones, which affects their development in the most diverse settings (Lasén, 2004), with these devices influencing young people's development within their families, affecting their attitudes toward school and the communities of which they are a part of (Campbell, 2005).

Thus, we can say that mobile phones have become an essential part of everyone's lives. Starting from the first and simplest form of these devices, they developed into the smartphones we all know and most own today. More than calling or messaging, in today's age mobile devices can be used for almost anything due to what we call mobile applications, a direct result of the rapid and significant advancement of technology coming together with the development of the internet and media. Apps have become something that can be used with many mobile devices, of which smartphones are an example (Phongtraychack and Dolgaya, 2018).

Ranging from categories like communications, games, multimedia, productivity, travel, or utilities (Islam et al., 2010), there are applications to fit any desire the user may have, and for any gap in the market that may exist, there are new apps being produced and marketed daily to fill it. What was once an innovation, such as alarms or calculators, are now automatically integrated in any mobile device and considered the simplest of forms of its kind. Mobile applications really have revolutionized and taken

over the way we live and, as of 2019 the number of apps in app markets reached 2.7 million (Li et al., 2020).

Because they are such a constant in everyone's lives and have been developing and multiplying mainly over the last two decades, there have been multiple studies elaborated about the theme. Islam, Islam, and Mazumder (2010) studied *Mobile application and its global impact* with an article published in the *International Journal of Engineering and Technology*, studying the uses given to mobile applications, their business consequences, an analysis of the market, an ethical perspective, and limitations (Islam et al., 2010).

Phongtraychack and Dolgaya (2018) also performed an analysis of the evolution of mobile apps, studying past and present data and situations as well as mobile apps' effects on society. Gokgoz, Ataman, and van Bruggen (2021) studied the impact of the download of different types of apps, and their market behaviour in the year following its release, considering a group of chosen variables, and creating a path that users tend to follow from their urge to find an application to its adoption.

Li, Zhang, Cao, Yi, Tarkoma, and Hui (2020) studied mobile applications but focused on the long-term evolution of mobile app usage. The authors studied mobile apps as a category as well as apps on an individual basis in their long-term evolution (Li et al., 2020) through the data collected on a platform named *carat*. The results revealed an initial growth followed by a plateau stage for the app-category and showed a pareto effect in the individual app analysis, followed by elimination due to the competition between apps in the same categories (Li et al., 2020). This view of long-term usage of mobile applications can raise the question of what it is that makes people choose which applications to continue using after their acceptance and trial runs, and what the factors are that influence the continuance intention of usage, a concept that should be analysed.

It is therefore clear and safe to conclude that there are many ways through which mobile applications have been studied regarding their use, their necessity, their longevity, and others, with this being a testimony for how important and active this topic is in today's world. However, we can also conclude that while there are indeed many

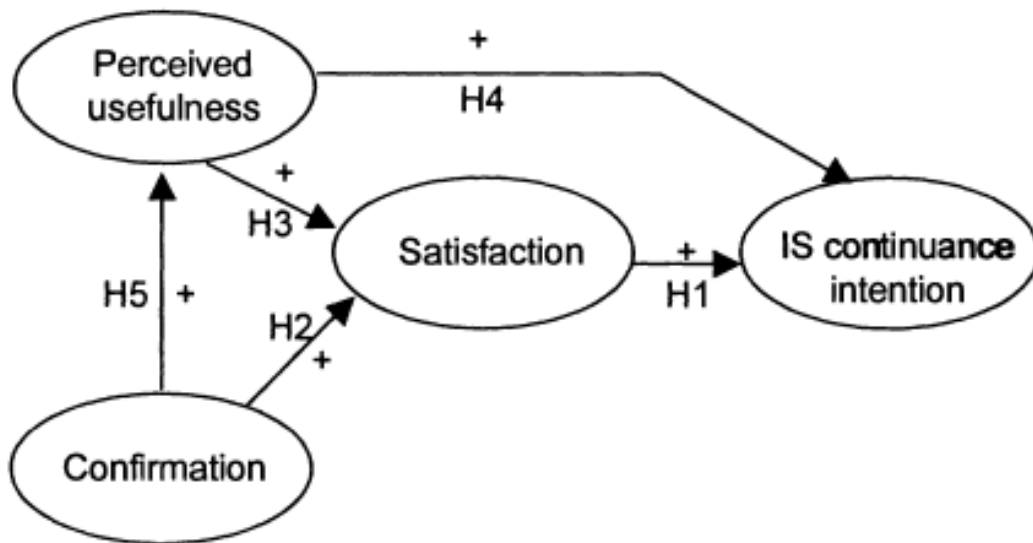
ways to approach the study of mobile apps, and there have already been several attempts to do so, the growth of this sector makes it a necessity to keep studying and developing scientific research about it. We therefore approach them with the goal of better understanding the continuance intention of their users, and factors that may influence that intention.

## **2.2 Continuance intention and the expectation confirmation model**

Anol Bhattacharjee is regarded as one of the initial authors to define and explain continuance intention (CI) as a separate process from acceptance and initial usage of information systems while modelling a theory that would adequately represent the differences between these two phases through the adaptation of the expectation confirmation theory, formulated by Richard L. Oliver in the late 1970s, from the consumption and purchase to the usage of information systems (Bhattacharjee, 2001).

In this expectation confirmation model (ECM), Bhattacharjee (2001) tests five hypotheses to achieve an answer to the question of what influences the continued use of an information system by its users, testing how confirmation, perceived usefulness, and satisfaction play their part in this process, as shown in Figure 1.

**Figure 1:** “A Post-Acceptance Model of IS Continuance” (Bhattacharjee, 2001)



Continuance intention represents the will of the user of a certain Information System to continue using it past the acceptance phase, and because of its importance for the development of information systems that aim to be continuously used, it has been studied regarding a diverse group of categories and systems. As an example, Chen, Yen, and Hwang (2012) studied what influences the continuance intention regarding the use of what is called the *web 2.0*, when they proposed a causal model of satisfaction and usage of the Web 2.0 applications using four factors: subjective norm, image, critical mass, and electronic word-of-mouth (Chen et al., 2012).

Amoroso and Lim (2017) also studied continuance intention regarding the mediating effects of habit on continuance intention. Using two models, one seeing the direct effects of attitude and satisfaction in CI and a second in which habit is introduced as a mediator, they find that consumer attitudes are the greatest determinant of CI. They find that habit is correlated to satisfaction, but less so with attitude, and that satisfaction, while not being a strong variable in the prediction of continuance intention, is mediated by habit (Amoroso and Lim, 2017).

More recently Yang (2021) studied the same subject of continuance intention, but this time regarding the determinants that can influence the continued use of social

recommender systems. The author formulated a theoretical model considering perceived information quality and perceived system quality, recommendation satisfaction and trust in recommendation, and finally continuance intention to use social recommender systems (Yang, 2021). Xue Yang (2021) was able to reach the conclusion that both satisfaction and trust relationships to recommendations are able to influence and affect continuance intention.

The articles above mentioned represent a small part of the literature developed on the topic of continuance intention but show the importance that this subject has had on the study of information systems and overall consumer and user behaviour. Mobile applications may follow the same premises as the mediums involved in the studies above, allowing for the formulation of theories and conceptualizations that would permit researchers and developers to understand CI in mobile apps, and granting them the opportunity to reach their main objective, given that ultimately the intention when releasing a mobile app is always to give as many users as possible the necessary tools and incentives to use it for extended and continuous periods of time (Phongtraychack and Dolgaya, 2018).

There have been several articles written about this very topic, some discussing mobile applications as a whole. Tam, Santos, and Oliveira (2018) set out to expand the expectation-confirmation model in order to understand continuance intention in mobile apps. This was achieved by using the ECM and the extended unified theory of acceptance and use of technology, and it was possible to determine which variables connected to continuance intention in mobile apps are the most important. One of the variables that we study is one of theirs (Tam et al., 2018).

Other studies focus on a specific category of mobile applications when studying continuance intention, as did Hsiao, Chang, and Tang (2016) regarding mobile social apps. Yan, Filietri, Raguseo, and Gorton (2021) did the same for health apps; and there are even specific studies for the continuance intention of use of mobile payment services, such as the one reported by Chen and Li (2017).

The existence of this research allows us to understand the emphasis that has already been attributed to continuance intention in the context of mobile application

usage. It also allows us to conclude that there have been some aspects explored in this regard, however, and because the world of technology is an ever-growing and changing one, the need to keep exploring different factors and possible influential variables exists, a context in which we identify interactivity to be a largely unexplored avenue.

### **2.3 Continuance intention and interactivity**

With this growing insight into mobile apps and the technology and influencing factors pertaining to its use, it has become common to study the psychology behind communications technologies, which is the context in which Sundar et al. (2015) introduced the idea that interactivity and being interactive is the key ingredient to succeed in modern media (Sundar et al., 2015, p. 49). Whether it refers to digital media, to mobile applications, or to any information system, the possibility to interact with the content being seen, and the platform in which it is being seen on, is an enormous part of the experience a consumer or user expects to have, and that can greatly influence their attitudes toward it.

Interactivity in itself has actually been studied in the context of continuance intention. Jiang et al. (2022) tackle the theme on online shopping experiences and the factors that can influence users and consumers to use the technologies that appear to be growing more and more, demonstrating the important influence of intrinsic value and perceived interactivity on users' behaviours regarding the systems and the technology at hand.

Yang et al. (2018), faced with the decline in use of mobile government microblogging service, undertook to understand if perceived integration and perceived interactivity could influence the emotions connected to the utilization of the service. They came to the conclusion that perceived interactivity could influence information, social, hedonic, and emotional values, which shows us that interactivity, once again, proves to have an influence on users' attitudes and behaviours.

Also relating their study to microblogging services were Zhao and Lu (2012), however, not in the same way. These researchers sought to understand how some factors could influence microblogging services' perceived interactivity for users, and how this perceived interactivity could actually affect their satisfaction and continuance intention, obtaining a positive result in both these propositions.

However, our goal is not simply to study interactivity or its perception, but rather to connect interactivity and continuance intention through the use of concepts that Sundar et al. (2015) defined as part of the interactivity effects model, one of the models of the theory of interactive media effects. This is something that to the best of our knowledge, is yet to be explored, leaving the scientific gap that we intend to fill.

## **2.4 Interactivity and the interactivity effects model**

To study the interactivity effects model, as well as the theory of interactive media effects and interactivity itself, we first need to understand it as a concept. There has been great debate to conceptualize and define interactivity in a worldwide accepted way.

Kiousis (2002) identified interactivity as the possibility for the establishment of channels of communication between users. This communication consists of reciprocal message exchanges, the action we most easily correlate with communicating and interacting and can be happening in a synchronous manner or not, following or not linear paths in doing so. These exchanges can range from direct exchange of information to movements on a videogame, thereby creating relationships between the parties involved, whether they be human in nature or not.

Kang, Lu, Guo, and Li (2021) congregate interactivity's definitions as defined previously by other authors, identifying it as a stimulus, cuing a state in the customer or user of a certain system that will affect their emotional responses and, therefore, their behaviour. This idea aligns with their proposition that the relationships and bonds formed between people are greatly and very directly influenced by social interactivity,

a factor that becomes an almost intrinsic need and want for them (Kang et al., 2021, p. 4), making us believe that interactivity is almost a primitive and always looked for precondition for our lives as humans.

This emotional and psychological response associated with interactivity proves to be a point in common to various authors, with Sundar et al. (2015) stating that interactivity goes beyond interaction and that, as a variable, it actually includes all of the underlying psychological responses the interaction in itself raises in the participant (Sundar et al., 2015, p. 50). It is in this same study that Sundar explains the context and utilization of the theory of interactive media effects.

The theory of interactive media effects (TIME) (Sundar et al., 2015) is constituted by four models: the interactivity effects model, the agency model, the motivational technology model, and the Modality-Agency-Interactivity-Navigability (MAIN) model, each representing a different premise of interactivity from the user's perspective. These models together represent the propositions of the theory of interactive media effects.

According to Sundar et al. (2015), the starting point to using this theory, will always be an *affordance*, a term developed by Gibson (1979) and through which he wanted to express a complementary relationship. Gibson (1979, p. 127) describes this concept in a chapter of his book, defining an environments' affordances as what an animal's habitat can offer them, the same way we can describe it as being what an interface can offer its user and vice-versa. Sundar et al. (2015) shares what Norman, in 1988, defined as affordances, namely the observable tools a system suggests and presents for the user to utilize and operate it. In simpler terms and applied to the context of this study, we can see affordances as the actions a user can distinguish and use when utilizing mobile applications.

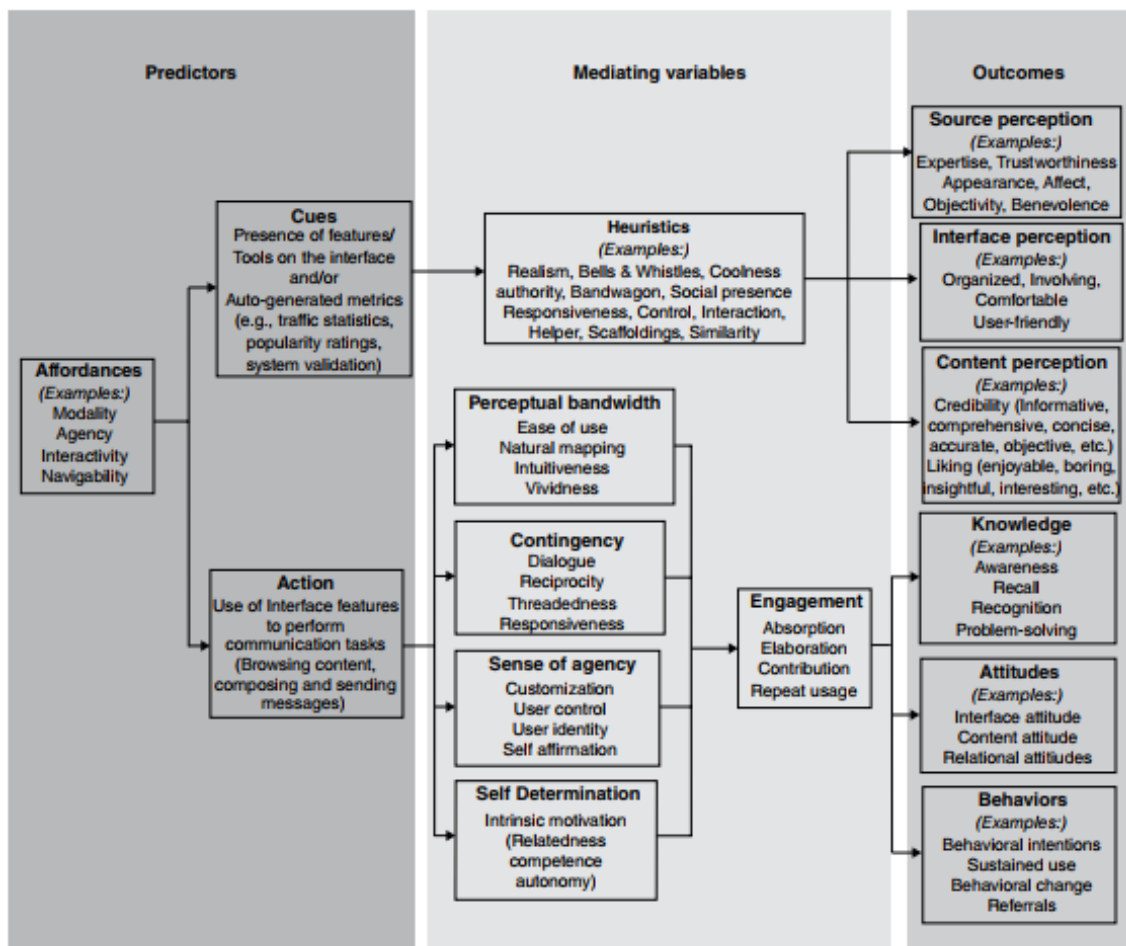
These affordances become one of the most important parts of an information system such as a mobile app, given that media has become a mechanism that has started to truly influence our interactions, and is no longer seen as just a means for some to share messages, and others to receive (Sundar et al., 2015). By this logic, it would be fair to assume that mobile applications that provide more actions that are included in the perceived interactivity by a user would have a better chance to be successful and that



the continued use would be more likely. This continued use of information systems is accounted for in the model of the theory of interactive media effects.

According to TIME, the action route (Figure 2) should lead to repeat usage as part of engagement, reached through the presence of affordances that invoke actions. Such actions should always have a psychological component attached to it, something that makes the user choose to take them. The psychological results of these actions are what mediates the relationship between user and system, which determines the continued use of said system (Sundar et al., 2015).

**Figure 2:** "TIME model" (Sundar et al., 2015, p.51)



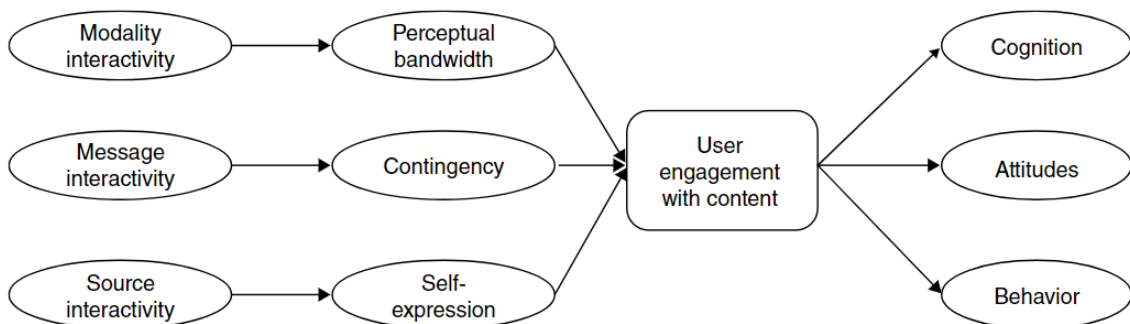
## 2.5 Interactivity Effects Model

The theory of interactive media effects comprises four individual models (the MAIN model, interactivity effects model, the agency model, and the motivational technology model), which together form a more complete framework, combining multiple facets of interactivity and communication media and technologies. These models jointly allow us to understand how our behaviour, while using technology and in the real world, can be influenced by interactive media, with the MAIN model identifying how the conclusions we derive from our system's use are influenced by its cues, and the others studying the repercussions of different actions available on the interface of different systems (Sundar et al., 2015).

For the purposes of this research, the interactivity effects model proves to be the most useful, because it addresses three fundamental types of interactivities (modality, message, and source interactivity) that propose the factor that most influences user engagement, and the way being engaged influences users' behaviours and perspectives (Sundar et al., 2015).

Three kinds of interactivity are conceptualized for this model, modality interactivity (or interactivity of medium), message interactivity, and source interactivity.

**Figure 3:** "Updated model of interactivity effects" (Sundar et al., 2015, p. 54)



All of these features in an interface, meaning the point of connection between the user and the mobile application, the screen in which the user works, from communicating and controlling the actions taken, the visuals (including what is or is not presented), to the organization through which it is presented, influence the user engagement with the content and can even increase it. These various kinds of interactivity make use of different mechanisms, and experiments reveal that interaction effects vary and depend on the type of interactivity that is activated on an interface, having different results when all or just some of the interactivities, as well as their combinations, are used to test user experience and engagement (Sundar et al., 2015, p. 59).

In sum, and as Sundar et al. (2015) state, this model can show how interactivity moulds user engagement, while influencing the way they behave and act, as well as their knowledge. This notion allows for the proposition that will lead to the investigation this thesis will be based on. Both the theory of interactive media effects and the interactivity effects model, as part of the first, give an idea of what influences user engagement, taking into account the psychology behind the actions, or *affordances*, that are allowed on an interface or information system such as mobile applications.

The aim of this study will be to focus on each of these interactivities combining them with the expectation confirmation model of Bhattacharjee (2001) , with the hope of reaching a conclusion about how this interactivity-influenced user engagement can translate into a factor of continuance intention of usage in mobile applications.

But before continuing with the development of the research, it is very important to distinguish the three components of the interactivity effects model we have been introducing.

### 2.5.1 Modality Interactivity

*“Modality interactivity leads to greater user engagement (absorption) with media by enhancing users’ perceptual bandwidth”*

(Sundar et al., 2015, p. 52)

Modality interactivity is described by Sundar as a *functional view* of interactivity, including functions such as those activated by users when they hover over the interface, scroll through a page, or even zoom on a picture (Sundar et al., 2015, p. 54), therefore representing the actions users can choose to take when accessing a certain information or media system, in this case, the tools allowed for the users to take action upon when using a certain mobile application. These are the tools that influence one’s perception of what and how they are seeing the information presented on the website, or any other system. In other words, they shape the users’ mental representation of the content provided (Sundar et al., 2015) , thus improving the *perceptual bandwidth*.

Perceptual bandwidth is a concept and understanding that has been studied in the past as well, with Reeves and Nass (2000) concluding that the social and perceptual nature of the interactions between humans, and between an individual and its environment is also present in their interaction with machines (Reeves & Nass, 2000). Although at the time the article cited was written there was no clear and factually proven conclusion about the debate regarding whether perceptual bandwidth is universally good or bad, it was tested that better perceptual responses and perceptual experience would represent a success for the interface at stake, therefore being a better experience for users, allowing the assumption that it would also engage them more (Reeves & Nass, 2000). This idea was more recently recognized by Sundar et al. (2022), who identify perceptual bandwidth has having a strong influence on modality interactivity’s effect on user engagement.

Additionally, and as Go and Bortree (2017, p. 730) explain, the more functionalities of those associated with modality interactivity are available to users, the

more they will recognize and feel the interfaces' interactivity, because they will obtain a more perceptual depiction of them as well. While this can be true, it has also been established that there are some tools that will increase users' positive attitudes toward the system more than others, as studied by Wang and Sundar (2018) as well as features that, either on their own or studied among others, can have different effects as well (Sundar et al., 2015).

### **2.5.2 Message Interactivity**

*“Message interactivity leads to greater user engagement (elaboration) with media by enhancing the contingency or interdependency in message exchanges”*

(Sundar et al., 2015, p. 52)

When writing about message interactivity, labelled the *contingency view* of interactivity, Sundar et al. (2015) identified it as the nature of the exchanges that occur between a system and its user, or between users. According to the authors, it is usually represented and most associated with how navigation tools are organized in order to create a unique path of action for the user, while also recording it and saving it to create an interaction history (Sundar et al., 2015, p. 56). The paper cited also states perceived contingency as one of the critical mechanisms of this kind of interactivity, concluding that when the website is responding in a unique and individualized way to users' actions and messages, the users tend to feel a greater engagement with it (Sundar et al., 2015), leading us to the fact that user engagement can be a positive factor in continuance intention.

Message interactivity is believed to be able to influence credibility, making it possible to assume that it would impact continuance intention. This proposition is a consequence of a conclusion taken from Go and Bortree's study, indicating that a company's willingness to connect and communicate with its users, or at least the extent

to which users believe the company is making this effort, influences how credible it looks to the consumer, therefore demonstrating how message interactivity can affect said credibility (Go & Bortree, 2017, p. 733).

This type of interactivity is the one that is closest to what we usually consider human-to-human interaction, given its synchronous and reciprocal nature (Sundar et al., 2022). It typically relies on the organization of the action-reaction tools, such as hyperlinks, and the subsequent creation of a unique path for the user, or, in simpler terms, it relies on where and what the user chooses to interact with on the app and its response, for example, the menu setting that the user chooses and that triggers the determined response from the app. A sequence of these user choices will create a unique path of reference in the system, leading us to the breadcrumbs that are left while navigating the app, and that will influence their following interactions (Sundar et al., 2022).

It is also significant to understand that while message interactivity exists in every website or mobile application we use, to a greater or lesser degree, it is a type of interaction that demands a higher cognitive effort and awareness to acknowledge and understand (Yang & Shen, 2018). Because of its importance and interest, studies have been made on this concept through conceptualizations and analysis of user behaviour. An example is Lee and Park (2013), who developed a study in which they found that a better sense and perception of contingency toward the system allowed for more satisfactory attitudes toward and about it, such as feeling trust and that the organization to which the system belongs is more committed, reliable, and has a better reputation.

In our research, message interactivity will be mostly represented and studied through the users' perceptions and feelings toward the action history feature, which is a record of users' actions and choices within the app through the breadcrumbs left by the navigation. This feature seems to be one more easily recognized by users, given that it is a very visible part of almost every web system we use.

### 2.5.3 Source Interactivity

*“Source Interactivity leads to greater user engagement (contribution) with media by enhancing users’ ability to customize, curate, and create content.”*

(Sundar et al., 2015, p. 52)

The third kind of interactivity that Sundar et al. (2015) identify for this interactive effects model is source interactivity, described as the extent to which the user can serve as a source of information while using an interface (Sundar et al., 2015), and relating to the possibilities a user has to control the interface in different ways (for example through selection, customization, curation and even generation of content), the opportunities allowed to be a creator and direct participant, and not only the passive receiver.

This level of regulation of an interface by the user allows for the tailoring and creation of content and information, as well as the choice of consumption of that information, conceding a level of self-expression, and in some cases even communication and validation from other users, that could also improve user engagement with that interface (Sundar et al., 2015). It is conceptualized as a kind of interactivity that causes a self as source and sense of agency in users, with special importance given to tools that allow these users some expression regarding themselves and their content, as well as other peoples’ and their communities’ (Sude et al., 2021, p. 1).

Source interactivity allows, therefore, the establishment of a sense of community and higher degrees of validation and satisfaction through the interaction with other users, being able to share comments and see the content they create as recognizable (Sundar et al., 2015). This relationship that can be created through interacting as a source, and in control of the environment, comes close to the interactions we as humans have, and the sense of community created on a mobile

application can bring users back to the comfort of a human and interpersonal in-person interaction.

This is the form of interactivity that allows the user to be themselves, through self-expression and a sense of agency that makes them feel in control of the content they create, see, and interact with (Sundar et al., 2022). One of the most recognizable tools today is the customization of the interface of the mobile application, being able to change its colours and most elements, the way the information is presented and which information is presented. This self-customization has been proven to increase self-expression, which in turn greatly influences user satisfaction (Sundar et al., 2015).

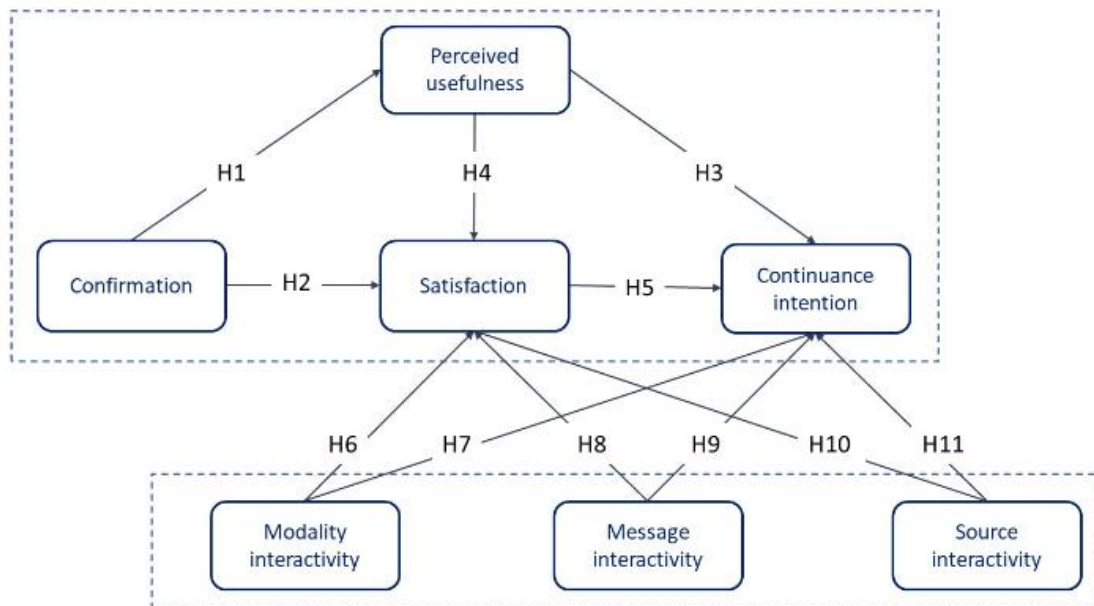
Studies have been developed about the tools provided by this component of interactivity, with one being developed by Sundar et al. (2012) who found that source interactivity tools have a psychological effect on users' positive attitudes toward the website, affecting how in control and able to choose action they felt, as well as their willingness and motivation, and even how integrated with the interface and other users they deemed to be, i.e., their sense of community (Sundar et al., 2012, p. 1). This is also the characteristic that will prevail in the study of source interactivity throughout this research, given that it is the most visible and easily accessible one to users, with almost all mobile applications today allowing for customization of their interface.



### 3. Research model and hypotheses

Our research model has ECM as a base, with a confirmatory nature of the hypotheses that Bhattacharjee (2001) first defined in his research on the ECM as an answer to understand continuance intention in information systems. As mobile applications become increasingly indispensable for most people's daily lives, the study of CI of apps also becomes necessary, making the factors that influence it interesting to study. With this in mind, in an exploratory manner, we decided to include interactivity in this research by relating it to the satisfaction and CI itself. Therefore, we created hypothetical pathways between modality interactivity, message interactivity, and source interactivity, concepts presented in the interactivity effects model (Sundar et al., 2015). Our research model is, in conclusion, a cross between information system's continuance intention's ECM and the different types of interactivities we can utilize according to the IEM.

**Figure 4: Research Model**



#### Confirmation

Confirmation is one of the four constructs that create the expectation confirmation model, and is therefore an important concept to explore and study in the research model shown in figure 4.

As described by Oliver in 1980 when explaining the expectation confirmation theory and later mentioned and cited by Battacherjee (2001), confirmation is taken as one of the phases a consumer or user has to go through to decide whether or not they wish to continue their use or consumption. It is described as the moment when users realize if their initial expectation matches the actual perceived performance of the system they are testing, meaning, the moment they realize if what they thought to be true about the mobile app is confirmed (Bhattacharjee, 2001). Previous research tells us that confirmation is connected to the moment after expectations of use are confirmed, or not confirmed, also believing that the perceived usefulness of a certain mobile app is amplified by the confirmation of expectations and decreases when the expectations are not confirmed (Pal et al., 2018). Tam et al. (2018) propose the same, indicating that when the user is able to positively confirm their expectations, that will affect their satisfaction as well as the perceived usefulness of the system at hand.

With this said, and in order to confirm what has been found in previous research, we propose the following hypotheses regarding the construct confirmation:

*H1: Confirmation is positively associated with the perceived usefulness of mobile apps.*

*H2: Confirmation is positively associated with the satisfaction of mobile apps.*

## **Perceived Usefulness**

Bhattacharjee (2001) gives it the operational definition of the benefits users perceive of the utilization of a system, affirming, in the same paper, that perceived

usefulness is believed to be a construct that can consistently influence the stages of use of an information system (Bhattacharjee, 2001).

Perceived usefulness in information systems relates to how necessary the user believes the IS at hand is in their daily lives, their job, their efficiency, and/or overall performance. If the user believes these to be benefits in her/his life, and if they are met, the satisfaction with the information system will increase as well as the chances of a continuous use of said IS. In sum, it is believed that users' satisfaction and, consequently, their will to continue using a mobile system can increase when they can take more benefits out of the use (Pal et al., 2018).

With this in mind, we propose the following hypotheses regarding the construct perceived usefulness and its connection to continuance intention, as well as satisfaction:

***H3:** Perceived usefulness is positively associated with the continuance intention of use of mobile apps.*

***H4:** Perceived usefulness is positively associated with the satisfaction of mobile apps.*

## **Satisfaction**

Bhattacharjee (2001) reminds us that a user can present feelings of satisfaction, dissatisfaction, or neither, from the use of a system, posing as well that, and as explained by the expectation confirmation theory, dissatisfaction can be a motivator to the abandonment of an information system, no matter how much users believe it to be of satisfaction, or overall what they expected or wanted during the previous phases of the adoption (Bhattacharjee, 2001, p. 357).

It proves to be, therefore, a critical construct in the post-adoption phase of an Information System, influencing how positive of an attitude the users have with, in this case, a mobile app. As Pal et al. (2018) pose in their research, a users' decision to keep using a system will depend on if they feel satisfaction, an idea shared by Tam et al.

(2018), who believe that if a user is satisfied with a mobile application, then the tendency will be to continue using it. This is also demonstrated, for example, by Chow and Shi (2014).

Therefore, taking into account the existing research and belief that satisfaction directly influences the will of the user to maintain a mobile application, we propose the following hypothesis:

*H5: Satisfaction is positively associated with the continuance intention of use of mobile apps.*

### **Modality Interactivity**

Modality interactivity, focusing on the different forms of interactions a user can have, relies on the concept of perceptual bandwidth, representing how many and which techniques of interaction are used, the adaptation of which can provide a richer experience for the user (Dou, 2013). Wang and Sundar (2018) give us an overview of how different interaction techniques affect, positively or negatively, a user's attitudes and actions toward, a website, increasing or diminishing it.

While these initial studies were made regarding websites, it becomes increasingly interesting to understand how they function in mobile apps, given that more and more organizations and enterprises adopt them as an option to their online presence. Instead of viewing the different facets of modality interactivity, we want to understand how these tools of interactivity, such as zoom, scroll or swipe, for example, affect how much users feel satisfied with the app, as well as how it makes them want (or not) to continue its use.

It has been showed that modality interactivity can affect users' positive attitudes toward a website, as well as user satisfaction (Niu et al., 2021), which could be the case

as well for mobile applications. Therefore, with this in mind, we propose the following hypotheses regarding modality interactivity:

*H6: Modality interactivity is positively associated with the satisfaction of mobile apps.*

*H7: Modality interactivity is positively associated with the continuance intention of use of mobile apps.*

### **Message Interactivity**

As stated by Sundar et al. (2022), message interactivity differs from other interaction tools because of its contingent nature. While other types of interactivity strive to increase how intuitive the interaction is, message interactivity focuses mainly on the interaction between a user and the interface of a system, the continuity of these actions, form of communications, and the consequential uniqueness and individual adaptation of the information shown (Sundar et al., 2022).

It is believed that this type of interactivity, through its way of creating a continued interaction with users and allowing them to access that message exchange through an interaction history, increases the users' engagement and creates positive attitudes toward the content and messages displayed (Sundar et al., 2015). Niu et al. (2021) have also found a positive influence of message interactivity in user satisfaction.

We propose that this user engagement and greater inclination to accept the messages being transmitted show and represent greater satisfaction with the interface they are interacting with. We would also like to propose that while being more engaged, even with the content, the users will be more likely to return to, in this case, the mobile application and continue its use. Therefore, we posit the following hypotheses:

*H8: Message interactivity is positively associated with the satisfaction of mobile apps.*

*H9: Message interactivity is positively associated with the continuance intention of use of mobile apps.*

### **Source Interactivity**

Regulating which content is seen, customizing how it is seen, creating new content, and interacting with the content of others are part of what is conceptualized in source interactivity. Relating to this, users' experiences and attitudes toward an online portal or website have been associated with the users' ability to self-express and have some type of control over what is presented to them, and in which way, with the creation of a sense of agency (Sundar et al., 2022).

This sense of agency and the way that different customization tools can increase the user's self-expression can lead to greater engagement. Sundar et al. (2012) even state that this engagement and sense of identity can have an impact on the positive attitudes of a user toward the system, including their motivation to continue using it many times (Sundar et al., 2012). Therefore, we propose the following hypotheses:

*H10: Source interactivity is positively associated with the satisfaction of mobile apps.*

*H11: Source interactivity is positively associated with the continuance intention of use of mobile apps.*

## 4. Methodology

To test our research model, we implemented a mixed methods approach, collecting both quantitative and qualitative data, and analysing and interpreting both in an effort to have both qualitative and quantitative results (Migiro & Magangi, 2011). This application was performed sequentially, with the quantitative method being applied first, followed by the collection of qualitative data.

To gather the quantitative data an online survey was constructed in line with the constructs and research model presented above and distributed through direct message in several social platforms. The questions were designed to lead respondents toward the themes, actions, situations, or characteristics regarding mobile applications. The responses were then analysed with the use of partial least squares structural equation modelling (PLS-SEM) and the program Smart PLS, which allowed us to understand the validity and integrity of both the measurement and research model, as well as confirm, or not, the hypotheses proposed.

After completing this analysis, we collected the qualitative data through interviews. These interviews were structured with the same themes as the survey was, with focus on the different constructs analysed and seeking answers to the same ideas. The difference resided in the format itself, being a lot more open-ended and allowing for the flow similar to a conversation, hoping not only for direct answers, but also for the interviewees to explain their opinion(s).

The interviews were conducted with six subjects, loosely following the same general profile identified during the quantitative study, young adults, the majority female, either still studying or beginning their careers, or even both. This decision was made with the goal of knowing why the data collected through the survey behaved the way that it did. Having people in the same age group and social situation in both these research methods allowed us a better understanding of the matter because it allowed for people in the same general situation to hopefully give a true picture of what justifies the survey results.

While the quantitative approach establishes an objective and reliable nature to the research (Zawawi, 2007, p.3), qualitative methods can be described as the techniques that allow the true understanding of the data’s meaning, describing and translating the information in order to correctly and more efficiently interpret it (Maanen, 1983 *apud* Zawawi, 2007, p. 3). The combination of both statistical results and the personal experiences and perspectives associated with them can make us understand a subject better than either of them would alone (Anguera et al., 2018).

#### 4.1 Methodology of the quantitative method

In order to complete the quantitative component of this study, an online questionnaire was constructed and shared, in Portuguese only, with specific questions to measure each of the construct’s influence on continuance intention. These questions were adapted from studies that had previously focused on each of the variables at hand, specifically: perceived usefulness (Pal et al., 2018), confirmation (Tam et al., 2018), satisfaction (Tam et al., 2018), continuance intention on information systems (Rabaa’i & ALMaati, 2021), modality interactivity (Dou, 2013), message interactivity (Dou, 2013), and source interactivity (Christy, 2016; Mathwick et al., 2010).

The answers to each item should be given according to a seven-point Likert scale (Joshi et al., 2015), ranging from “1-totally disagree” (“1-*discordo totalmente*”) to “7-totally agree” (“7-*concordo totalmente*”), with the goal of understanding how much each of them affected, or not, the user’s behaviour and feelings regarding mobile applications. All of the items used to evaluate each construct are represented in the following table:

**Table 1:** Survey questions

Constructs	Variables	Items	Support
	PU1	I find mobile apps useful in my daily life.	(Pal et al., 2018)



Perceived Usefulness	PU2	Using mobile apps helps me be more efficient.	(Pal et al., 2018)
	PU3	Mobile apps allow me to perform various tasks more easily and conveniently.	(Pal et al., 2018)
Confirmation	CON1	Using mobile apps was better than I expected.	(Tam et al, 2018)
	CON2	The quality or function provided for mobile apps in general was better than I predicted.	(Tam et al, 2018)
	CON3	Overall, most of my expectations from using mobile apps were confirmed.	(Tam et al, 2018)
Satisfaction	SAT1	I believe I made the correct decision in the mobile apps I use.	(Tam et al, 2018)
	SAT2	Using mobile apps makes me feel very satisfied.	(Tam et al, 2018)
	SAT3	I am pleased with the mobile apps I have downloaded.	(Tam et al, 2018)
IS Continuance Intention	CI1	I intend to continue using mobile apps in the future.	(Rabaai and Almati, 2021)
	CI2	I will try to use mobile apps in my daily life.	(Rabaai and Almati, 2021)
	CI3	I will keep using mobile apps as regularly as I do.	(Rabaai and Almati, 2021)
Modality Interactivity	MOD1	While I browse in mobile apps I use the tap the screen to access information.	(Dou, 2013)
	MOD2	While I browse in mobile apps I swipe the screen to access other areas of the app.	(Dou, 2013)
	MOD3	It's useful for me to be able to perform actions such as scrolling, zooming, rotating and clicking, for example, while using mobile apps.	<i>created as an understanding given from literature</i>
Message Interactivity	MES1	It's important for me that mobile apps show a history of interaction with its users.	(Dou, 2013)
	MES2	It's useful when mobile apps show a way to have a back and forth communication channel with users.	(Dou, 2013)

	MES3	It's useful when mobile apps show threaded conversations with its users.	(Dou, 2013)
Source Interactivity	SOU1	The benefits I receive when I am able to customize the interface of a mobile app is often worth the time and effort it takes to change it.	(Mathwick et al, 2010)
	SOU2	It's important for me that mobile apps have content that is a reflection of what I want to see.	(Christy, 2016)
	SOU3	It's important for me that a mobile app lets me adapt it to my taste.	(Christy, 2016)

This main subject, mobile applications, was in line with the use of an online survey, as was the environment in which we live in 2022. Using a digital means of collecting answers allowed for the questionnaire to be promulgated on an individual basis, sending messages through various social media websites, mostly Facebook and LinkedIn. A snowball effect was also created, meaning that the people who received the survey also shared it with their acquaintances, allowing for the total number of questionnaires, 203, to be collected in almost two months (3 March to 24 April 2022).

Before sharing it with everyone, a sample of 30 answers were collected as a means of testing the questions and the model, the validity and integrity of all of the constructs, as well as if they were significant and if the answers could give us an appropriate means of measuring each of them. When, through an initial analysis of the pilot data, following the same measurement methods used later for the final results, we reached the conclusion that the questionnaire and constructs were viable, we continued the implementation.

As Hair et al. (2011) explain in their paper, there are rules of thumb that should be followed when looking at the minimum sample size to collect in a survey. They appoint two rules, of which the one producing the larger sample should be followed, namely: *“(1) ten times the largest number of formative indicators used to measure one construct or (2) ten times the largest number of structural paths directed at a particular*

*latent construct in the structural model*" (Hair et al., 2011, p. 144). In our case the greater of these numbers corresponded to rule two, given that we have a maximum of five structural paths directed at the latent construct continuance intention, meaning that the minimum sample size needed would be of 50 responses. This value was quadrupled, with a total of 203 answers.

While filling in the online survey, each person had to answer basic descriptive questions regarding their identity. While anonymous, it was asked of everyone to select the gender they identify with (female, male, or other). Their school level, ranging from fourth grade to a doctoral degree, respecting the end of each cycle according to the Portuguese schooling system, as well as their current occupation. It was also asked of the participant to indicate their area of focus, being allowed to select from a wide range of fields, with the possibility to insert another. Their marital status, age, and knowledge on the theme at hand, and about each of the schools responsible for the masters for which this study is being made, were the last three questions.

Of all of these questions, the variables that created the profile of the average respondent were selected and are presented in Table 2. Of the 203 participants of the online survey utilized during the quantitative portion of our study, almost three quarters of them were female, with just 28% of male respondents. The majority of people that answered also indicated that their highest education level was a bachelor's degree, followed by 29% of people with a master's, 12% completed high school, and one person, representing approximately 0% of the sample, who reached 9<sup>th</sup> grade. Occupation also varied, with close results for student, with 50%, and employed, with 43%. All other options correspond to 5% or less of the sample.

To analyse the variable age, six groups were created: equal to or lesser than 25 years old, accounting for 75% of respondents; 26 to 30 years old, 8% of the sample; 31 to 35 years old, 6%; 36 to 40 years old, 3%; 41 to 50 years old, 5%; and above 50, 3% of the sample.

**Table 2:** Sample characteristics (quantitative surveys)

<b>Distribution (n=203)</b>			
<b>Gender</b>	Male	57	28%
	Female	146	72%
<b>Age</b>	<=25	153	75%
	26-30	17	8%
	31-35	12	6%
	36-40	6	3%
	41-50	11	5%
	>50	6	3%
	<b>Education</b>	9 <sup>th</sup> grade	1
High School		24	12%
Bachelor's degree		120	59%
Master's degree or higher		58	29%
<b>Occupation</b>	Employee	86	43%
	Self-employed	10	5%
	Student	102	50%
	Other	1	0%
	Unemployed	4	2%

The vast majority of our answers were from 18 to 25-year-olds, mostly female and with a bachelor's degree, either employed or still studying. These general results can be explained by a snowball phenomenon, in which people who responded reached

out to their friends, colleagues, and closest people. This can help explain why most of the responses came from the same general type of subject. The major difference between the average respondent resided in their field of work/study, the area to which they dedicated their time.

Because our use of the qualitative method has a confirmatory and explanatory nature, in the sense that it is made mostly to better comprehend the trends noticed on the quantitative research, we sought to follow a model that allowed the average subject of our interviews sample to be the same as our average subject of the quantitative component.

## **4.2 Methodology of the qualitative interviews**

With this in mind, six interviews were scheduled with a sample that would fit the desired profile. The interviews were performed on the platform Zoom, with all of the participants agreeing to have the interview voice-recorded for analysis and transcription purposes.

The choice to not conduct the interviews in person was made for several reasons. Firstly, it allowed us to exclude any geographical disturbances when choosing the sample because it made it possible for people to participate from wherever they were; it allowed fitting the interview in any time slot convenient to both interviewer and interviewee, without having to account for travelling time and other conditions that could influence the amount of time necessary for the interview; it was more comfortable for participants, given that they could choose if they had their camera on or not, allowing them to not have to show their face, with comfort being a hugely important factor in peoples honest and genuine answers.

The choice to have their faces seen or not provided comfort and a sense of freedom and relaxation for participants for what can be a stressful moment, given that people want to give good answers and satisfy the request that was made to them. However, all the participants in these interviews chose to have the camera on, allowing

us to introduce some of the perks of face-to-face interviews in an online one, namely the inclusion of non-verbal communication through face expressions and gestures (Knox & Burkard, 2009).

The interviews ranged between 15 and 21 minutes, which we believe was a time that allowed participants to remain engaged and focused without becoming overly fatigued. The interviews were then transcribed using the voice-recording and then analysed individually for each of the constructs, to finally be explored considering the results from the quantitative approach.

Even though the questions followed the same line of questioning that the survey did, they had a less formal and strict structure, allowing for the comfort and openness of the interview, mimicking a normal conversation and following the flow of one, and therefore creating the environment for more in depth and exemplified answers. This explains the fact that there is not a strict script applied to the interviews.

#### 4.2.1 Characteristics of the interviewees

As was done during the online survey, for the quantitative approach of this study, participants were asked to disclose their age, gender, the highest education level attained, as well as their area of occupation. Table 3 shows the results.

**Table 3:** Sample Characteristics (Qualitative Interviews)

<b>Distribution (n=6)</b>			
<b>Gender</b>	Male	33,30%	2
	Female	66,70%	4
<b>Age</b>	<=25	50%	3
	26-30	16,70%	1

	31-40	16,70%	1
	41-50	16,70%	1
	>50	0%	0
<hr/>			
<b>Education</b>	9 <sup>th</sup> grade	0%	0
	High School	0%	0
	Bachelor's	66,70%	4
	Master's	33,30%	2
<hr/>			
<b>Occupation</b>	Employee	33,30%	2
	Self employed	0%	0
	Student	66,70%	4
	Unemployed	0%	0
	Other	0%	0
<hr/>			

The average age of the participants is about 28 years old, with three of them representing a younger demographic. About 67% of the sample is female, with also about 67% having a bachelor's degree, with the others having a master's as the highest degree attained. Four out of the six interviewees are still studying while also having activities such as part time jobs and internships, and two of them are full time workers and have finished all of their studies. The areas in which each of them find their occupation (studying or working) varies considerably.

Our goal was to find a somewhat similar sample for both components of this research in order to more coherently associate results and justifications, given that the context in which someone lives, most likely influences their views and the way they behave. We ended up with a variety of people from different backgrounds and different ages, which we believe is going to be crucial for the analysis of our results.

## 4.2.2. Interviews

The interviews made are transcribed below, in Sub-sections 4.2.2.1. to 4.2.2.6. They proved to be a technique of large significance for the understanding and interpretation of our results, allowing for the comprehension of the hypotheses and insight into the behaviour and feelings originated by the integration, or lack thereof, of interactivity tools. The six interviews conducted are presented below.

Because they were conducted in Portuguese, and all of the interviewees are Portuguese as well, the interviews were not translated.

### 4.2.2.1 Interview 1

Question (Q): ***Conheces o tema em questão?***

Answer (A): Mais ou menos, não tenho experiência por aí além.

Q: ***Mas como utilizadora tens?***

A: Sim.

Q: ***Então utilizas aplicações móveis, certo?***

A: Certo sim, na maior parte dos dias.

Q: ***Como utilizadora de aplicações móveis achas que são úteis no teu dia a dia?***

A: Sim, acho que são muito úteis e são um benefício, sendo que utilizo praticamente todos os dias. Nem que seja a aplicação de trabalho, da *note list* para o que vou fazer naquele dia, seja em redes sociais, seja o simples facto de haver aplicações agora por exemplo da minha área específicas para feridas, que eu posso abrir e ir lá fazer uma *review* do que já sei e atualizar o conhecimento.

Q: ***Achas que te tornam mais eficiente nesse sentido?***



A: Sim, sem dúvida. Torna-se muito mais eficiente, porque se antigamente tinha de ir a uma biblioteca para procurar a mínima coisa de dúvida que eu tivesse no trabalho, agora com aplicações consegue-se muito mais rapidamente. O que conseguia em horas consigo em minutos.

**Q: *Achas que a utilização de mobile apps em geral, qualquer uma delas, superou as tuas expectativas, o que achavas que poderia ser a utilização?***

A: Sim, mas este sim não foi muito convicto. E porquê? Porque depois também depende das aplicações, do motivo, ou melhor, qual o objetivo para que elas foram feitas. Sei que já instalei aplicações que depois acabei por desinstalar porque não vi motivo para continuar a utilizá-las. Portanto acaba por depender um bocadinho de cada pessoa. Mas sim, há muitas aplicações que instalei, pensei “que desilusão, não tem funcionalidade para mim”, e desinstalei. As que eu instalei e têm efetivamente muita utilidade compensam as que não têm.

**Q: *Então achas que em geral, as aplicações que mantiveste são aquelas que corresponderam às expectativas?***

A: Sim, sem dúvida. Sendo que, sendo sincera, há aplicações, por exemplo de edições de fotografias, que eu ainda tenho no telemóvel e que já não uso há bastante tempo, mas que continuam lá porque sei que gosto e que responderam às minhas expectativas.

**Q: *Das aplicações que tu fizeste download e que usas diariamente, achas que estás satisfeita com o desempenho delas?***

A: Sim, demorei um bocadinho porque estava a pensar em todas as aplicações que tenho, mas sim, a maioria delas estou satisfeita com o desempenho delas.

**Q: *Vais continuar a utilizá-las no teu dia-a-dia? Achas que pretendes continuar a utilizar essas ou outras aplicações móveis de forma regular, ou tão regular quanto a que usas agora?***

A: Eu acabo por não ser a pessoa mais regular em todas as aplicações, porque o tempo também não ajuda. Mas aquelas em que sou mais regular, por exemplo, a rede social Instagram, a que mais utilizo também é o bloco de notas. Outra, como exemplo, o

calendário do google. E agora falando em calendário, utilizo outra mesmo para colocar o meu horário, que também não me estou a lembrar do nome, Shift algo. Mas essas aplicações sim, continuarei a manter e a utilizá-las como utilizo. As outras vai dependendo sempre de se estou de férias, se tenho mais tempo livre, se realmente apetece utilizar ou não. E isto também falo porque também tenho três apps de jogos, que acabo por não utilizar muito, é raro. Mas lá está, depende da ocasião, mas por enquanto acho que as vou manter, não vou desinstalar.

**Q: *Quando estás nessas aplicações, tens tendência a utilizar funções como fazer scroll, ou a utilizar funcionalidades de swipe, scroll, etc, para aceder a outras partes da aplicação ou para conseguires cumprir as funções para as quais as utilizas?***

A: Como assim? Fazer swipe ou scroll?

**Q: *Sim, achas que é útil para ti esse tipo de ações, de técnicas de interatividade, como fazer zoom, como andar para o lado para mudar de página, como fazeres scroll para aceder a outras partes?***

A: Sim, isso é ótimo, agora estava a lembrar-me do gmail, quando temos no telefone dá para ter a funcionalidade de fazer swipe para, ou arquivar, ou fazer *delete* do email, e isso por exemplo para mim é espetacular, essa funcionalidade é muito boa. Por isso sim, concordo. Utilizo e acho que é incrível.

**Q: *Quando existem essas técnicas, e quantas mais existem, ou seja, se puderes fazer scroll e swipe na mesma aplicação, achas que isso torna a utilização melhor e mais satisfatória?***

A: Sim, acho que sim porque acaba por facilitar o que vais fazer. Quando falaste no swipe lembrei-me do gmail, mas por exemplo o Tumblr, é uma app que não utilizo há muito tempo, mas tem a funcionalidade de fazer *reblog* mais facilmente clicando durante alguns segundos, e essa funcionalidade também é incrível. Melhora muito a aplicação, torna a aplicação muito mais cativante de utilizar.

**Q: *Achas que influencia a tua visão sobre a aplicação, ou que é importante para ti, que a aplicação reflita o conteúdo que tu queres ver? Que reflita a tua personalidade?***

A: Sim, aliás, atualmente a maioria das aplicações até acabam por estar um bocadinho personalizadas para ti, para o que gostas, independentemente de teres escolhido isso ou não.

Q: ***E achas que isso é importante?***

A: Sim, eu acho que é importante, apesar de um bocadinho assustador em certas coisas. Às vezes dizemos alguma coisa e de repente parece que só nos aparece isso no telemóvel. Mas continuando, fugi à questão, eu acho que é bom, porque vai ao encontro do que queremos, mas depois há o outro lado, que por vezes o que achamos que queremos não é exatamente, ou pode haver algo mais que achamos interessante que não esteja ali naquela caixa.

Q: ***Ou seja, achas que por vezes o conteúdo pode ficar demasiado taylorizado aquilo que tu queres e que não vês outras perspetivas e outros temas?***

A: Sim, exatamente. Eu senti isso ainda há pouco tempo no Instagram, já tinha passado aquela fase de todas as publicações das pessoas que segues, e apareceu aquela parte em que aparecem outras publicações, mas mesmo essas acabam por ser coisas que já tinha visto, ou muito parecidas de género do que o que já tinha idealizado antes. E, nesse sentido, se calhar não é tão interessante e torna um bocadinho chato estar nessa aplicação. Aliás, quando isso acontece acabo por ou fazer *refresh* para ver se há novas publicações, ou simplesmente sair da aplicação e fazer outras coisas. Tendo em conta o que perguntaste, estou um bocadinho dividida, porque se por um lado é bom, por outro lado tem o lado negativo de depois acabar por ser sempre a mesma coisa e parece que tu não tens escolha, que já está escolhido por ti o que vai aparecer.

Q: ***Não pensando em conteúdo, pensando na interface da aplicação, na imagem mesmo, achas que é importante que isso seja personalizável? Gostas de ir a uma aplicação e escolher as cores e a forma como vais ver tudo? Ou achas que isso não tem grande influência na tua utilização?***

A: Sim, eu acho que isso é bom. Estás a falar mais na parte estética?

Q: ***Sim.***

A: Sim, acho que essa parte até é bom, porque acabas por estar tu a personalizar a aplicação que for. Mas sim, essa parte é boa, concordo.

**Q: *Achas que gastarias o tempo e farias o esforço para, numa aplicação, mudar todas essas feições da interface para a utilizares de forma mais adaptada àquilo que tu gostas? Ao teu gosto em termos estéticos ou em termos de como as coisas se apresentam, por assim dizer?***

A: Sim, na realidade quando falaste agora disso, eu já o fiz com uma aplicação de horário, *shifts*, que eu não estou a dizer o nome correto, mas também não é importante. Aquilo tem opções de mudar a cor, o *icon*, ao nosso gosto, a parte estética mesmo, se queremos o calendário com bolinhas ou com quadrados... Eu dei-me ao trabalho e acho que isso é bom, porque fica como tu idealizaste. Depois é bom veres o resultado final.

**Q: *Dá-te mais satisfação a utilizar depois?***

A: Sim, especialmente quando fica bonito.

**Q: *Achas que é importante uma aplicação permitir que tu estejas ciente e que tu vejas a troca de mensagens que existe entre ti e a aplicação? Com mensagens eu quero dizer as interações que existem, os links em que clicas, como se fosse um histórico daquilo que tu fazes lá.***

A: Ou seja, se eu acho pertinente?

**Q: *Se achas que é importante.***

A: Eu acho interessante, diria, mas não estou a ver assim propriamente o benefício.

**Q: *Achas que é útil para a utilização da aplicação?***

A: Não estou a ver a utilidade propriamente, só se fosse no sentido do histórico, de eu às vezes precisar. Já aconteceu precisar de ir à mesma página, não estar a conseguir encontrar a forma como pesquisei, e ir pelo histórico e conseguir chegar lá. Mas só se for por aí, mas neste momento não estou a ver o benefício.

**Q: *E achas que é importante, por exemplo, quando existe uma troca de ações, quando existe, e vou usar a expressão em inglês, quando existe um back and forth entre ti e a aplicação, por exemplo: clicas em determinado sítio e és levada a uma página, e dessa***

***página tu podes clicar em algo que te leva a outra, como sendo uma sequência de hyperlinks, uma sequência de ações que te levam a determinado sítio?***

A: Sim, isso eu acho útil. Isso acontece às vezes no Instagram, quando as lojas online têm as páginas e clica-se num link e aquilo leva-nos para a loja em si, ou clicas noutra link e leva-nos para outras coisas idênticas. Isso sim, e eu acabo por me perder nessa situação, mas acho que é útil porque leva-nos e direciona-nos para o sítio correto. E sim, por acaso é bom, de certa forma.

***Q: Achas útil a troca de informação entre ti e a aplicação? Ou seja, tu fazeres uma ação que dá aso a uma resposta da aplicação, neste caso levar-te a uma nova página?***

A: Mas sou eu que decido, certo? Ou seja, sou eu que escolho onde quero ir?

***Q: Sim, fazes determinada ação, clicas em qualquer ponto da aplicação, ou seja, mandas uma mensagem e a aplicação dar-te uma resposta.***

A: Sim, isso é muito bom porque às vezes encontramos as coisas e não precisamos propriamente de andar à procura de nada, porque conseguimos através daquele link encontrar toda a informação que queremos e que precisamos sobre esse tema. Eu acho que isso é útil, na verdade. Principalmente porque facilita muito mais a obtenção dos dados que queremos.

#### 4.2.2.2 Interview 2

Question (Q): ***Como é que considerarias o teu conhecimento sobre o tema das aplicações móveis?***

A: Eu acho que enquanto utilizadora de várias aplicações e de várias redes sociais, e já há alguns anos, tenho conhecimento suficiente para dar respostas informadas àquilo que tu queres saber.

Q: ***Então, estavas a dizer-me que já utilizas aplicações móveis e que utilizas há algum tempo, achas que são úteis no teu dia a dia?***

A: Acho que sim, porque por um lado há vários tipos de aplicações móveis. Há aplicações como WhatsApp que permitem comunicar com amigos e famílias, aplicações como o Instagram que permitem partilhar fotos e vídeos, há outras, por exemplo, que são auxiliares de concentração, ajudam no teu trabalho, tudo isso. Há aplicações que te ajudam a organizar o teu tempo e os teus dias, por isso, havendo cada vez uma maior oferta de aplicações de vários tipos, acho que são cada vez mais úteis, não só a nível de entretenimento, como também a nível do próprio trabalho, ajudam a facilitar as tarefas que tens para fazer.

Q: ***Então ajudam-te a ser mais eficiente?***

A: Sim.

Q: ***Pelo que estavas a dizer efetivamente utilizas aplicações para tornar mais fáceis várias tarefas do teu dia, vários momentos?***

A: Sim.

Q: ***Na generalidade das aplicações móveis, ou seja, não tem de ser um tipo específico, achas que o uso de aplicações móveis corresponde às tuas expectativas?***

A: Eu acho que sim, não sei se estás mais a perguntar em termos de facilidade de utilização ou da oferta que há.

**Q: *Qualquer expectativa que tivesses. Antes de utilizares uma aplicação tens determinadas expectativas. Achas que, na generalidade, a maior parte das tuas expectativas, ou algumas, ou nenhuma, são correspondidas?***

A: Eu acho que sim, até porque não é uma coisa nova, já vêm a ser desenvolvidas há vários anos, e vão recolhendo informações sobre a experiência do utilizador e enfim, isso ajuda-os a desenvolver as aplicações da maneira que as pessoas estão à espera e com os recursos que as pessoas necessitam, da forma mais fácil para quem as utiliza. Por isso acho que, com o avançar do tempo, até as mais antigas têm vindo a tornar-se melhor e a corresponder cada vez mais às expectativas.

**Q: *E isso é importante?***

A: Sim.

**Q: *Achas que das aplicações que tens, que utilizas, estás satisfeita?***

A: Eu estou satisfeita. Pessoalmente uma coisa que me irritava um bocadinho era específica a uma aplicação, o Youtube, porque não podia continuar a ver os vídeos se saísse da aplicação, mas agora já vi que eles estão a alterar isso mesmo sem aderir à versão premium, o que é ótimo, quer dizer que ouviram e deram atenção ao feedback dos utilizadores. E sim, no geral estou satisfeita com as aplicações que uso.

**Q: *Tencionas continuar a utilizá-las?***

A: Tenciono, até porque mesmo as pequenas coisas que às vezes me chateiam em algumas aplicações não são o suficiente para fazer com que pare de as utilizar, e o benefício de as utilizar supera as partes menos boas, ou seja, aquilo que eu não gosto tanto em determinada aplicação.

**Q: *Tanto as que tens, como novas, experimentar algumas que estejam a sair agora ou que já tenham saído e nunca usaste, achas que vais continuar a utilizar tão regularmente, ou tens essa intenção de utilizar regularmente aplicações móveis?***

A: Sim, tenho essa intenção, e aqui falo com uma distinção entre as aplicações no geral e as aplicações mais relacionadas com redes sociais, porque essas arruinam um bocadinho a minha capacidade de gestão de tempo. Mas ao mesmo tempo gosto delas

e tento estar em contacto com pessoas e por isso sim, pretendo continuar a utilizar, talvez tentando reduzir um bocadinho o tempo que passo nelas, mas continuar a utilizar.

**Q: *Quando tu utilizas essas aplicações, existem diversas técnicas de interação, como scrolling, como swiping, e como fazeres zoom, tudo isso. Primeiro, utilizas essas funções?***

A: Utilizo essas funções. E agora aqui já não é bem na pergunta, mas está relacionado, uma coisa que não tenho gostado no Instagram ultimamente - eu achava útil aqueles *posts* em forma carrossel, em que fazes *swipe* e vês várias imagens, agora pelo que tenho percebido os *reels*, vídeos, dão mais *engagement*, então a maior parte das contas tem desistido de colocar esses carrosséis e substituí por *reels*, em que não podes fazer nada, não podes avançar o vídeo, e tens de ficar à espera que passem as informações que é suposto o *post* ter. Eu não gosto muito disso. Mas sim, eu utilizo tudo isso que disseste, todas essas funcionalidades.

**Q: *Então achas que elas são úteis na tua utilização?***

A: Sim, e acho que as aplicações devam mantê-las e não inventar outro tipo de *posts* que limitam a experiência do utilizador e a forma como ele pode interagir com as publicações.

**Q: *Agora, vamos esquecer um bocadinho o conteúdo em si das aplicações, achas que é importante para ti conseguir adaptar a interface da aplicação, a aplicação em si, àquilo que tu és, ao teu gosto?***

A: Eu acho que sim, eu gosto especialmente quando as aplicações deixam adaptar, por exemplo, se o telemóvel estiver no *dark* ou *light mode*. Se a própria aplicação te deixar aplicar esse padrão de cores dentro da própria aplicação. Gosto que dê para personalizar ao teu gosto, porque acho que torna a experiência mais pessoal, e deixa de ser tão *standard* para cada utilizador, acho que é bom conseguir colocares a aplicação mais ao teu gosto e da forma como é mais útil para ti. Por exemplo, há certas aplicações que eu uso, a aplicação que uso para controlar os dias do período, que se chama *Clue*, tem uma opção de alinhares as várias informações à esquerda, à direita, se queres ver as informações em quadro, em lista, eu gosto disso.



**Q: Então achas que a ti te traz benefícios, mesmo que tenhas de gastar tempo e mesmo que tenhas de ter o esforço de ir e encontrar a forma e de experimentar as diferentes formas e adaptar aquilo ao que queres? Achas que os benefícios valem o esforço dessa personalização?**

A: Eu acho que sim, até porque normalmente não exige assim um grande esforço, e eu até gosto de escolher o que acho que fica melhor, o que acho que é mais útil, por isso não é uma coisa que costumo demorar muito tempo, e depois mais tarde é útil.

**Q: Achas que é importante para ti quando uma aplicação te permite comunicar com ela? Ou seja, quando podes, de certa forma, trocar mensagens, quando consegues ter interação com a aplicação? Quando digo trocar mensagens, estou a referir-me por exemplo a uma ação-reação, ou seja, tu envias uma mensagem à aplicação através de um click num link, por exemplo, e a aplicação responde ao levar-te a esse link, achas que isso é importante para ti? Esse esquema de comunicação?**

A: Sim, eu acho que sim, ou seja, é tu fazeres alguma coisa e a aplicação dar resposta àquilo que tu queres fazer e levar ao sítio onde tu queres ir?

Q: **Exato.**

A: Sim, eu acho que isso é importante, e acho que é das coisas que acho mais essenciais numa aplicação, porque estás a utilizar aquilo com o objetivo de chegar a alguma informação ou conseguir fazer alguma coisa e estás à espera de que a aplicação consiga dar resposta a isso e mostrar aquilo que queres ver. Estou a dizer que acho que isso é uma das coisas mais essenciais nas aplicações porque quando tu estás numa aplicação, quando a instalas, instalas com o objetivo de ter acesso a alguma informação, conseguir fazer algo, e esperas que a aplicação consiga dar resposta ao que queres ver ou que queres fazer portanto uma aplicação que não consiga fazer isso de forma eficiente não é uma boa aplicação.

**Q: Achas que também se torna importante teres um registo dessas interações? Dessa troca de mensagens?**

A: Acho importante que esse registo exista até para haver uma noção daquilo que a pessoa faz e das interações que existem dentro da própria aplicação. O que, e talvez já

esteja a ir um bocadinho além do que se pretende, o que eu não gosto muito nisso é que esse registo seja por exemplo consultável por qualquer pessoa, ou que seja partilhado para outros motivos. Ou seja, deve ser uma coisa mais consultiva, quer da própria, nomeadamente a nível da própria aplicação, para ter um registo do que vai acontecendo, ou do próprio utilizador, mais do que isso já é um bocadinho problemático.

**Q: *Estás a dizer, portanto, que em termos de dados de utilização, para a aplicação sim, para fins externos, talvez não?***

A: Isso.

**Q: *Só para perguntar de uma forma diferente, achas que é importante que a aplicação tenha em conta aquilo que tu fizeste anteriormente?***

A: Acho que é importante até porque talvez vá ajudar a sugerir, por exemplo, resultados de pesquisas semelhantes a coisas que já pesquisei, caso seja uma aplicação que permita fazer esse tipo de coisas, e também pode ajudar a fazer com que a aplicação seja mais intuitiva e perceber melhor qual é o teu objetivo na utilização daquela aplicação.

### 4.2.2.3 Interview 3

Question (Q): ***Como é que classificarias o teu conhecimento sobre aplicações móveis?***

Answer (A): Da ótica do utilizador tenho algum das aplicações que uso.

Q: ***Dessas aplicações, achas que são úteis no teu dia a dia, nas tuas tarefas?***

A: São muito úteis, mas também são uma grande distração. Mas são muito úteis por uma questão de facilidade de comunicação, o WhatsApp então é assim a principal, a que eu uso mais. Há quem lhe chame hoje em dia uma rede social, de facto ele adquire algumas características de rede social, mas não acho que seja ainda uma rede social, mais uma forma de comunicação. Mas é muito útil, o facto é esse. Outras mais lúdicas, mas também úteis, como o *duolingo*. O *duolingo* durante um tempo usei para, mais por uma questão lúdica, mas ao mesmo tempo relembrar os conhecimentos de francês que tinha, etc. Mas são. Resumindo, as que permitem a comunicação e facilitar a comunicação entre pessoas são as mais úteis, mas também algumas de organização que são igualmente úteis. Em termos de lúdicas, eu não sou muito fã de jogos.

Q: ***Achas que essas de organização e assim te ajudam a fazer as tarefas, a ser um pouco mais eficiente? Ou achas que não tem grande influência?***

A: É assim, as de organização ajudam, havendo depois outras que desajudam, o problema é esse. O dispositivo em que essas aplicações existem tem demasiadas coisas que requerem a nossa atenção, digamos assim.

Q: ***Em geral, pensando em todas as aplicações que já usaste, achas que corresponderam às tuas expectativas?***

A: Sim, corresponderam. E uma utilidade, digamos assim, uma facilidade que não disse antes é que as aplicações móveis permitem reduzir aquilo que seria uma parafernália de aparelhos, de objetos que são simplesmente ícones no ecrã do telefone.

Q: ***Achas que as expectativas, e que as funções que achavas que ias conseguir cumprir com as aplicações móveis, tudo foi correspondido?***

A: Geralmente sim, às vezes. Há sempre um período de teste quando instalas a aplicação, e rapidamente percebes que aquilo não vai servir o propósito, ou, mesmo que sirva, é maior o transtorno do que digamos a facilidade que iriam trazer, portanto acabas por desistir.

Q: ***Então achas que nem sempre ficas satisfeito com as aplicações?***

A: Sim, nem sempre fico satisfeito.

Q: ***Das aplicações que tu manténs, satisfazem-te?***

A: Exato, no fundo é isso. As que tenho, as que uso diariamente, satisfazem-me. Normalmente quando há alguma que instalo que não me satisfaz, rapidamente desisto dela.

Q: ***Em termos gerais, achas que o uso de aplicações móveis vai continuar a ser algo do teu dia a dia? Que continuarás no futuro?***

A: É assim, muito provavelmente sim, embora eu ande a fazer um esforço para reduzir o tempo geral no telemóvel, portanto no dispositivo onde as aplicações móveis vivem.

Q: ***Agora, pensando um bocadinho mais no fator interatividade, quando estás a utilizar uma aplicação móvel, usas funções como por exemplo, no email agora existe a função de poderes fazer swipe para apagar ou arquivar ou algo assim, há imensas aplicações em que podes fazer scrolling, em que podes fazer zoom, em que podes utilizar todas essas ferramentas de interação. Tu utilizas, em geral?***

A: Sim, quer dizer, as ferramentas de interação intuitivas geralmente uso, mas digamos que nesse aspeto eu seria um – no meio daquela curva, há os *early adopters*, os *late adopters*, os do meio. Mas ou seja, as coisas que são intuitivas costumo usar logo, conforme as aplicações disponibilizam, assim as coisas mais a fundo, que envolvem explorar as aplicações só ao final de algum tempo é que me dedico a isso, mas pode haver casos excecionais.

Q: ***Mas achas que essas coisas são úteis?***

A: Sim, sim.

**Q: Não falando tanto em conteúdo das aplicações, mas pensando mais na parte estética, na interface da aplicação, consideras importante quando consegues adaptá-la, quando consegues personalizá-la àquilo que gostas?**

A: Sim, gosto dessa ideia de personalizar a interface das aplicações sim.

**Q: Achas que justifica o esforço e o tempo que gastas a fazer isso, a mudar, por exemplo, cores, ou a forma como as coisas aparecem, do lado direito, esquerdo, etc, achas que justifica o tempo e o esforço, depois a satisfação que tens de ter tudo ao teu gosto?**

A: É assim, digamos que há um ponto de equilíbrio. Ou seja, se não for demasiado complexo, demasiado demorado, sim, justifica. Ah, e por vezes pode haver alterações que deixem a aplicação menos eficiente, como eventualmente pôr backgrounds de imagens e assim em sítios em que é suposto ser... pôr uma imagem onde era suposto não ter nada, ou ter um background mais neutro. E, eventualmente, nesse caso, pondo a imagem fica mais personalizado, às vezes até gosto mais, mas ao mesmo tempo a aplicação pode ficar mais pesada e mais lenta, aí prefiro a eficiência.

**Q: Portanto a eficiência será sempre muito mais importante do que o customizing?**

A: Sim.

**Q: Agrada-te mais ter uma aplicação que mostra, por exemplo, o teu histórico de conversação com ela, o teu histórico de utilização? Por exemplo, quando vais a um website de compras, algo assim, depois desligas, e a próxima vez que entras ele dá-te os últimos itens visualizados, ou recomenda coisas baseadas no teu histórico de pesquisa, pensa nisso em termos de aplicação móvel.**

A: Sim, acho que algum equilíbrio é aceitável nisso também. Acho que faz sentido o utilizador ter a opção de a aplicação guardar ou não esse histórico e utilizá-lo para personalizar a experiência, o que seja, por uma questão de privacidade dos dados, mas também por uma questão, mais uma vez, de gestão da atenção. Estou a pensar no Youtube por exemplo, nos tempos áureos do Youtube, que continua, mas no início - mesmo tendo conta criada, nós estávamos a ver um vídeo, e as sugestões que davam eram ramificações úteis do vídeo que estávamos a ver. Pessoalmente via muito música

e descobria imensas novas com essas sugestões relacionadas. Hoje em dia é muito mais personalizado, mas parece que a experiência fica um pouco mais empobrecida, é muito mais cativante para a atenção, mas ganhamos muito menos com isso. Posso estar a ver um vídeo de uma banda que eu gosto muito e às vezes os relacionados não têm a ver com a banda, mas sim com um *sketch* de humor que eu estive a ver, que eu costumo ver com frequência. Ok, isso pode captar a minha atenção e eu até posso quase instintivamente carregar no vídeo para ver porque está dentro da minha área de interesses, mas ao mesmo tempo a experiência em si é mais pobre porque não permite essa expansão, digamos assim.

**Q: *E achas que é importante para ti quando numa aplicação existe uma resposta clara às tuas ações? Por exemplo, quando num menu vais escolhendo sub-menus, como forma de estares a enviar uma mensagem à aplicação e ela responder à tua ação. Ou seja, tu clicas em determinado sítio e ela leva-te para lá. Achas que essa atenção é importante?***

A: Consegues-me dar um exemplo?

**Q: *É como uma sequência de hyperlinks, tu tens uma ação única, porque nós seres humanos não temos todos a mesma ação. Ou seja, eu clico em determinado sítio que me leva àquela página, e a resposta que tenho da aplicação é diferente porque como eu vou seguir um caminho diferente, também vou ter uma resposta personalizada. Eu e tu não vamos à mesma aplicação e vemos o mesmo menu e escolhemos exatamente as mesmas páginas onde ir.***

A: Sim, pois... Eu estou mais ou menos a perceber, mas tirando este exemplo do Youtube, em que tens a tua página personalizada aos teus gostos, às tuas definições. Se eu pegar na minha experiência do Youtube, eu gosto que aquilo seja personalizado, porque às vezes abro uma página de Youtube num computador que não é o meu, e aquilo faz-me confusão, vídeos de música, exercício físico, e de *stand up comedy*, pronto, mas não sei se é exatamente isso que tu estás a dizer.

**Q: *Eu consigo perceber a resposta sim.***

#### 4.2.2.4 Interview 4

Question (Q): ***Como é que classificarias o teu conhecimento do tema? Ou seja, sobre as aplicações móveis.***

A: Diria que conheço mais ou menos, não domino o tema, mas como agora temos acesso a tantas aplicações no dia a dia acho que posso dizer mais ou menos. Mas lá está, não domino, não é de todo a minha área.

Q: ***Então conheces pela parte de utilização, como utilizadora?***

A: Exatamente, do dia a dia.

Q: ***E achas que no teu dia a dia elas são úteis?***

A: Fazem muita diferença, sim. Acho que cada vez mais somos mais, não é dependentes, mas ajuda bastante, facilita muito o nosso dia a dia.

Q: ***Achas que de certa forma te torna mais eficiente?***

A: Algumas sim, podem ajudar bastante. Não tenho nenhuma em mente, mas sim.

Q: ***Mas em geral, consideras que elas te ajudam a fazer algumas tarefas de forma mais conveniente, ou de forma mais fácil?***

A: Sim, agora não tenho nenhum exemplo em mente, mas sim.

Q: ***Das aplicações que tu usas, em geral, achas que elas normalmente correspondem àquilo que tu procuras? Às expectativas que tu tinhas sobre a utilização delas?***

A: Sim, na maioria sim, estou a tentar lembrar-me de um caso específico, mas não me estou a lembrar...

Q: ***Não há problema, podemos falar em geral***

A: Em geral sim, creio que sim.

Q: ***Achas que as expectativas que tens, ou aquilo que achas que as aplicações são capazes de fazer, ou são capazes de te dar, achas que isso normalmente é correspondido?***

A: Creio que na maior parte do tempo sim. Creio que no futuro, daqui a alguns anos, ainda vão ser mais eficientes do que são hoje, mas acho que já houve uma grande evolução e na maior parte dos casos é positiva

Q: ***Considerarias então que estás satisfeita com as aplicações que usas?***

A: Sim, diria que sim.

Q: ***E mais do que estar satisfeita com as aplicações que usas, achas que utilizar essas aplicações te traz satisfação?***

A: Sim, acho que podemos dizer que sim.

Q: ***Também pode haver um espaço neutro, de sim e não, mas achas que assim em geral?***

A: Acho que se pode dizer satisfação, estava à procura de outra palavra. Mas sim, acho que sim.

Q: ***E achas que tens intenções de, no teu futuro, no teu dia a dia a partir de agora continuar a utilizar aplicações móveis?***

A: Sim, sem dúvida.

Q: ***Achas que vais continuar a utilizá-las, mesmo como uma constante de dia a dia?***

A: Sim, não sei se podemos chamar de utensílio, mas sim, como uma ferramenta de dia a dia que nos pode auxiliar. Eu acho que o futuro passa cada vez por uma aposta de aplicações, acho que sim.

Q: ***E agora pensando mais em termos de interatividade. Quando utilizamos aplicações móveis normalmente existem ferramentas de interatividade, como tudo aquilo que tu possas imaginar de scrolling, zooming, de fazeres swiping de um lado para o outro, dentro das aplicações, etc... Tu usas essas funções?***

A: Sim.

Q: ***E achas que são coisas úteis?***

A: Nem todas, porque sou assim um bocado básica, mas sim, acho que sim.

Q: ***E achas que são úteis?***



A: Na maior parte dos casos ajudam, sim. Se são imprescindíveis, se calhar não, mas são úteis.

Q: ***Se tiveres a opção de fazer algo desse género, por exemplo no email agora tens opções de se fizeres swipe para a direita eliminas, para a esquerda é arquivado...***

A: Isso eu não, como eu disse eu sou um bocado básica, isso também ainda não utilizei por acaso, ainda não utilizei essas funcionalidades.

Q: ***Ou seja, o que é mais visível é melhor.***

A: Sim

Q: ***Não falando tanto de conteúdo, porque às vezes o nosso conteúdo pode ser mesmo personalizado, mas falando mais em termos estéticos de interface, backgrounds e assim nas aplicações, achas que é importante para ti que uma aplicação móvel te deixe personalizar esses aspetos?***

A: Lá está, eu sou um bocado básica e não sou muito criativa, mas gosto quando consegues criar e alterar ao teu gosto, gosto. Não é que o faça, porque como digo sou muito básica e não exploro muito, mas quando dá para alterar sim, acho que sim.

Q: ***Eu ia mesmo perguntar-te se achavas que os benefícios, ou a satisfação, ou o gosto, de ter a aplicação adaptada àquilo que tu és ou ao que tu gostas, de ter as coisas personalizáveis e personalizadas, se os benefícios ultrapassavam o esforço de o ter de fazer, ou o tempo gasto nisso.***

A: Acredito que deve compensar. Por exemplo, sei que há uma aplicação em que podes alterar o *wallpaper* no teu telemóvel, na *Apple* sobretudo, e quando vejo os resultados finais deve valer a pena. Mas lá está, eu sou básica e não perco muito tempo a explorar e a tentar alterar, mas pelo que vejo nos outros vale a pena. Visto do ponto estético, acho que as pessoas que investiram tempo, deve ter valido a pena.

Q: ***E achas que é importante para ti que a aplicação móvel consiga refletir o conteúdo, ou seja, achas que é importante para ti que o conteúdo de uma aplicação móvel consiga refletir aquilo que tu és? Aquilo que tu queres ver?***

A: Sim, não tudo centrado, mas sim.

Q: ***Ou seja, que haja recomendações?***

A: Recomendações dos meus interesses, porque agora também ao fim ao cabo é o que têm feito mais ou menos, mas também um bocadinho mais diversificado, não só centrado nos meus interesses. É um bocado controverso, estou-me a contradizer um bocadinho.

Q: ***Eu percebo o que estás a dizer, ter uma parte que sim, mas também não queremos estar completamente fechados no que conhecemos.***

A: Exato.

Q: ***Achas que te influencia e é importante para ti as aplicações mostrarem uma interação contigo? No sentido de uma troca de mensagens, quando digo troca de mensagens quero dizer fazeres uma ação que leva a uma reação, clicares num link que te leva a uma página, tudo isso sendo troca de mensagens.***

A: Sim, vendo nesse prisma, sim.

Q: ***E achas que é importante para ti que esteja disponível um histórico das tuas mensagens com a aplicação? Vou desde já dar um exemplo, por exemplo o instagram mostrar-te imagens de contas em que já meteste like, ou ires a um site de eletrodomésticos ou roupa, o que for, veres alguns artigos, e depois saíres, e quando voltas, assim que entras, mostram os últimos artigos visualizados. Achas que isso te influencia de alguma forma a utilizar ou não a aplicação?***

A: Pode ser útil, pode influenciar um bocadinho sim. Imagina que há um artigo que vi e já não consigo encontrar, nesse caso acho que é útil mostrarem, consegues logo encontrar. Acho que sim. O histórico nesse caso acho que consegue influenciar a tua escolha.

Q: ***Achas que a aplicação mostrar-te informação que é baseada nas tuas ações tem influência na forma como tu a utilizas? Em se a queres utilizar ou não?***

A: Acaba sempre um bocadinho por influenciar, sim. Acho que só gostaria dessa ferramenta nessas aplicações de artigos e assim, noutras acho que não seria necessário.

**Q: Isso é um exemplo, é uma questão de as tuas ações dentro de uma aplicação serem guardadas de forma a depois a informação eu te é mostrada ser adaptada a elas. Fazeres uma ação e ela responde-te ao que fizeste, e isso fazer parte do que te é mostrado depois.**

A: Ok, sim, sim.

#### 4.2.2.5 Interview 5

Question (Q): ***Como é que classificarias o teu conhecimento sobre aplicações móveis?***

A: Só na ótica do utilizador, nada mais.

Q: ***Como utilizador, as aplicações que utilizas, achas que são úteis no teu dia a dia?***

A: As que uso sim, mas também procuro as que me convêm. Sei que há muito lixo no mercado, vou buscar as que preciso.

Q: ***E achas que essas então te ajudam a fazer algumas tarefas mais facilmente ou te tornam mais eficiente de alguma forma?***

A: Sim, sem dúvida.

Q: ***Já disseste que fazes alguma seleção, mas, em geral, as expectativas que tu tens antes de descarregar uma aplicação móvel, ou antes de a utilizar, achas que na generalidade das vezes as tuas expectativas são correspondidas?***

A: Mais ou menos. A nível de utilidade, sim, costumam cumprir o que prometem. Tenho tido problemas de velocidade honestamente, cada vez mais graves, uma pessoa descarrega uma aplicação a pensar que é uma aplicação, mas é uma aplicação cheia de publicidade.

Q: ***E em termos de qualidade e função?***

A: A nível de função costuma cumprir o prometido.

Q: ***Então, já que fazes essa seleção e que consegues ver aquilo mais ou menos que te é útil ou não, achas que estás satisfeito com as aplicações móveis que utilizas?***

A: Sim, bastante. Estou agora aqui a pensar alguns exemplos que usava ou não usava e realmente dão-me jeito para o dia a dia

Q: ***E mais do que estar satisfeito com as aplicações móveis que usas, achas que utilizar essas aplicações móveis te deixa satisfeita? Ou seja, a utilização traz-te algum tipo de satisfação?***

A: Sem dúvida, uma resposta mais virada para as aplicações de lazer, redes sociais e etc, têm um papel importante na minha forma de lazer e satisfação.

Q: ***Então, a intenção é continuar a utilizar aplicações móveis?***

A: Sem dúvida, neste momento não há nada que substitua o que esse formato faz, tudo o que é em formato móvel neste momento é quase tudo feito por aplicações, mesmo as que já vêm no telemóvel.

Q: ***Pensando na utilização das aplicações móveis, quando estás a utilizar tens uma série de técnicas de interatividade que lá colocam, como sendo a capacidade de fazer scroll, de fazeres swipe e aparecer uma nova página, achas que esse tipo de ferramentas são importantes e influenciam o uso?***

A: Acho que sim, sem dúvida. Primeiro porque conseguem dar mais maneiras de interagir com a coisa, por exemplo, deste aí um bom exemplo de deslizar a página e em vez de fazer *scroll* aparecer uma página nova, isso permite-nos logo ter duas interfaces dentro da mesma aplicação. Poupa espaço porque não preciso de ter duas, consigo segregar tudo num sítio e para mim é boa porque tenho mais utilidades no mesmo sítio. Tudo o que é acrescentar função está ótimo, claro que há algumas que acabam por cair na inutilidade, porque o que eu preciso se calhar é um bocadinho menos do que outra pessoa precisa, mas desde que não ocupe um espaço exacerbado, não me faz comichão ter funcionalidades a mais dentro da mesma app.

Q: ***Achas que se pode então tornar útil ter esse tipo de possibilidade? E incluímos aqui aquelas coisas como o zoom e tudo o que podes fazer para alterar de alguma forma a interface para utilização.***

A: Sem dúvida, e posso dar um exemplo muito fácil. Há uns anos os computadores eram naquele formato muito estranho de *matrix*, e apesar de serem coisas muito simples, muito retrógradas, olhamos e não percebemos nada do que lá diz, simplesmente não têm essa componente virada para o utilizador. É tudo muito *straight*. E são essas técnicas de *interface* que nos ajudam a ser mais *user friendly*, mesmo que não utilizemos todas, conseguimos perceber como utilizar só por ela estar lá e isso dá mais utilidade à

coisa. Ninguém lê um manual de instruções de uma aplicação, mas sabe utilizar, sabe o que fazer.

**Q: *Pensando um bocadinho na parte estética, achas que é importante para ti que as aplicações móveis te deixem personalizar a interface, que te deixem adaptar as coisas ao teu gosto?***

A: Sem dúvida, se calhar para aplicações de trabalho nem tanto. Lembro-me agora de um exemplo de uma aplicação que eu meto à frente do documento e me faz a digitalização, se calhar quando vou usar não quero saber como ela se apresenta. Mas se passar duas horas no Instagram importa-me que tenha um perfil de cores adequado, que não esteja cansado a olhar, que seja interessante, que cativa, isso faz parte do pacote, quando uma pessoa se vicia em alguma aplicação.

**Q: *Sim, então achas que de certa forma pode justificar o tempo e o esforço de estares a personalizar e a ver que cores ficam melhor, que layout fica melhor para ti... Achas que depois os benefícios pesam mais do que esse esforço?***

A: Sem dúvida, apesar de serem benefícios meramente pessoais, quero isto assim porque gosto, mais ninguém vai ver, mesmo para mim não tem mais utilidade que não visual, mas mesmo assim acho que compensa.

**Q: *Achas que é importante que a aplicação mostre tipos de conteúdo com que tu te identificas?***

A: Claro, se não a aplicação não serve para mim. Posso gostar muito de notícias e ter a aplicação de notícias, se só me falarem de notícias que nada me dizem, que não me dão consequências, não tem interesse para mim.

**Q: *E achas que é importante para ti que a aplicação seja capaz de mostrar um histórico das tuas ações?***

A: Aí se calhar depende um bocadinho mais do tipo de aplicação não é. Ao bocadinho dei aquele exemplo do *scanner* em aplicação para o telemóvel, não me é muito relevante o que digitalizei antes, mas se for por exemplo... nem tenho exemplos, mas se for algo que eu faça ações separadas, vou fazer isto a seguir vou fazer aquilo – então

acho que sim, que é relevante ter um histórico para ter um *tracking* do que fiz ou do que não fiz, principalmente se forem aplicações de trabalho.

**Q: *E achas então que por exemplo, quando fazemos algo numa aplicação que ela nos dá uma resposta, quando clicamos num link que nos leva a uma página, ou quando por exemplo vamos ao Instagram, escrevemos um username e ela leva-nos a um perfil. Achas que é importante para ti que esses tipos de ações demonstrem muito conteúdo que tem a ver contigo? Que a aplicação saiba que é aquilo que queres ver?***

A: Por acaso não sei responder, é uma resposta muito ambígua a minha. Porque por um lado isso acontece muito no dia a dia e é assustador, vai contra tudo o que é RGPD. Isto pode ser mania da perseguição, mas acontece-me diariamente quando começo a falar ou pesquisar um tópico, todas as pesquisas que faço vão dar a esse tópico. Por exemplo, se agora começar a pesquisar preço de comida para cães, as minhas aplicações todas vão-me sugerir comidas para cães, se eu procurar cão no Instagram vai aparecer um anúncio de comidas, etc. Por outro lado, esquecendo a mania da perseguição, se eu realmente preciso de comida para cães, até me dá jeito que me sugiram, portanto acho interessante e honestamente costumo aproveitar-me disso. Estou a lembrar-me do exemplo que falaste de procurar algo no Instagram e aparecer-me algo relacionado comigo, quando quero procurar alguém em específico, claramente tenho algo em comum com ele, por isso vai ser das primeiras pessoas que me sugere, as pessoas que têm em comum e facilita em encontrar, isto em Portugal há milhentas pessoas com o mesmo nome, se fosse buscar todas as pessoas era impossível encontrar a que queria.

#### 4.2.2.6 Interview 6

Question (Q): ***Como é que classificaria o conhecimento sobre esta área, sobre as aplicações móveis?***

Answer (A): Quantitativamente?

Q: ***Pode ser qualitativamente.***

A: Penso que neste momento é razoavelmente bom, porque, sobretudo devido à pandemia, há muitas pessoas que foram obrigadas a recorrer a elas, quer a nível de organismos públicos que já as introduziram para marcar atendimento, quer devido até a brincadeiras entre as pessoas, aquelas aplicações para contar passos, essas coisas, portanto acho que já é bastante bom o conhecimento

Q: ***E acha que são úteis no dia a dia, que fazem a diferença?***

A: Sim, a maioria acho que é, alguns sinceramente não lhe reconheço utilidade, acho que são pouco práticos, são dispensáveis, mas uma boa parte sim.

Q: ***E acha que existem aplicações que ache que a tornam mais eficiente, ou que ajudam a fazer algumas tarefas de forma mais fácil, de forma mais conveniente?***

A: Sim, sim, há. Das que eu conheço há, normalmente são as que mais recorro, e acho que sim, que são bastante úteis.

Q: ***Em termos de expectativas, antes de utilizares aplicações móveis, em geral, achas que as expectativas que tens são correspondidas com a utilização?***

A: No geral sim, algumas são muito fraquinhas, são muito elementares, mas no geral sim. No geral, para aquilo que elas foram criadas, para o básico, elas funcionam. Eu não sou uma utilizadora que aprofundo muito, normalmente sou muito prática, preciso de uma determinada funcionalidade, uso para aquela funcionalidade, não exploro mais, mas penso que sim.

Q: ***Em termos de qualidade e função, achas que correspondem àquilo que esperarias?***



A: Tirando uma ou outra que já usei e que deixei de usar porque achei que não tinha qualquer utilidade. Mas também depende um pouco, porque há algumas que para mim não são úteis, mas que para outras pessoas podem ser, já me aconteceu ter curiosidade sobre uma aplicação e instalei e depois desinstalo porque vejo que para mim não tem qualquer utilidade, mas para as pessoas até trabalham, ou pelo prazer que lhes dá, que funciona, e acho que sim, nesse aspeto. Mas para mim há coisas que não correspondem.

**Q: *Então achas que, com a seleção que vais fazendo, as aplicações que tu usas neste momento te deixam satisfeita?***

A: Sim, sim. Até ao momento sim, tenho é que obviamente selecionar, nem sempre elas são muito... algumas não são muito boas pronto, às vezes há uma função, umas são melhores que outras, é uma questão de experimentar uma e outra e dependem de pessoa para pessoa. Já me aconteceu instalar uma aplicação, não gostar, desinstalar e instalar outra que agrada mais e outras pessoas de família terem precisamente aquela com que eu não me dei e gostarem mais dessa. Portanto acho que depende um bocadinho da pessoa que usa.

**Q: *Então a intenção é continuar a utilizar aplicações móveis no dia a dia e com a regularidade com que usa agora?***

A: Sim, sim, penso que sim. Apesar de muitas delas terem sido por causa da pandemia, espero que fiquem, por exemplo e sobretudo aquelas ligadas à função pública que é onde eu acho mais difícil haver este tipo de aplicações, penso que fiquem. Entidades privadas acho que as que já estão a ser usadas vão continuar, as outras espero que venham para ficar e que se mantenham.

**Q: *E então acha que, mesmo no dia a dia, continuará a utilizar, em geral?***

A: Sim, as que estou a usar penso que vou continuar a usar, e haverá momento em que hei de aderir a outras. Há algumas que eu nunca coloquei no telemóvel, que conheço, mas nunca coloquei porque nunca usei, já me aconteceu ter algumas, usar, e depois quando deixei de precisar tirar e ao contrário, portanto sim, sempre que precisar acho que sim.

**Q: *E, pensando um bocadinho na forma de utilização, muitas aplicações agora, muitas digamos todas praticamente, têm ferramentas de interatividade como sendo a possibilidade de fazer scroll, a possibilidade de fazer zoom nalgumas partes, a possibilidade por exemplo de fazermos swipe e irmos para outra página - por exemplo até no email agora temos a possibilidade de fazer swipe para a direita e o email é arquivado e tudo isso (...) Há muitas funções dessas nas aplicações, cada vez mais e cada vez mais combinações, achas que são funções importantes de ter? Que influenciam a forma como utilizas?***

A: Sim, sem dúvida que são importantes, porque quando a ferramenta é muito pouco amigável há tendência a deixá-la. E às vezes quando é pouco intuitiva sobretudo, às vezes há aplicações que a gente tem de andar à procura de menus ou não é muito - não gosto muito, mas sem dúvida haver mais funções acho que é melhor, mas não é preciso exagerarmos.

**Q: *Então achas que esse tipo de possibilidades de fazer scroll e desse tipo de coisas que ajuda a ser mais intuitivo, que ajuda?***

A: Sim, e mesmo quando à partida às vezes dá problemas porque não nos apercebemos imediatamente que está lá a função e mexemos onde devemos, acho que aí aprendemos, é mexer uma vez ou duas e começa a funcionar bem.

**Q: *Pensando na interface, na parte estética da aplicação, achas que é importante nós conseguirmos adaptar o background e adaptar a forma como tudo é apresentado ao nosso gosto?***

A: Sim, eu tendencialmente nas aplicações gosto de fundos neutros, não sou assim muito amiga de coisas muito confusas, gosto de simplificar. Gosto de coisas em que o mais importante, digamos assim, é a teclazinha para ir para a função de que eu preciso. Portanto quanto mais pensada é a aplicação do ponto de vista gráfico, para mim melhor. O design, se por vezes se entender a estética, imagem mais bonita, é relevante, mas não é tanto. Com mais bonequinhos ou mais animados, eu não sou muito de excesso de imagem. Há pessoas que gostam muito e quase todas as teclas são um boneco ou têm uma cor diferente e eu privilegio o fundo branco, entre aspas, e o chamar a atenção é

por exemplo - há aplicações que nos dirigem o olhar para aquilo que vamos precisar de fazer a seguir, eu isso acho importante esteticamente falando, agregado à função a estética ser a função. Sou muito funcional e prática e, portanto, acho que é muito importante. Muito design distrai um bocadinho o olhar e eu perco-me um bocado, distrai-me muito, não gosto.

**Q: *Isso pode ser mesmo uma forma de personalização, por exemplo podermos colocar as coisas mais simples, tirar elementos...***

A: Conheço pessoas que preferem por exemplo fundos escuros, e trabalham bem com as aplicações com os fundos escuros quando se consegue. Não sei se nas aplicações é muito prático, mas vejo muito isso por exemplo nas redes sociais, e há pessoas que só conseguem trabalhar com o fundo escuro, eu a mim o fundo escuro - não é distrai-me - não consigo perceber tão bem o que lá está, prefiro o fundo claro, por oposição. Prefiro o fundo claro e a letra bem mais escura, porque é onde eu me foco, é no texto, foco-me mais no texto do que no grafismo porque ainda venho assim de uma escola mais antiga em que a gente lia mais, e ainda me estou a adaptar ao escrever com *emojis* por exemplo. Os *emojis* às vezes eu ainda não sei bem o que querem dizer, para não usar mal prefiro não usar, portanto ainda tenho esse *handicap*.

**Q: *Achas que compensa o tempo gasto e o esforço feito adaptar esse fundo, ou seja, achas que os benefícios de poder adaptar a interface das aplicações é superior ao tempo gasto e ao esforço feito?***

A: Depende das aplicações. Por exemplo, se é uma aplicação que se usa com regularidade acho que compensa. Por exemplo, uma aplicação tipo aquelas da segurança social que são muito elementares, muito básicas, dava-me imenso jeito que aquilo fosse mais intuitivo. Porque é muito importante, é muito útil. Já vi por oposição por exemplo, as do trânsito que acho que são melhores, são mais intuitivas e são mais funcionais, e esse tipo de coisas são úteis, por exemplo para apanhar transportes, esse tipo de coisas acho que sim, que compensa, sobretudo quem as desenvolve. Quando quem as desenvolve pode ter retorno, digamos assim - quando não é para ter retorno, quando é uma brincadeira, para passar o tempo ou para aprender, acho que não se justifica - numa aplicação que realmente é para ser usada, é como eu digo. Aquelas da

função pública faz sentido, para marcar atendimentos na Segurança Social, até fazia sentido investir numa aplicação desse tipo.

**Q: *Mas na ótica do utilizador - como utilizador, nós muitas vezes nas aplicações temos a opção de alterar tudo no nosso telemóvel, e se eu e tu tivermos exatamente a mesma aplicação, podemos ter tudo diferente mediante o nosso gosto. Achas que para ti vale a pena gastares tempo e teres o esforço para modificar uma aplicação da forma que ela vem?***

A: Eu se puder mudar, normalmente mudo, se tiver essa opção - pelo menos o mais básico. Se tiver a possibilidade de mudar por exemplo o fundo, alguns tons, eu mudo, porque para mim é mais fácil, é mais fácil utilizar.

**Q: *É importante utilizar aquela forma como ela funciona melhor para nós.***

A: É.

**Q: *E em termos de conteúdo, achas que é importante para ti numa aplicação veres um tipo de conteúdo que reflete aquilo que queres ver lá?***

A: Sim, é importante. Não sei se sempre é possível, por exemplo, nalgumas aplicações o que era importante era uma espécie de mãozinha a definir o que é o quê, porque já me aconteceu em algumas aplicações eu querer uma coisa, e ela até poder estar, mas eu não perceber que é aquilo, porque a linguagem nem sempre é aquela que eu uso, as pessoas utilizam linguagens diferentes para definir a mesma coisa. Penso que é mais por aí.

**Q: *Achas que é útil que uma aplicação consiga ter uma forma de comunicação coerente e um canal de comunicação bom com os seus utilizadores? E quando falamos em comunicação, falamos numa troca de mensagens própria de humano com máquina, portanto estamos a falar de nós fazermos uma ação, tocarmos em determinado sítio, ou irmos a determinado menu, que depois nos leva a uma reação por parte da aplicação.***

A: Sim, não tenho nada contra, acho que nalgumas situações ajuda, noutras se calhar atrapalha um bocado porque nós até sabemos onde queremos ir e se a aplicação nos

direciona, já me aconteceu direcionar para o sítio que não quero. Sobretudo no trânsito, começam a criar as alternativas deles e pede demasiado da nossa parte estar a mudar o que nos é oferecido. Ao mesmo tempo, ajuda porque se for a conduzir, se for com uma aplicação dessas ao lado, convém que vá orientando, o que nem sempre é a melhor opção porque às vezes esses softwares estão desatualizados e mandam-nos para uns caminhos que não existem. Eu aí a minha opinião não é muito segura, já me aconteceu achar isso importante, já me aconteceu isso não resultar muito bem. Por exemplo, estar à procura de um canal, de uma situação e ele me orientar quer nisto, quer naquilo, sim, aí sim. Noutras situações pode não correr tão bem.

**Q: *Achas que é importante poder existir por exemplo um histórico das tuas ações nas aplicações, por exemplo quando vamos a um website de compras, quando saímos e voltamos a entrar eles dão-nos sempre aquela questão dos últimos artigos visualizados, isso é um histórico das nossas ações no site. Achas que pode ser útil? Importante?***

A: Acho que sim, porque nos permite se quisermos recuperar alguma coisa que já precisámos e que já pesquisámos e precisamos outra vez, acho que sim.

## **5 Results**

In this section we present the results of both the quantitative and qualitative tests. The quantitative method allows for the determination of confirmation, or not, of each of the hypotheses, while the qualitative method only allows for the explanation and presentation of opinions, feelings and attitudes toward the questions, not giving a solely quantitative and certain answer to each hypothesis, although one can be reached by interpretation.

### **5.1 Quantitative results**

To implement our research model and obtain a reliable conclusion for whether our hypotheses were or were not confirmed, we used the PLS-SEM method. Amongst the various ways to analyse the data from this research, the choice to use PLS-SEM offered the most benefits. PLS-SEM is now the choice of many scholars in many areas of work, including, but not restricted to, management information systems (Hair et al., 2019).

There are several motives that can be attributed to this preference, namely the fact that PLS-SEM allows for data samples smaller and larger, as well as secondary or primary, being appropriate for both confirmatory or exploratory research with greater statistical power. These factors make it possible to better identify relevant relationships between data and theory, which in turn has the possibility to be studied while still being less developed or even still developing, all without distributional assumptions that often compromise the exploration on non-normal data (Hair et al., 2019). These reasons make it tempting for scholars in several areas, even social studies, to analyse and develop their research of quantitative data samples through it.

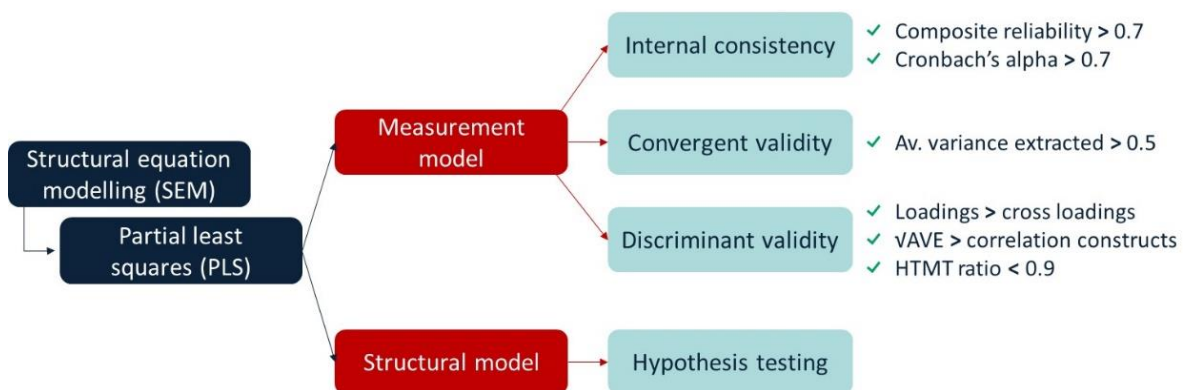
Our sample is composed of primary data collected for this research, as explained previously, with the number of people reached being more than 10 times the largest

number of paths going to a particular construct, a rule described in Henseler et al. (2009, p. 292). This allows us to continue this research with PLS, which will be both exploratory and confirmatory in nature given the crossover of theories included in our structural model.

### 5.1.1 Measurement model

Evaluating the reliability and validity of reflective models such as the one being tested in this study is of great importance (Hair et al., 2011). To obtain the conclusions of validity and reliability necessary to evaluate the measurement model and its constructs a series of *rules of thumb* are followed, namely the analysis of internal consistency, convergent validity, and discriminant validity, using the tests named in Figure 5 and described below.

**Figure 5:** Process of assessment of the measurement and structural models



As a starting point, we look at the items' loadings in order to be sure that each is over 0.7. The fact that loadings are all above 0.7 (see Table 4) indicates that the item explains more than half of the variance of the indicator, which in turn assures reliability (Hair et al., 2019, p. 8).

**Table 4: PLS loadings and cross-loading**

Constructs		CONF	PU	SAT	MODI	MESI	SOUI	CI
Confirmation (CONF)	CONF1	<b>.899</b>	.601	.733	.466	.528	.582	.694
	CONF2	<b>.939</b>	.521	.674	.437	.574	.562	.573
	CONF3	<b>.899</b>	.588	.661	.450	.480	.545	.601
Perceived usefulness (PU)	PU1	.552	<b>.921</b>	.568	.525	.294	.414	.567
	PU2	.591	<b>.941</b>	.607	.423	.237	.420	.573
	PU3	.612	<b>.940</b>	.608	.488	.331	.504	.558
Satisfaction (SAT)	SAT1	.637	.571	<b>.897</b>	.550	.478	.534	.647
	SAT2	.714	.558	<b>.887</b>	.530	.522	.563	.651
	SAT3	.711	.604	<b>.939</b>	.585	.481	.543	.699
Modality interactivity (MODI)	MODI1	.474	.482	.572	<b>.920</b>	.434	.401	.632
	MODI2	.402	.434	.494	<b>.830</b>	.343	.321	.514
	MODI3	.412	.416	.526	<b>.855</b>	.425	.406	.552
Message interactivity (MESI)	MESI1	.546	.282	.515	.376	<b>.862</b>	.534	.417
	MESI2	.490	.259	.444	.428	<b>.881</b>	.460	.430
	MESI3	.505	.278	.490	.433	<b>.926</b>	.499	.424
Source interactivity (SOUI)	SOUI1	.487	.389	.511	.309	.391	<b>.815</b>	.477
	SOUI2	.607	.487	.535	.426	.506	<b>.838</b>	.476
	SOUI3	.453	.315	.465	.356	.521	<b>.872</b>	.395
Continuance intention (CI)	CI1	.634	.550	.651	.637	.473	.476	<b>.926</b>
	CI2	.668	.624	.704	.643	.444	.534	<b>.940</b>



CI3 .567 .474 .651 .499 .381 .458 **.867**

To test the internal consistency of the measurement model two tests were run, one evaluating composite reliability, and the second being Cronbach’s alpha. Both have the same goal, to have a value above 0.7. However, composite reliability tends to be credited as the most precise measure given that it takes the indicator’s differential weights into account, therefore accepting that different indicators are not equally reliable, while Cronbach’s alpha does not (Hair et al., 2011, 2017, 2019). For both these measures, values should exceed 0.7, which has been achieved, as showed in Table 5, in the columns named CR (Composite Reliability) and CA (Cronbach’s Alpha). This means that internal consistency is assured, and the indicators are reliable.

Convergent validity, i.e., how much the item’s variance can be explained by the construct (Hair et al., 2019, p. 9) also has to be assessed, and for that the average variance extracted (AVE) must be calculated and be higher than 0.5 so that we can know that each of the constructs justifies at least 50% of the variance of their items (Hair et al., 2019). This rule is also met, as reported in Table 5, which positively confirms convergence.

**Table 5:** Means, standard deviations, correlations, and reliability and validity measures (CR, CA, and AVE) of latent variables

Constructs	Mean	SD	CR	CA	CONF	PU	SAT	MODI	MESI	SOUI	CI
Confirmation	5.328	1.167	.937	.899	<b>.912</b>						
Perceived usefulness	5.290	1.360	.954	.927	.627	<b>.934</b>					
Satisfaction	5.492	1.254	.934	.893	.758	.636	<b>.908</b>				
Modality interactivity	6.194	1.087	.903	.838	.495	.512	.612	<b>.869</b>			

Message interactivity	5.582	1.218	.919	.868	.578	.308	.544	.463	<b>.890</b>		
Source interactivity	5.979	1.221	.879	.794	.618	.478	.602	.434	<b>.842</b>		
Continuance intention	5.701	1.380	.936	.898	.685	.606	.733	.654	.476	<b>.538</b>	<b>.912</b>

The third dimension that has to be explored to validate the items and indicators of the constructs as well as the constructs themselves is discriminant validity. To test this validity we run three tests. Firstly, we checked to see that the loadings of each indicator toward their respective latent variable was higher than its cross-loadings (Hair et al., 2011). Secondly, the Fornell-Larcker criterion, according to which the square root of AVE should be higher than the correlation between constructs (the square root of the AVE for each construct are in bold in Table 5, while the correlation between constructs are the values underneath them in the same table), which can be confirmed in Table 5. The third and final test run to confirm the validity of items is the Heterotrait-Monotrait Ratio (HTMT), presented in Table 6, for Hair et al. (2019) a more precise method. It should have a value lower than 0.90 in order to confirm the validity of the indicators of the structural model, which once again can be confirmed to be the case for this research in Table 6.

**Table 6:** Heterotrait-Monotrait Ratio (HTMT)

Constructs	CONF	PU	SAT	MODI	MESI	SOUI	CI
Confirmation							
Perceived usefulness	.684						
Satisfaction	.843	.699					
Modality interactivity	.568	.581	.706				

Message interactivity	.654	.343	.616	.541		
Source interactivity	.724	.549	.710	.528	.675	
Continuance intention	.757	.661	.818	.747	.538	.631

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### 5.1.2 Structural model

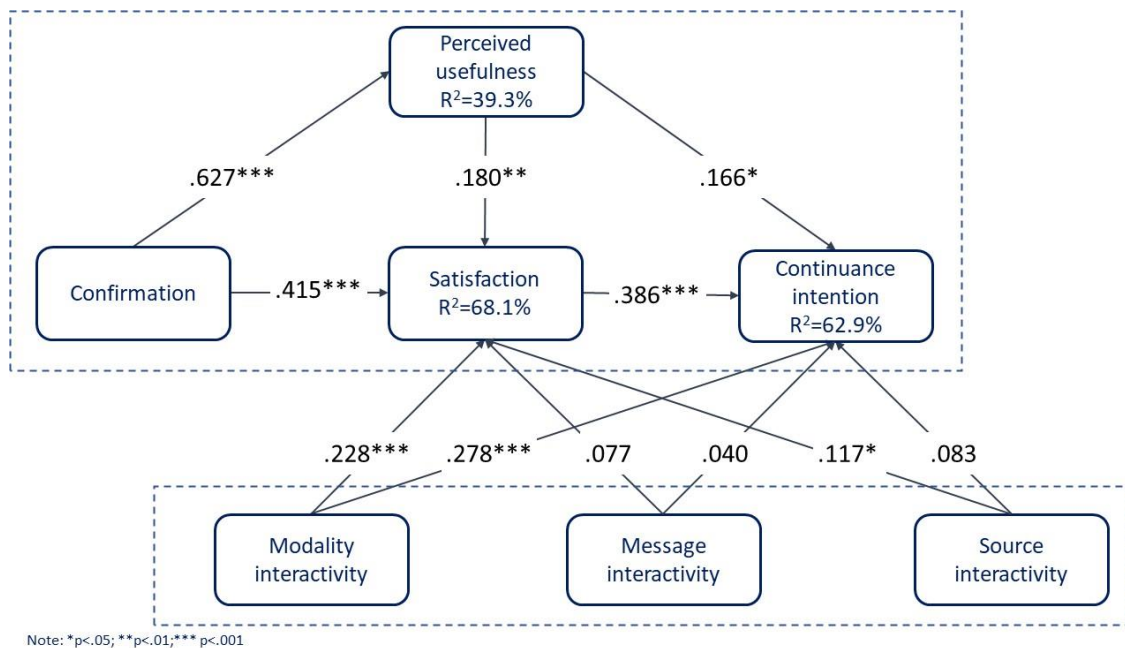
After determining the consistency and validity of the items and knowing that the study can continue with the items defined, we move on to the testing of the structural model, and thus the confirmation, or lack thereof, of the hypotheses. Firstly, we need to check the collinearity of the model in order to ensure that it does not affect the analysis of the relationship between constructs and the path coefficient values. For the collinearity to not be an issue, the value of the variance inflation factor (VIF) should never be above 5 (Hair et al., 2019), which is the case in this research, which allows us to continue the evaluation of the structural model.

The next step is to check the coefficient of determination that assesses the explanatory power of the model, i.e.  $R^2$ , a measure of variation that gives us an insight into how much the model explains the endogenous constructs, or constructs that are determined by others (Hair et al., 2019). In our model perceived usefulness, satisfaction, and continuance intention are all endogenous constructs the variance of which is somewhat explained by the model. This being said, it is fair to conclude that the model explains 39.3% of the variation of perceived usefulness, 68.1% of the variation of satisfaction, and 62.9% of variation of continuance intention. According to Hair et al. (2019), the first one is considered a value that is situated between weak and moderate, while the other two are somewhere between moderate and substantial (Hair et al., 2019, p. 11).

To determine the significance and relevance of the paths between constructs in PLS, we ran nonparametric bootstrapping, which consists of the creation of multiple

smaller samples, taken from the original larger one, that are tested in order to determine standard errors (Hair et al., 2011, p. 148) . For this study we used bootstrapping based on 5000 resamples. The results of the bootstrapping with significance levels of 5%, 1%, and 0.1% are shown in Figure 7 and explained below.

**Figure 6: Structural model results**



The information given by the structural model evaluation of Figure 6 lets us know which paths between the different constructs show relevance for the structural model. Table 7 shows which paths are statistically significant.

**Table 7: Hypotheses supported**

Hypothesis	Variables	Findings
H1	Confirmation → Perceived Usefulness	Supported
H2	Confirmation → Satisfaction	Supported

<b>H3</b>	Perceived Usefulness → Continuance Intention	Supported
<b>H4</b>	Perceived Usefulness → Satisfaction	Supported
<b>H5</b>	Satisfaction → Continuance Intention	Supported
<b>H6</b>	Modality Interactivity → Satisfaction	Supported
<b>H7</b>	Modality Interactivity → Continuance Intention	Supported
<b>H8</b>	Message Interactivity → Satisfaction	Not supported
<b>H9</b>	Message Interactivity → Continuance Intention	Not supported
<b>H10</b>	Source Interactivity → Satisfaction	Supported
<b>H11</b>	Source Interactivity → Continuance Intention	Not supported

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Confirmation proves to be significant and have a positive impact on both perceived usefulness and satisfaction, which confirms both H1 and H2 with a  $p < 0.001$ .

Perceived usefulness proves to be impactful in explaining both continuance intention and satisfaction, therefore confirming H3 and H4 with  $p < 0.01$  and  $p < 0.05$  respectively.

Satisfaction has a theorized path of influence to continuance intention, which is also significant, confirming H5 with a  $p < 0.001$ .

Modality Interactivity also proves to be significant in explaining both satisfaction and continuance intention with  $p < 0.001$  in both, which confirms H6 and H7.

Message interactivity, on the other hand, does not seem to have any impact on the explanation of either satisfaction or continuance intention, therefore not confirming H8 and H9.

Source interactivity, with  $p < 0.05$  shows significance in explaining satisfaction, confirming H10, however, it does not show any impact on continuance intention, making H11 not confirmed.

## **5.2 Qualitative Results**

The results of the qualitative component of this research are based on the answers and conversational cues given by the participants during the interviews. None of them can be simplified into a number, providing more depth and insight into the significance, or lack thereof, of each construct to the dependent variables at stake. For that reason, and to better understand the conclusions that can be taken from the sample of interviews made, the results are presented for each of the constructs being evaluated as a possible influence on Continuance Intention.

During the interviews much was learned about what was mostly understood, or not, by the participants, as well as what was the most profitable way to conduct the interview, which is why for some variables the questions ended up changing between participants. However, even with these changes, the ultimate goal was always the same, to obtain the answers concerning what we were trying to evaluate for each construct.

Some of the answers given regarding a certain variable can, however, be applied to another one, given that because we are often speaking of different types of interactivity, they seem to overlap in users' minds, which is why in both Sections 5 and 6 answers for a certain variable can be used as an explanation for something else, if applicable.

### **5.2.1 Confirmation**

In general, the interviews showed that the confirmation of expectations about a mobile application is relevant for people's satisfaction with it, as well as for their intent to continue using it. The interviewees shared that in their experience mobile applications have been living up to their publicized goal and functions, and for that reason they tend to match the expectation created upon the download of the app. In

cases in which for some reason those expectations are not met, for example because the app did not work as well, as fast, or as efficiently as they expected it to, the users tend to cease its use. One of the interviewees explained how the existence of too many ads affected their experience with the app, therefore not meeting their expectations of its use, and they chose to uninstall it.

Another interviewee explained that there is a process they go through after downloading an app by which they determine if it is going to live up to the reason they first installed it, and if it really brings the ease they needed for the purpose they downloaded it for. If the app does not correspond to their expectations and wishes while using it, it is uninstalled. This process of elimination confirms our proposition that the confirmation of expectation has an impact on users' satisfaction with the mobile app, as well as on the continuance intention to use the app.

### **5.2.2 Perceived Usefulness**

All of the interviewees identified mobile applications as useful in their day to day lives, with some of them even using work related ones for their jobs, while looking for needed information and communication. The general idea was that mobile apps have now become a part of their day, concentrating in one place much of what they needed and that was previously scattered through different objects and places, speeding up and facilitating many necessary tasks, and thus providing efficiency, even though there was also a distraction factor associated with apps that one interviewee identified.

It was recognized that the market is growing, as well as the amount of types and uses those applications can have, there being apps that are useful in very different contexts, while some can boost productivity at work, and others are useful in the context of communication with friends or even in learning new skills.

The general answers of the interviewees show that there is in fact importance placed on what they see is useful for them, and that they recognize the applications they have as useful. This leads to the conclusion that, similarly to the answers relating to the

variable *confirmation*, interviewees showed that they choose their apps based on how useful they perceive them to be. One interviewee said that the market is really big, and there are many mobile applications out there, not all useful, which makes them choose which ones they need, which ones they see are useful for their tasks, and those are the ones that are kept.

### **5.2.3 Satisfaction**

All of the interviewees showed satisfaction toward the mobile applications they have and use, demonstrating that they are satisfied with the app while also feeling satisfied while using them.

The same trend seen through the variables *confirmation* and *perceived usefulness* is also confirmed here, with the interviewees mentioning that after the adoption of a mobile app, if its use does not satisfy them, they will uninstall it and keep only the ones that bring them some sort of satisfaction. This shows that the continuance intention of use of a mobile application is in fact affected by how much satisfaction, if any, it brings to its user.

### **5.2.4 Continuance Intention**

When asked about their intention to continue using mobile applications (ones already in use and others later adopted) all of the interviewees expressed their intent to keep using them on a daily basis. Mobile apps are seen as something that cannot be replaced by anything else at this moment, and while some of the interviewees expressed their desire to reduce their use of mobile phones in order to decrease their digital dependency in general, and more specifically to social media and leisure applications, they believe that they will keep using mobile applications in their various fields of action in the foreseeable future.



### **5.2.5 Modality Interactivity**

Interviewees showed satisfaction regarding the inclusion and utilization of tools that are a part of the interactivity of medium, such as scrolling, zooming, hovering, and others, stating that they can make the application more user friendly, intuitive, and easy to use. All of them reported using them, with many identifying a specific feature that they thought improved their experience on a certain mobile app.

While the consensus is that these interactivity tools are useful, some of the interviewees mentioned that many of them could become useless because of the user's limited needs. This means that sometimes there are more features than necessary for the basic use of an app, with all of the other ones being left unused. However, none of them mentioned that fact as having negative or unpleasant impact on their use of the app, even mentioning that it could take some time, but it could eventually become part of their utilization, or that more features do not hurt the experience, only that it is possible that if they are more complex, users may not be able to take full advantage of them.

Overall, these tools are seen by interviewees as useful and satisfactory in their use of mobile applications, creating a more user-friendly environment.

### **5.2.6 Message Interactivity**

Interviewees saw message interactivity as a significant feature of the use of a mobile application. Overall, the answers showed that it was important to some extent for the users to have a unique experience while using the app, and have it reflect their activity within it. One interviewee mentioned the example of news apps, and the usefulness of seeing news that are tailored to what their areas of interest are, instead of having to read through many things that have no real consequences in their life. Other

interviewees also stated that it could be very useful to revisit some of the things they previously saw, or showed an interest in, because it truly reflects what they are looking for or need at the moment.

While there is that interest in having their personalities and continued use of the app shown through the content presented, interviewees also expressed that they do not want their history of message exchanges with the app to be the sole influencer of what they are recommended to consume. Some of the interviewees shared that they feel like the experience could be impoverished, making it more difficult to access information and content that goes beyond their main interests. One interviewee shared that they noticed that fact on their use of YouTube, for example, a website and app in which they felt that they could discover more music related to the particular song they are listening to at the moment, but now are recommended videos related to something else they also watch.

Some of the interviewees also shared their concerns on what impact the storing of this message exchange and activity history could have on their data privacy, some of them being cautious about how these data and this information could be treated by the mobile app.

Overall, there was usefulness identified in the elements of the interface representing the users' actions, and therefore assumed personality, within the mobile app and in communication with it, while also facilitating the access to what they need and the information they wish to receive. This is, however, accompanied by some reluctance in this process as well, a reluctance which could affect the use of the app.

### **5.2.7 Source Interactivity**

When asked about the importance of source interactivity, studied here as the personalization and customization of the interface of a mobile application, all interviewees said that they like and use those features. Showing preference for either a simpler and plainer interface, or a more elaborate one, everyone from the sample of

interviews recognized that they like to take the time and put in the effort to adapt apps to fit what is better for them. All of the interviewees believed that the benefits collected from customizing their interface and mobile app could be worth the time and effort, the answers showed that this action brings them satisfaction in using the app, makes it easier and more pleasant to use for longer periods of time, even improving their concentration in what mattered most in the app.

However, even recognizing the satisfaction of self-customization, some interviewees created a separation between the apps where this was or was not worth it. One interviewee mentioned that work applications, or those with very specific and niche functions would not benefit from a customization given the fact that the time spent on them is very diminished, therefore also diminishing the benefits of customizing it, while applications where one would spend more time, such as social media, are worth the effort of customizing it, because they are associated with longer periods of utilization. Another interviewee mentioned the fact that customization is good until the point where it could affect the efficiency and normal execution of the functions to which the app was designed, mentioning that sometimes these types of features on an app could affect its speed, as well as the access to key information on it.

This leads us to conclude that, in general, interviewees identified source interactivity as being a very substantial source of satisfaction in the use of a mobile app, but the efficiency and overall goal of using it should always be a priority over customization.

## 6 Discussion

Our intention with this research was to discover how interactivity could affect users' continuance intention to use mobile applications, if different features of interactive tools could influence users to maintain their interest and satisfaction with the app. With this goal in mind, we set out to retest the expectation confirmation models' (ECM) constructs and hypotheses. Both our quantitative and qualitative research confirmed what was already previously stated in other research and studies about this model.

It became clear through our results that confirmation is significant for both perceived usefulness and satisfaction, meaning that when users' expectations are confirmed or exceeded their level of satisfaction will increase, as well as how useful they deem the mobile app to be. These results are in line with those of various previous studies such as Kumar and Natarajan (2020), Franque et al. (2021) , and Daneji et al. (2019) . These are also confirmed by the interviewees that took place for this study, which showed a very interesting association between the confirmation of expectations and the usefulness of the app for each individual person.

When asked if mobile applications would usually meet their expectations, one interviewee said that they often did, but if they found that it had no utility for them after all, they would uninstall it. Another stated that they always have a test run period when installing a mobile application, during which they ascertain if it actually fits their intended purpose and initial will to install and use it, and if it does not live up to the expectations, it is quickly abandoned and uninstalled. This leads us to the realization that when users do not see their expectations for the use of an app met, they end up dissatisfied with its performance and fail to see any value in it, giving up its use. This finding aligns with the conclusions reached by Luqman et al. (2016), who stated that exceeding users' expectations influences continuance intention of the mobile services at hand by creating and increasing their satisfaction with it, with the same being applied to our case of mobile applications.

It was also seen that confirmation has a more significant impact on satisfaction than does perceived usefulness, which is in line with previous studies (Bhattacharjee, 2001; Daneji et al., 2019), even though our results show that perceived usefulness does have a positive association with both satisfaction and continuance intention.

While the relationship we found between this variable, meaning perceived usefulness, and satisfaction is corroborated by various studies (Franque et al., 2021; Hsiao et al., 2016), it also disagrees with others, such as the one developed by Daneji et al. (2019). This last research found no association between perceived usefulness and satisfaction but identified it as a significant predictor of their information systems' continuance intention, with Alshurideh et al. (2020) also seeing a positive influence between perceived usefulness and continuance intention, which contradicts studies such as those conducted by Franque et al. (2021) and Hsiao et al. (2016).

While the number of differing results concerning the association of perceived usefulness with both satisfaction and continuance intention can become somewhat confusing, given the considerable differences and contradictions between studies, the explanation for this can be quite simple. On the one hand, users have been living with mobile apps for several years now, with some using them since a very young age, we know how they work and how we can utilize them to our advantage, and for that reason it becomes less of a question and less of a factor of consideration for our satisfaction. The usefulness of an app is something we already accept as a given.

One of our interviewees even stated that apps are really not something new, and that because they have been being developed over the years, and with the input and experience of people already using and enjoying them, they now are already imbued with the resources and tools that users most value and find necessary, which in a way aligns with the idea that apps are preconceived to live up to users' expectations of usefulness, therefore not making it a selling point.

Another explanation can be that the utility of an app can depend on its main goal for the user, and that is usually something that is assessed previously to the adoption of an app. A user who wants to communicate better and in an easier way with friends and family will most likely install an app such as Whatsapp, while one who wants to better

organize their days will download some sort of schedule or calendar application, already choosing the app before they install it. Their use of it and if they like it or not will most likely have to do with whether their expectations are met, and less with its efficiency, given that its purpose was evaluated before, with perceived usefulness being one of the primary factors in the acceptance of information systems (Bhattacharjee, 2001).

One connection that does not cause any ambiguity, however, is the one between satisfaction and continuance intention. Our results show a clear positive influence between the two variables, supporting multiple previous studies (Alshurideh et al., 2020; Chow & Shi, 2014; Junjie, 2017; Kumar & Natarajan, 2020; Tam et al., 2018). As previously mentioned, our qualitative results support these findings, with all of the interviewees showing satisfaction with the mobile apps they use, and stating that if for some reason an app they install does not satisfy them, they will uninstall it, thus supporting the hypothesis that the continuance intention is in fact influenced by users' satisfaction, and slightly contradicting Amoroso and Lim (2017), who concluded that satisfaction is not a very strong predictor of continuance intention.

Apart from testing the expectation confirmation model, in which all of the hypotheses proposed were supported by our results, this research had the goal to test how modality interactivity, message interactivity, and source interactivity, constructs from the interactivity effects model (IEM), could influence the satisfaction and the continuance intention of use of mobile applications. Our findings show that some sort of interactivity influences users' experiences in a positive way, although it varies according to the type of interactivity.

Modality interactivity seemed to have a positive influence on both satisfaction and continuance intention, with the interviews corroborating this finding and interviewees expressing how the presence of functionality interactivity could enhance their experience, making the interface more user friendly and pleasant to use. This aligns with Niu et al. (2021), who found that modality interactivity indeed positively influenced the users' satisfaction, Sundar et al. (2022), whose findings indicate that modality interactivity enhances ease of use and usability, and also Sundar et al. (2015), whose reflections about earlier work present findings that the conceptualization of interactivity

of medium through tools of functionality, such as zoom, hover, scroll, and others, can increase the users' positive attitudes toward the websites and the products displayed in them.

This idea that modality interactivity's function tools influence users' engagement and interest aligns with what we discovered through our interviews, with one particular example that stands out. One of our interviewees mentioned a change in the algorithm of a content sharing application they use – a change that stopped promoting one type of publication that encourages users' interaction through a sliding show of images that changes the slide upon a swiping motion from the user. This is a change that the interviewee stated made them feel less engaged with the content they are being viewed, and that has been a topic of conversation amongst the users of the app.

While modality interactivity seems to be a variable that does not raise much doubt, and that finds support in our study, message interactivity presents weaker relationships with both satisfaction and continuance intention, with both hypotheses failing to be supported in our quantitative results. While a previous study was not found in which the influence of message interactivity on continuance intention was tested, Niu et al. (2021) state that this variable positively influences user satisfaction, and Sundar et al. (2016) report that users' attitudes toward website and content were positively impacted by message interactivity and increasing user engagement and involvement.

Our own qualitative results seem to disagree with the survey findings. While being interviewed and asked about their opinions regarding a record of message exchange history as a message interactivity tool, interviewees saw benefits in it, expressing positive feelings toward having the application tailor content and utilization to what the users previously interacted with. While there was some reticence in the legitimacy of their information being collected and with how much that would impact their experience, with most interviewees expressing that seeing only content the app deems to be of interest could impact their ability to expand their knowledge and interests, there was a general feeling that a unique experience within the app was a good thing.

Several interviewees also expressed that it is useful to be able to quickly find something they had previously seen or having searches more tailored to what they had previously done, with the example of being easier to find someone on some social media applications because of people or activity they have in common, since the application is able to recognize that connection.

There are some possible explanations for this discrepancy in results. Firstly, it could happen that the questions on the survey were not clear or had too much of a technical way to them, thereby compromising participants' understanding of them. While this could be a reason, there is a stronger, but related, explanation for this difference. When asked about the idiosyncratic paths that allow users to have a unique experience of navigation, as well as about the message exchange through action-reaction between the user and the app, interviewees expressed some confusion, requiring specific examples and even then, not being able to fully grasp that form of communication as interactivity. This difficulty was not noticeable when activity and interaction history was talked about, a feature that while being part of message interactivity, is very present in users' daily use of apps, becoming very tangible. Therefore, it is possible that part of the reason participants did not show a connection between message interactivity and satisfaction is because they were not aware that it affects them, given that they do not realize it is there.

This reason aligns with Niu et al. (2021) when they state the conclusion that message interactivity negatively influences the variable at hand in their research, theorizing that the explanation may reside in the fact that this type of interactivity demands a much greater effort of interaction and understanding on the users' side (Niu et al., 2021, p. 10). In the same study it is shown that higher message interactivity influences user satisfaction. Sundar et al. (2016) present a similar idea when they theorise about idiosyncratic paths being able to increase the sense of interactivity of an information system, but never quite as much as dialogue itself does, and sharing as a possible reason that the possible interactivity between the system, through the interface, and the user, lacks the mutual and contingent nature that the users own perceptions demand (Sundar et al., 2016, p. 3-4). The degree to which this interactivity



can be felt and perceived can, however, be the explanation for positive results regarding message interactivity effects on users during tests that involve the continued use of a certain interface to therefore understand the sample's behaviour.

Yang and Shen (2018) also recognize the growth of the information and options available online for users as a reason for this type of interactivity to be less influential on user behaviour, stating that modality interactivity and its tools is the most easily accessed and visible form of interactivity on a system, therefore making it more influential than message and source interactivity. These last two have functionalities that are not always perceptible and demand much more time and effort to recognize and understand (Yang & Shen, 2018, p. 17). This theory further explains and corroborates the uncertainty users feel toward message interactivity and its effects and influence in their use of mobile apps. It also aligns with our own results, both quantitative and qualitative, that modality interactivity tends to be of more importance and influence on users' attitudes than both message and source interactivity.

This last variable, conceptualized as interface customization, was showed to influence satisfaction in both the quantitative and qualitative results, which goes in line with Sundar et al. (2015), who said that users' wish to self-express increases with the ability to control the look of an interface and customize it in a personal way (Sundar et al., 2015, p. 57). This motivates other types of interaction with the website and users, providing a better experience and sense of agency, making the user feel self-control, and thus sensing the website as having more usability. During our interviews, several answers led to the fact that customizing the interface of an app made it more satisfying to use and easier to highlight the most important parts of the content shown for each user.

In regard to the relationship between source interactivity and continuance intention, the results from our survey showed no influence, which can be corroborated by our interviewees, who expressed that if the tools to customize the interface are there, they will make use of them, although it did not seem likely that it would be a factor to decide if they would or would not use the app.

One interviewee also mentioned that they would not want to jeopardize the functionality tools just to be able to go through with the customization of their interface, therefore prioritizing functionality over customization, and that some features of customization could actually take away from what is being shown on the app. This aligns with the findings of Yang and Shen (2018), who recognize that too many interactivity features could take away from knowledge and information processing. The fact that there is no relationship between source interactivity and continuance intention is contradictory, however, to the idea that Sundar et al. (2012) expressed, which highlighted that self-expression could affect psychological factors that would increase users' positive attitudes toward the information system, and therefore their will to continue its use.

## **6.1 Theoretical Implications**

The first theoretical implication of this research resides in the retesting of ECM, with our study supporting all of the five hypotheses of the model, in compliance with, for example, Anil Kumar and Natarajan (2020), Chiu et al. (2020), and Rahi et al. (2021). Additionally, this confirmation of the model was made in the context of mobile applications in general.

Secondly, we introduced three new variables to ECM, namely modality interactivity, message interactivity, and source interactivity that derive from the interactivity effects model (Sundar et al., 2015). The combination of these two models is not reported in literature.

While we have seen studies connecting perceived interactivity to continuance intention developed over the years (e.g., Jiang et al., 2022; S. Yang et al., 2018; Zhao & Lu, 2012), to the best of our knowledge, IEM variables have never been studied in this context. Additionally, we incorporated all three strands of interactivity, which has happened with less frequency than only one of them being studied separately. It is also

worth mentioning that our study incorporated IEM in the research in the context of mobile applications, while most of the studies performed so far have been on websites.

With all three variables having yet to be studied in regard to Continuance Intention, our study introduced some conclusions and ideas that, because of the lack of theoretical support concerning continuance intention, would benefit from having additional research.

We would like to highlight the importance of the finding that modality interactivity has a greater influence on both satisfaction and continuance intention than perceived usefulness does, in terms of both theory and practical terms.

## **6.2 Practical Implications**

The findings of this study can be useful for mobile app developers, companies that want to create or update their mobile apps in a way that retains more users for longer periods of time, and for researchers who want to use these theories and/or constructs.

We found that the variable that shows the most influence over continuance intention is satisfaction. Therefore, companies and developers could invest in more research about what brings users satisfaction in the product they have to offer in terms of apps. This could be done through focus groups and pilot tests, for example, in order to increase satisfaction in the target audience of the mobile app at hand, and therefore boost the chances of continued use.

Apart from satisfaction, the variable that seems to be of greatest importance for continuance intention, as previously stated, is modality interactivity, which demonstrates the value for mobile apps developers in understanding the right way and amount of medium interactivity tools to implement in their apps. This can be done through testing which features best adapt to the product and the main psychological response that companies and apps aim to achieve. Modality interactivity contains a wide

variety of tools that can be studied to understand their individual and mixed effect, taking Wang and Sundar (2018) as an example.

Message interactivity was another variable that provided more curiosity, and one of the things we extracted from its study is the way it is often misunderstood or not noticeable by users. For this reason, it could be useful for developers to study it through more practical means than the ones used during the development of this research.

Interviews and the survey itself when compared with the literature makes us believe that awareness is not always present when dealing with message interactivity, but when interacting with a certain interface, if it is present, users will most likely engage with it, therefore giving more reliable results than ones based on theory, compared to studies with a more experimental approach (Christy, 2016; Wang & Sundar, 2018; Wise et al., 2006). This would also allow developers to understand the best practical way to integrate these features into their mobile applications.

Source interactivity proved to bring satisfaction to users, with all of the participants in the interviews recognizing that they use them. However, many of them had different definitions of how they wanted to customize their interfaces, so it could be useful for developers to understand the best way of presenting these features with regard to their content presentation, providing simpler and less extravagant options when designing it. In this way the apps could appeal to more users, not neglecting some groups.

The work developed during this study proved to us that there seems to be a difference between which apps people with different ages, with different occupations, and from different areas prefer to use. For example, one of interviewees works as a nurse and uses some mobile apps in a knowledge-based way, while another works in a pharmaceutical industry and uses apps that support the scanning of products, and other job specific needs.

This indicates to us that different people with various needs will have different factors influencing them more or less in their continuance intention, which may make it

wise for some companies to test their applications taking into account the restricted user group they wish to target

## 7. Limitations and Future Research

While involuntary, our study ended up taking an age restriction, with people with very close ages responding, putting the vast majority of our quantitative collection sample in their early twenties. We believe this was due to the method of sharing and collecting our data. This is something that can be considered a limitation, given that a study that was not meant to be of a specific population, ended up basing most of its results on persons of the same profile. For this reason, it could be useful for future research to limit their sample characteristics or look for ways to control the distribution if it is deemed better to make a study regarding the entire population.

Technical limitation and time restraints also affected the way this study was made. We now understand that, ideally, interactivity should be studied in a sample population through practical tests, for example, the creation of different interfaces with different characteristics to evaluate first-hand how different types of interaction affect users' attitudes and behaviours. While this proposition is certainly not innovative, being adopted by most people studying interactivity prior to this study (e.g., Niu et al., 2021; Sundar et al., 2015) , we consider it something that jeopardizes our results.

Regarding interactivity in mobile applications and referring back to the practical implications section of this study, it would be of great interest to apply different studies of the different tools of each type of interactivity to mobile applications in general, and even to determined types of apps with more delimited goals and subjects. Additionally, the application of crossovers and analysis of the consequences of different types of interactivities on the same interface at different levels of intensity, as has been previously studied in websites (e.g., Niu et al., 2021; Yang et al., 2018), would be essential for mobile application continuance intention research.

Additionally, more than continuing to study continuance intention in mobile applications, which is indeed very important and significant, especially as different tools, ways, reasons, and environments in which to use mobile applications continue to grow, it could be valuable to hypothesize how continuance intention actually determines the

future utilization, or not. It would be useful, for example, to start from a study such as the one presented here, in which a variable like modality interactivity proves to have a positive influence, and progress it into the later stages, in which users actually continue, or not, this use. This would create a better understanding of which factors actually invoke users' wishes and persistence, other than just their intention to use the mobile apps.

## 8. Conclusions

This research set out to fill a gap in the literature and find an answer to the research question: can modality, message, and source interactivity be motivating factors for continuance intention of usage of mobile applications? And if so, how?

To achieve our goal, we created a research model based on Bhattacharjee's expectation confirmation model, and the interactivity effects model, with its modality interactivity, message interactivity, and source interactivity introduced as a model by Sundar and his co-authors in 2015. Eleven hypotheses were proposed with the seven variables involved (confirmation, satisfaction, perceived usefulness, continuance intention, modality interactivity, message interactivity, and source interactivity).

To test the hypotheses and understand the existence, or non-existence, of their influence on each other, we developed mixed methods research, with the gathering of quantitative data through an online survey, followed by six interviews to collect qualitative data in order to both confirm and explain the conclusions available from the surveys.

Our quantitative data supported eight out of the eleven hypotheses, including the five that resulted from ECM, confirming a positive influence between confirmation and both satisfaction and perceived usefulness; between perceived usefulness and both satisfaction and continuance intention; and between satisfaction and continuance intention. Regarding the inclusion of the three interactivities in this research model, three hypotheses were confirmed: the positive influence between modality interactivity and both satisfaction and continuance intention, and the positive influence of source interactivity on satisfaction. This confirms the entire expectation confirmation model.

Hypotheses concerning message interactivity, its influence on satisfaction and continuance intention, and source interactivity on continuance intention were not supported by the results. However, qualitative data originated from the interviews showed that message interactivity has more of an influence than originally thought. Therefore, we found that message interactivity actually has an impact on users' attitudes while using mobile applications. Nevertheless, it proves to be a concept harder



to understand and acknowledge, with users not even recognizing it as a form of interactivity. Message interactivity in the form of interaction history proves to increase satisfaction in users.

An important finding from this research is that modality interactivity has greater value of positive influence over satisfaction and continuance intention than perceived usefulness, a variable that has been associated with both constructs for long and has proven to not always show a connection with them. Therefore, modality interactivity should not be overlooked by app developers and companies that would like to create long lasting relationships with their users.

It was found that source interactivity is important in user satisfaction and engagement, and it also seems that the more important an application is for the user, the more they feel the need to customize and adapt its interface due to the greater amount of time they spend using it.

We would like to highlight, as conclusion from this research, the importance and significance of complementing quantitative results, given that they can be too simplistic in the sense of not providing an explanation, and not providing participants' opinions of them.

Finally, it was found that modality interactivity is the only one of the three that we can say is a conscious motivating factor for continuance intention. However, both message and source interactivity affect users' attitudes, and therefore play a part in their satisfaction or not, and their will to utilize the mobile application for long periods of time, or not.

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