EMBS 12
Master Thesis

The Impact of Airline Mobile Applications on the User Experience:
Implementation of the CUE Model

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Abstract

Title: The Impact of Airline Mobile Application on the User Experience: Implementation of the CUE Model

Purpose: The evolution of Information Technology (IT) has changed the business scenery in many industries, especially in the airline sector. With the development of mobile technologies, airline companies have developed and implemented new tools as mobile applications aimed at increasing the availability and frequency of communication between the company and their customers. This research aims to investigate the quality perceptions and emotions that influence the overall passengers' experience when using the mobile application of an airline.

Theoretical Framing: Definition and key characteristics of mobile applications are reviewed to set the context of the study. Then, the CUE model is used as the theoretical basis for examining the users' interaction with airline mobile apps, where instrumental and non-instrumental quality perceptions, together with user emotional reactions, are taken into consideration in order to assess the overall evaluation of the user experience.

Design and Methodology: This research employed a method of quantitative nature with respect to mobile applications experience in the airline sector. An online self-administrated questionnaire is developed following the structure of usability questionnaires, in particular the meCUE (modular evaluation of key components of user experience).

Value: Despite the widespread use of mobile apps, it is argued that there is inadequate analysis of the perception of travellers about the mobile technologies. Thus, by examining the key components of the User Experience, the study aims to conduct further research and explore the relationship between the airline mobile application and the user experience.

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List of Abbreviations

App	Application
CUE	Components of User Experience
ICT	Information and communication technology
HCI	Human Computer Interaction
MAU	Monthly Active User
meCUE	Modular Evaluation of the key components of User Experience
TAM	Technology Acceptance Model
UX	User Experience

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Chapter 1: Introduction

This section will provide a background to present the area of Mobile Application and its evolution into the airline sector. This will be followed by a problem discussion that will justify the purpose and research questions of the study.

Background

Over the previous years, advancement has been phenomenal in mobile internet services, promising unprecedented comfort and pleasure for customers. As a result, many organizations changed their way of doing business in general, but the travel industry and airline companies particularly (Dredge, Phi, Mahadevan, Meehan, & Popescu, 2019).

According to Xiang and Fesenmaier (2017), it is possible to identify three key phases of technology development in the travel sector. Figure 1 shows examples of digital technologies during the last decades from the Internet to the evolution of social media and mobile applications. In the first phase, digital point-of-sale and software support helped make travel activities more effective: websites began replacing paper-based marketing materials and web-based reservation systems began facilitating company operations. Between 2000 and 2010, the Internet consolidated its position as a main source of data for travellers. Developments in Internet technologies allowed a virtual marketplace where products and services could be searched, compared, and transacted online. In addition, internet intermediaries and review sites, such as Expedia or TripAdvisor, arose disrupting the traditional business model of travel agency. Since 2010 onwards, mobile and wearable technologies have accelerated the connections between the digital and the physical worlds opening up innovative possibilities for product development.

Overall, it is evident that companies in the travel industry are constantly adapting to new technologies with the aim to offer a larger variety of options and enhance the passenger experience. In particular, compared to other companies in travel/tourism, airlines are early ICT adopters and have a remarkable history of technological innovation (Buhalis, 2004).

Figure 1: Examples of Digital Technology
Adapted from Xiang, Z. & Fesenmaier, D. (2017)

Phase 1. 1990-2000	Phase 2. 2000-2010	Phase 3. 2010 onwards
Electronic cash registers Financial software Mobile phones Email Intranet Internet banking Office software Video conferencing Websites Destination (city) cards	Smart phones Computer graphics software Property management systems Computerised ticketing systems Computerised stock control systems Online booking systems Customer reservation systems Email marketing Customer relationship systems	Augmented reality Virtual reality Mobile Apps Cloud computing and online data storage Wearable technologies Social media Google analytics Review websites Collaborative online environments Web 2.0 Chatbots and instant advice Peer production, e.g. platform collaborative economy; commons collaborative economy

Figure 1

More recently, one of the tool that has influenced the passenger experience the most is the mobile phone, which is now a standard accessory for all travellers. In addition, already in 2013, it was predicted in an airline trend survey (where the majority of respondents were airline companies) that smartphones would have been one of the two dominant sales channels in their sector. Indeed, all airlines are investing in business intelligence solutions, mobile and personalized passenger services, which enable them to understand more about their clients and have better decision-making data in their activities (SITA, 2013).

However, as the globe has gone digital and the number of mobile devices has increased, an explosion has occurred also in the growth of apps. Mobile application development has been on the rise since July 2008, when the very first App Store appeared with Apple and the iPhone which disrupted the market (Masi, 2012). Initially, mobile applications were only used for productivity assistance such as email, calendar, weather forecasts and other simple calculations. Yet, the high demand expanded the market rapidly into other context offering portability, location awareness, accessibility and many other benefits to their users. In January 2011, approximately 160 million iPhone and iPad users celebrated 10 billion downloads of 350,000 applications accessible in their App store. Game, multimedia, online bookings, travel and social network communication are just some of the functioning area where the mobile app developers extended (Rashedul, 2010; Florido-Benitez & Del Alcázar, 2015).

This year the App Store alone counts around 1.96 million available applications, representing a 7 percent increase compared to the previous quarter (Clement, 2019). In the "Travel" category, approximately 400 apps can be downloaded, with 34 being flight manager apps (Ayeh, Au & Law, 2013). It's now simple to have the entire travel process under control. Check flights, bookings, self-service check-in, seat reservation, travel guide downloads, up-to-date information and journey personalization, is what today's travellers expect (Amadeus, 2011). All phases of the passenger life cycle are affected: from the moment they look for a flight to the time they board to the plane. Mobile applications have now the ability to disconnect the user experience from the desktop PC and offer anytime anywhere connectivity (Wang, 2012).

Problem statement

The area of innovation in the airline industry appears as an interesting research area for both academics and practitioners (Christou & Kassianidis, 2010). A study confirms that, during the flight process, 75% of frequent travellers use cell phones (Gheorghe, 2013). However, despite the wide spread, it is claimed that there is insufficient analysis concerning the passengers' perception towards the implementation of airline mobile technologies (Lubbe & Louw, 2010). Therefore, further study and re-exploration of the relationship between applications and user experiences would be of great interest (Cantoni & Xiang, 2013; Szymczak, 2018).

Nevertheless, attracting customers to install is only the first step: more than 60% of customers have been revealed to delete apps within two weeks of downloading. It is not certain that such innovative service represents the key of airlines' success (Purcell, Entner & Henderson, 2010). Indeed, in this paper, the purpose is to analyse both the utilitarian and experiential aspects of Airline Mobile Apps from the point of view of passengers and to understand whether this service is enhancing and facilitating their journey.

Research Question

From the previous argument, the goal of this research is to investigate how passengers' experience have been influenced by the adoption of airline Mobile Apps. The focus will be to generally examine the level of influence and involvement that this technology has at all stages of their journey by practically proposing and testing a model to clarify the constructs affecting the components of Mobile App user experience in the airline sector. Mahlke and

Thüring (2007) integrated emotions into their UX model, arguing that the perception of instrumental and non-instrumental qualities resulted in emotional reactions, which in turn influenced the overall judgement of the system used.

Overall, by gathering relevant data from a sample of passengers, the study hopes to shed light into whether airline mobile apps have changed positively the passengers' experience. Based on the CUE- model, the following research question will be further investigated:

RQ1. To what extent is the Airline Mobile App having an impact on the overall passenger experience?

Chapter 2: Theoretical Background

The following section presents an overview of the literature and theoretical constructs to substantiate the research question put forward. It starts by defining and describing the key characteristics of mobile applications, setting the context of the study. It moves on to review existing studies on the passenger experience when using Airline Mobile Apps in order to identify what has been studied in the same research stream. Then, the CUE model is presented and adapted to the research study.

Mobile application definition and Key characteristics

The definition of mobile application is explained by different authors from distinct viewpoints: there is no standard industry-wide definition of what is and what is not. The mobile industry is currently undergoing development and expansion. Any new offers (phones, apps and other products) could be a disruptive component in the mobile ecosystem. Therefore, periodically reviews on the subject are needed. (Florido-Benitez & Del Alcázar, 2015).

Bellman, Potter, Hassard, Robinson and Varan (2011) describe a mobile application as a promotional instrument to seek media effect and foster virtual communication with consumers through ads, offers, discounts and more. Others define it as an product that automatically and interactively adds value to customer management, data and resolution (Florido-Benitez & Del Alcàzar, 2012). Alternatively, the so called "Mobile app" is expected to be an essential tool in the service sector to constantly connect customers through an omnipresent network (Nayebi, Desharnais & Abran, 2012).

For the purpose of this report, Mobile Apps will be defined as end-user applications designed for a mobile operating system which extend the capabilities of the phone by allowing users to perform specific tasks (Sanz, Martí & Ruiz, 2012).

In addition, it is essential to differentiate between a mobile application and a mobile site, which is merely a website with a format suited for tablet and smartphone browsing. By entering the URL in the navigation bar, it is accessed via an internet browser: there is no download required, but access requires an online link. In contrast, a mobile app needs to be

downloaded first from an online store such as the App Store or Google Play and then it is saved on the device (Aguado, Feijóo & Scolari, 2012).

Florido-Benitez, Del Alcázar and González (2016) highlight how people changed their manner in performing their duties as new Apps are being created with more functionalities that better address specific needs both at professional and recreational level. Hence, one of the main reasons behind the development of this research is the increasing level of user participation on mobile apps and the positive impact they create (Hutton & Rodnick, 2009).

Mobile Application in the Airline Industry

Many travellers have noticed that the accessibility on their smartphones of user-friendly applications enables them to handle many components of their daily lives. Passengers can never be certain about airline schedules and travel plans; any instrument that provides flexibility on the go can be of great assistance. With the growing number of Portable Electronic devices (PEDs) that passengers carry in the terminal and on board the aircraft, there appears to be a real market opening up to make airline applications more important (Florido-Benitez & Del Alcázar, 2015; Hutton & Rodnick, 2009).

According to a recent study, more than one in three visits to travel websites now come from mobile devices. It makes sense that airlines should strive to provide their users with the best and most effective mobile experience. Any airline without a mobile solution is likely to be overtaken as the competition is rising to new levels. Generally speaking, applications have cleaner design, supply customers with information faster and are easier to use than most airline mobile site. Many advantages can be identified from the point of view of airlines when considering the implementation of mobile apps (Nucleus, 2012).

According to PwC Global Airline CEO Survey 2014, 92% of airline CEOs are concerned about the rapid advancements in mobile connectivity and customer expectations. Mobile applications will pave the way for higher sales and distribution capacity of their company (Smith, 2014).

Mobile apps assist airlines decrease costs through self-service alternatives, such as kiosks, that speed up the airport boarding process and help current staff concentrate on customer support (Amadeus, 2011).

In the Foresee Mobile Satisfaction Index Travel Edition, satisfied users are said to be 73% more likely to use the airline mobile app as main source. In this industry, providing a quality mobile experience is now fundamental: data show that more users prefer to use the app rather than the mobile site, reporting they discard the latter when the app is available (Foresee, 2013).

On the other hand, from the passenger's point of view, Airline Mobile Apps allow both business and leisure travellers to manage trips more efficiently. Based on the data mining by Budd and Vorley (2013), the following functionalities are all provided by the 22-sampled airline mobile apps:

- Flight search and flight booking.
- Mobile check in by adding passport details in the profile area.
- Mobile boarding pass available offline with no data connection, no printer or queuing at check in desks.
- Easy access to a personalized page in order to manage bookings
- Change the flight's date, add seats, bags, sports equipment, insurance and more extras.
- Check the flight status, i.e. planes location in real time to check the latest arrival and departure information with live updates direct from the control centre.

Components of User Experience (CUE) Model

Understanding what leads people to adopt and use information technology is crucial to human computer interaction. These processes are concerned in particular with two models, namely the Technology Acceptance Model (TAM) and User Experience models (UX). Based on the TAM and UX frameworks, it is evident that they vary significantly and although they both involve the experiential component in HCI, they are seldom compared (Hornbæk, K. & Hertzum, M., 2017).

However, sufficient literature proof stated that Technology Acceptance Model could not provide comprehensive foundations to mobile use. Although this model measures the concept of both utility and usability, it was mostly used due to its simplicity without considering actual applications in the study (Ajibade, 2018).

Today usability and utility are no longer considered adequate quality features for most technical devices. Rather, User Experience (UX) has appeared as a systematic approach to

the design and investigation of interactive systems. According to the International Organization for Standardization, UX can be defined as a individual's perceptions and responses that result from the use or anticipated use of a product, system or service (Mirnig et al, 2015).

By considering the overlap between these models, the primary interest of this study aims at employing constructs that cover both the TAM and UX views of the experiential. Therefore, the CUE model by Mahlke and Thüring (2007) is the model adopted to this research as it has described the experience of using interactive systems from both the instrumental and non-instrumental perspectives.

In the research, the definition of User Experience will include both instrumental and non-instrumental qualities as a compound of emotions and perceptions. These components are implemented into a common theoretical model called CUE, which stands for Components of User Experience.

By concentrating on the key parts of user experience and their interrelations, the model results useful in going beyond already used usability methods. It offers a comprehensive framework for empirical studies with suitable set of dependent factors and measurements to assess the user experience. In addition, it provides the most important aspects of human–technology interaction and a number of interesting issues for future research (Minge & Thüring, 2018).

The model is based on two general assumptions. The former says that user experience is a phenomenon that coincides with human-technology interaction and strongly affects the system's assessment by the user. The latter suggests user experience can be defined in terms of distinct components interacting with one another in a specific way. The second assumption is why the model is then called "CUE Model" (Mahlke & Thüring, 2007). As shown in Figure 2, it is possible to distinguish three separate parts worth explaining.

Figure 2. The CUE model: Components of User Experience

Adapted from Mahlke & Thuring (2007)

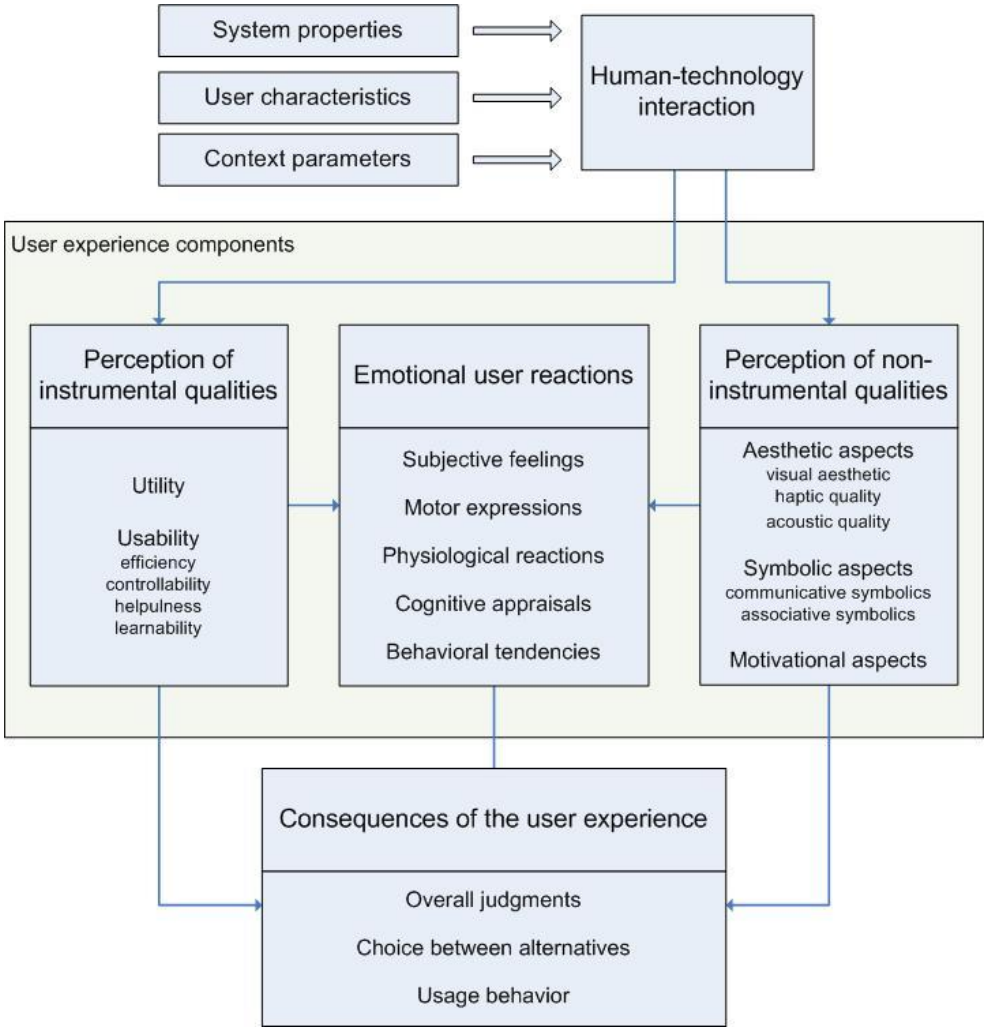


Figure 2

System properties, User characteristics and Context parameters

Firstly, system properties, user characteristics and context parameters are the three categories that influence the user experience when interacting with a technical device or an interactive system. This interaction usually seeks to solve a specific task, in a given context, over a limited time-period.

Starting with the system properties, product-specific aspects are taken into consideration such as functionality, icons, word of labelling and other interface design elements (Bevan et al, 1991). Regarding the user, a variety of characteristics are involved. Expectations, needs, motivations and predispositions as age, gender, personality, are examples discussed by

Hassenzahl and Tractinsky (2006). Following, context parameters involve all aspects of the situation in which a product is used in. For instance, Crilly et al. (2004) considered organizational and social setting, meaningfulness of the activity, and voluntariness of use as main influencing factors.

The next sections will discuss in details the three core elements of user experience, i.e. instrumental and non-instrumental perceptions of quality as well as emotional user responses. Furthermore, the consequences of user experience are outlined, incorporating, for example, overall judgements and usage behaviour.

Perceptions of non-instrumental qualities

Various contributions have been already made when underlining the importance of products to satisfy user needs beyond the instrumental value. For instance, Logan (1994) describes the non-instrumental qualities of an interactive system as "... serving the needs beyond the functional objective" (pp.61).

Based on these definitions, a hierarchical model of non-instrumental qualities is proposed, including aesthetic, symbolic and motivational aspects. Aesthetic aspects are divided into various dimensions related with visual, haptic, and acoustic perceptions. However, one of the most relevant interaction is the visual aesthetics of the product (e.g. colours), defined as the extent to which sensory and formal attributes of a product provide positive visual experiences for the user (Lang, 1988).

Two dimensions can be differentiated with regard to symbolic qualities: communicative and associative aspects. On the one side, communication elements are linked to the messages connected to a product. On the other side, associative aspects relate to subjective memories linked to a particular product or only to its characteristics (form, materials) that have already been experienced as explained by Norman (2004). In other words, associative symbolism is defined as the degree to which the associative attributes (personal memories) of a product provide the user with a positive experience.

Emotional Reactions

Several models define relevant components that can be used when considering the multi-component character of emotions in human-technology interaction. Izard (1977) presented an emotional triad that includes subjective feelings, physiological activation, and motor expressions. This triad is linked to two other elements in a Scherer (1984) model, i.e. cognitive assessments and behavioural tendencies. Regardless of the precise structure of these models, they assume that to comprehend human emotions, all elements are essential.

Perceptions of instrumental qualities

The CUE model highlights the relation of utility and usability in order to measure instrumental quality perceptions in user experience. In 1989, the Technology Acceptance Model (TAM) was introduced to demonstrate that, from the user's point of view, both the perception of usefulness and usability are essential for the purpose of using a system. According to the definition:

Usefulness, relating to the perceived utility of a system, is *"the degree to which an individual believes that using a particular system would enhance his or her job performance"* (Davis, 1989, p.320).

Perceived ease of use, relating to the perceived usability of a system, is *"the degree to which an individual believes that using a particular system would be free of physical and mental effort".* (Davis, 1989, p.320).

While Davis (1989) adequately defined the notion of perceived utility, different methods have been developed to further identify the notion of perceived usability. Based on theoretical and empirical results, Table 1 compiles a set of dimensions of perceived usability to create a broad idea of its composition.

Table 1. Dimensions of Perceived Usability.
Own Elaboration.

Item	Author	Key Aspect
Effectiveness	Shackel, 2009	It refers to the feeling of the user that the software allows the task to be accomplished quickly, efficiently and economically.
Learnability	Shackel, 2009	It refers to the "easy to learn attribute" or the ease with which a user can get started and learn new features of the product;
Flexibility	Shackel, 2009	It refers to the adaptation to tasks and environments beyond those first indicated
Attitude	Shackel, 2009	It is connected with acceptable levels of human costs in terms of fatigue, discomfort, frustration and personal effort. Also seen as precursor to user satisfaction.
Efficiency	Bevan, 2008	A measure of the user's perception of temporal efficiency and mental workload caused by the interaction;
Controllability	Kirakowski, 1993	Degree to which the user feels that he, and not the product, is setting the pace;
Helpfulness	Kirakowski, 1993	This refers to the user's perceptions that the software communicates in a helpful way and assists in the resolution of operational problems;

Table 1

Consequences of User Experience

As already mentioned, perceptions of instrumental and non-instrumental qualities, together with emotional user reactions, define the consequences of the user experience. The model outlines three specific categories of consequences of user experience: overall judgments, choice between alternatives, and usage behaviour.

The first consequence proposed by the model is the overall judgment of an interactive product, which can be formed by weighting and combining different aspects of a system's quality (Hassenzahl, 2000).

However, the actual interaction of a user with an interactive system must be observed in order to measure usage behaviour. Indeed, the model excludes this component due to the study's difficulty and focuses on overall judgments and alternatives (Mahlke & Thüring, 2007).

Interrelations of User Experience Components

In summary, the human-technology interaction is supposed to be influenced by the three groups of influencing factors and in turn the three components of user experience are determined. All interrelations among the compenents of UX are highlighted in the framework (Mahlke & Thuring, 2007).

There is no direct link between the HCI and emotional responses mostly due to the difficulty in investigating these short time reactions. Thus, the component of emotions is only influenced by instrumental and non-instrumental quality perceptions.

Furthermore, no direct link has been found between the two quality perceptions, these components independently affect the overall user experience.

Chapter 3: Research Model and Hypothesis

In this section, the items that are considered more relevant and suitable for this research are presented. Through literature review, the conceptual framework is proposed and will be then used to develop the hypothesis and the questionnaire.

Figure 3: Adapted CUE-model. Own Elaboration.

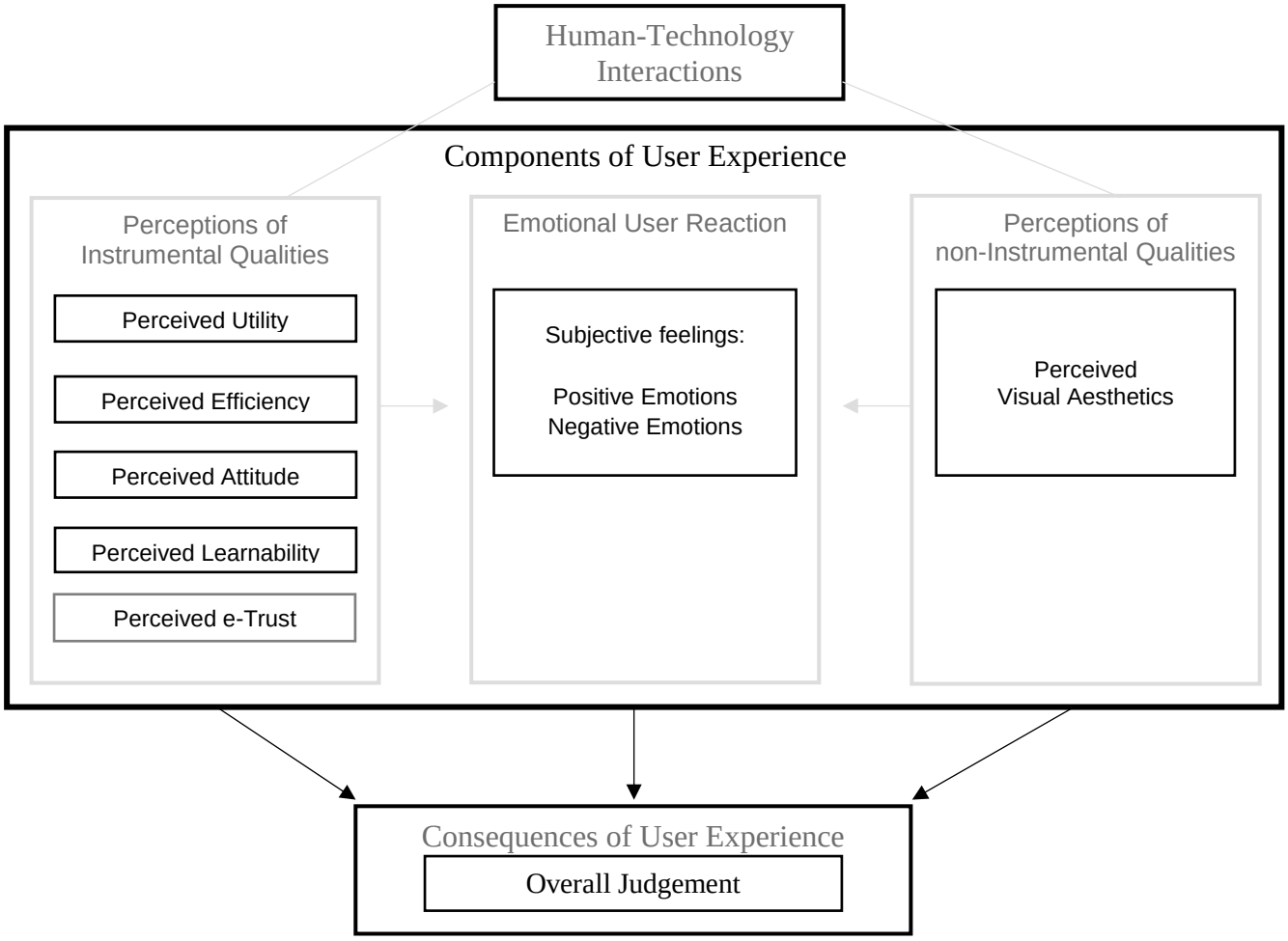


Figure 3

As technology progressed over the previous years, HCI's focus moved to what people can do, rather than what computers can do, showing the importance of understanding the user (Lubbe & Louw, 2010). For example, in an empirical research by Mahlke and Lindgaard (2007), cultural background and the centrality of visual product aesthetics were chosen as primary user characteristics, affecting the human-technology interaction and thereby determining the UX. Accordingly, this research aims at investigating relevant user features

(e.g. knowledge, education, age and nation) and their impact on the components of the user experience.

A variety of empirical research have confirmed the importance of perceived utility and perceived usability. Indeed, the CUE model measures the perceptions of instrumental qualities with both dimensions which are argued to be essential and determinant in assessing the instrumental value of an interactive system (Davis, 1989; Venkatesh & David, 2000).

Perceived Utility

Previous studies have found significant effects of perceived utility on behavioural intent to use e-booking apps (Kim et al., 2005). In addition, Norazah and Norbayah (2017) support that perceived utility is the biggest impact on individuals in terms of their intention to interact with an airline mobile App. The first hypothesis is thus formulated for further empirical validation on the grounds of the above discussion:

H1: Perceived utility have an effect on the Consequences of Airline Mobile Application User Experience

Perceived Efficiency

Starting with Efficiency, Bevan (2008) describes it as support offered to the user to better achieve the tasks. Low efficiency implies the system to function in a likely inconsistent and slow way that confuse the user. In contrast, high efficiency indicates that users find the system convenient and easy to use. Therefore, it is supposed that:

H2: Perceived Efficiency have an effect on the Consequences of Airline Mobile Application User Experience

Perceived Attitude

Satisfaction is often described in the literature as an attitude with the following definition: “freedom from discomfort and positive attitudes towards the product” (ISO 9241-11, 1998). In addition, HCI uses the term attitude regularly in discussions on satisfaction.
Therefore, in this research the two words can be interchangeable and are related to human cost in terms of tiredness, distress, frustration and personal effort. If the system results

complex and frustrates the user, a positive experience is unlikely to be outsourced (Kirakowski, 2008).

H3: Perceived Attitude have an effect on the Consequences of Airline Mobile Application User Experience

Perceived Learnability

In usability tests, learnability is one of the quality metrics to be assessed. A small degree of learnability demonstrates that it's hard for users to relearn how to use the system, namely it is easy to forget how it works. On the other hand, if users feel comfortable in start using the app straight away, a high degree of learnability will be reflected (Rafique et al, 2012). To sum up, good learnability not only contributes to enhanced productivity, but influence the users' acceptance or rejection rate of a technology. It is also said that this item is usually measured with the use of a retrospective questionnaire in terms of subjective perceptions rather than objective performances like time-on-task and error rate (Shackel, 2009). Thus, the following hypothesis is claimed:

H4: Perceived Learnability have an effect on the Consequences of Airline Mobile Application User Experience

Perceived e-Trust

In the context of e-commerce, e-Trust can be defined as a general belief in a seller online that results in behavioural intention (Gefen, 2000). In theory and practice, transactions safety on the Internet has gained significant attention. Todays' technology, or specifically, the Internet, must be an object of trust for airline Mobile Apps to thrive (Shankar et al, 2002). It is important that the customer feels safe about the privacy of personal information using airline B2C e-Commerce. Without any practical guarantee, the consumer won't be sure that the seller won't engage in undesirable behaviour, such as violation of privacy or unauthorized use of credit card information (Munoz-Leiva et al., 2017).

In this research, perceived e-trust is introduced in the framework as component of usability as it reduces the need for understanding and monitoring the situation, making it easier for the user to utilize the tool with little effort.

Hence, it follows the hypothesis:

H5: Perceived e-Trust have an effect on the Consequences of Airline Mobile Application User Experience

Perceived Visual Aesthetic

Aesthetic judgments have been found not only in the web, but also in mobile contexts (Miniukovich & De Angeli, 2014). Visual aesthetics, a non-instrumental quality, plays a significant part as it is viewed at first glance and instantly determines whether or not the system attracts users. It can be defined as the direct, quantifiable, pleasant and subjective experience affected by the manipulation of particular design characteristics (Laviea & Tractinskyb, 2004).

H6: Perceived Visual Aesthetic have an effect on the Consequences of Airline Mobile Application User Experience

Instrumental and Non-Instrumental Qualities

According to the CUE model, emotions are suggested to be affected by both instrumental and non-instrumental qualities that users perceive when interacting with the product. There is no direct connection between human-technology interaction and emotional user reactions (Mahlke & Thuring, 2007).

H7: All instrumental and non-instrumental quality perceptions have an effect on the user emotions

User Emotion (Subjective Feelings)

All three components of the UX, including user emotions, will have an impact on the consequences of user experience. Emotions can be described in the study as a response representing a good / bad feeling about an object, individual, or event of different intensities. Accordingly, the hypothesis is claimed:

H8: User Emotions when using an Airline Mobile App have an effect on the Consequences of User Experience

Chapter 4: Review of literature

In this section, a list of the most relevant papers is provided.

#	Title	Author (Year), Published	Contribution
1	Technology Acceptance and User Experience: A Review of the Experiential Component in HCI	Hornbæk, K. & Hertzum, M. (2017), ACM Transactions on Computer-Human Interaction	Description of several models that could have been applied to this research. By exploring the overlap between TAM and UX models, the experiential component of HCI was reviewed.
2	The effects mobile of applications as a marketing tool in airport infrastructure and airlines	Florido-Benítez, L. & Del Alcázar Martínez, B. (2015), International Journal of Leisure And Tourism Marketing,	General overview of mobile applications in the airline industry, including definition, strenghs and weaknesses.
3	Aplicaciones Publicitarias Para Móvil: Conocimiento, Actitudes, Motivos De Uso Y Valoración Por Parte De Los Adolescentes Españoles.	Sanz, S., Martí, J.and Ruiz, C. (2012), International Journal of Advertising Research	Definition of Mobile application as a management tool to conduct certain tasks.
4	Analysis of the Impact of Mobile Marketing on Passenger Experience and Satisfaction at the Airport.	Florido-Benítez, L., Del Alcázar, B. And González, E. (2016), International Journal of Innovation, Management and Technology	Analysis of the basic concepts: mobile marketing and mobile applications in the airline context
5	Airlines, apps, and business travel: a critical examination	Budd, L. & Vorley, T. (2013), Research in Transportation Business & Management	Overview of Mobile Apps functionalities, sample of 25 airlines
6	Studying Antecedents of Emotional Experiences in	Mahlke, S. & Thüring, M. (2007), CHI 2007 Proceedings, Emotion &	The paper presents a model of UX that integrates interaction characteristics,

	Interactive Contexts	Empathy, San Jose, California, USA.	instrumental and non-instrumental quality perceptions, emotional user reactions and overall judgments of system quality (CUE model).
7	Perceived Usefulness, Perceived Ease Of Use, And User Acceptance Of In- Formation Technology.	Davis, F. D. (1989), MIS Quarterly	Definition of perceived usefulness and perceived ease of use
8	E-Commerce: The Role Of Familiarity And Trust.	Gefen, D. (2000), Omega	Perceived Trust in e-Commerce and its influence on the intention to use
9	The MeCUE Questionnaire. A Modular Evaluation Tool For Measuring User Experience.	Minge, M., Thüring, M., Wagner, I. & Kuhr, C.V. (2017), Advances In Ergonomics Modeling, Usability & Special Populations.	Development of the questionnaire and results that meCUE can be applied in UX studies on all types of interactive systems
10	Flight Ticket Booking App On Mobile Devices: Examining The Determinants of Individual Intention To Use.	Norazah, M. & Norbayah, M. (2017), Journal Of Air Transport Management 62, 146-154.	Examination of the individual intention to use such lfight ticket booking App on Mobile devices, with the implementation of the TAM
11	Usability – Context, framework, definition, design and evaluation	Shackel, B. (2009). Interacting with Computers 21, 339–346	It provides the broad definition of usability, including learnability, attitudes, flexibility and effectiveness.
12	Mobile Media: Towards A Definition And Taxonomy Of Contents And Applications.	Scolari, C., Aguado, J. & Feijóo, C. (2012). International Journal of Interactive Mobile Technologies, 6(2).	The paper brings together previous fragmented approaches to study and analyse mobile media, developing a set of definitions and classifications of contents and applications.

Table 2. Review of literature

Chapter 5: Methodology

In this section a description of the research method that will be used for this work will be presented. Following, information will be given about the way the sample is selected, how data is collected and thereafter analysed.

Consistent with the emerging nature of the ICTs and the structure of the airline industry, this study has a casual nature, using quantitative methods with primary data collection. The aim is to quantify and analyse the components that affect the Airline Mobile App user experience. Secondary research is used to revise the theoretical background of mobile technologies and to identify previous research. A number of articles and airline surveys were used to define the historical development of ICTs in travel and air transportation (Amadeus, 2011; Smith, 2014). In addition, a research model applicable for the measurement of instrumental and non-instrumental quality perceptions, the CUE model, is described based on existing literature. Further adaptation to the model is presented in order to follow the research aims and define only a limited number of variables that will fill the research questions.

Participants

The sample shall include a well-proportioned section of passengers' types that have already downloaded and used an Airline App on their mobile devices. At an early stage of the survey, a question will be formulated in order to exclude the data from respondents that have no experience with the app. Thus, respondents will not go through the whole questionnaire unnecessarily.

Figure 4: Use of Airline Smartphone apps by travellers who flew in the past 12 months. Adapted from Silk, R., (2016)

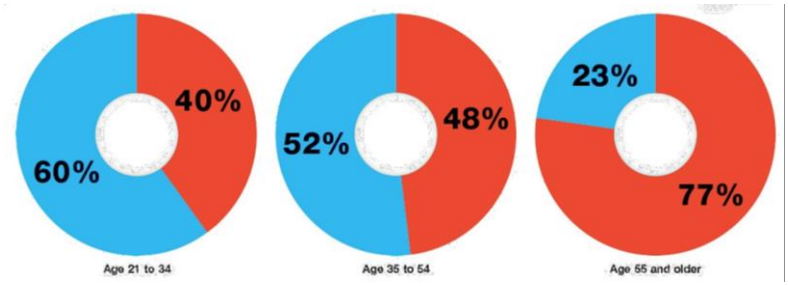


Figure 4

People aged 21-34 (also called “Millennials”) are considered the young consumers who grew up during the period of technological evolution and now have stronger skills in using smartphone apps (Komodromos, 2019). Indeed, Figure 4 shows that this generation is clearly deemed to be the most connected to the Internet when travelling. According to an additional recent study by the World Youth Student and Educational Travel Confederation (WYSETC), when compared to the other generations, Millennials are travelling more often, exploring new areas of the world and searching and booking more over the Internet (Pendergast, 2010). On the other hand, among 35–54-year-old Airline Mobile App users, only the 52% had used an airline app before (Silk, 2016).

However, the sample will have no age limits in order to broaden the research area and make comparisons if significant. Participants eligible for the survey will include both respondents travelling for business and leisure purposes as well as study, culture and health.

The questionnaire will be addressed to respondents of European countries, with a main focus on Germany and Italy. The reason behind this selection is the ease of data collection in comparison with other nationalities.

According to the sample size calculator Raosoft, the sample should be made of 377 people, with a 5% margin of error, 95% confidence level, 50% response distribution and population size equal to 20,000 (Raosoft, 2004).

Research Instrument

On the basis of CUE model, the meCUE (‘modular evaluation of user experience’) questionnaire was created in an attempt to develop a standardized UX measurement. Three modules where constructed and validated independently, for a total of 34 items. The first module adresses product qualities (instrumental and non-instrumental), the second module includes positive and negative emotions, and the last module deals with the consequences that follow from the user experience (Minge et al., 2017).

However, insights pointed out that items for instrumental and non-instrumental qualities should not be clustered in the same module. Thus, a new version, meCUE 2.0, was constructed by dividing the first module into two sub-modules, one for instrumental and one for non-instrumental quality perceptions (Minge, M. & Thüring, M., 2018). Figure 5 clearly illustrates the combination of modules in which the evaluation model is splited into.

Unlike other existing questionnaires, this tool provides a new method that comprehensively evaluates all key components of user experience. In addition, its modular nature enables the questionnaire to be adjusted and fulfil particular study objectives.

Figure 5: Final structure of the meCUE questionnaire.
Adapted from Minge et al. (2017).

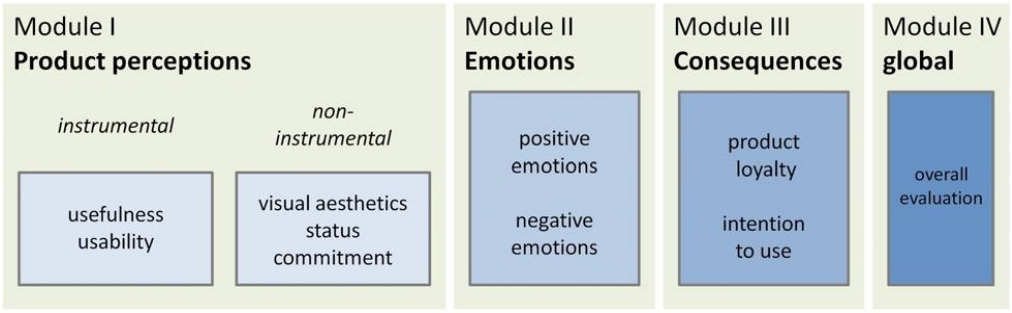


Figure 5

In addition to the meCUE 2.0 model, more sections where the user characteristics are requested will be included. Firstly, the relationship between respondents and Airline Mobile Apps will be investigated by asking particular questions about smartphone's usage as well as the number of Airline Mobile Apps downloaded and whether they delete them once the travel process has ended. Following, another section aims at collecting data about their travel habits. Questions regarding their travel experience will be asked such as frequency of taking flights and travel purposes, in order to enable the surveyor create various passenger profiles when data are collected. At the end of the questionnaire, the last section involves demographic questions, such as age, gender, nationality and current position.

Before starting the meCUE 2.0, the respondent will be asked to select among a list the Airline Mobile App they used the most and consider it during the process of questioning in order to take into consideration to which Airline Mobile App they refer to.

All items are part of the model described in the theoretical background, but since this was an exploratory study in nature, the opportunity to incorporate a new item of interest was taken: Perceived e-Trust is used as a sub-context of usability. In the Appendix (1), the questionnaire and the items that will be used to prove the hypothesis mentioned in the previous section are presented.

Questionnaire Design

An online self-administrated approach to questioning will be used to interact with participants and collect valid responses. It will be created by using Sphinx and it will be accessible from computers, laptops, smartphones and tablets. By implementing an online questionnaire, the advantage of time effectiveness in terms of administration, distribution and collection will be taken (Bryman & Bell, 2007).

As the sample will be made of people coming from different countries, two translations of the same questionnaire will be performed by a native speaker. Being most of the countries taken into account, both an English and an Italian version of the survey will be made available.

To engage participants, attention will be given to visual components: colours, pictures, icons and backgrounds. The surveyed will be able to read a short presentation of the topic before completing the questionnaire in order to understand what the questionnaire will be about.

Procedure

Before the official launch of the questionnaire, a pre-test was sent to a group of people in order to receive an initial feedback, especially with regards to translation issues, which are critical for consistency and validity of the results. Following some modifications, the survey was published and distributed. The software used to distribute the questionnaire will collect data and SmartPLS will provide tools to test the hypothesis this work is based on.

The distribution among the users will take place through an online link shared on social media: for instance, by identifying their posts (hashtags) on Facebook, Instagram or Twitter, it will be feasible to select a group of people that recently experienced a travel process and shared the experience online. An individual that uses social network, will most likely also use mobile apps, presenting a suitable subject rich environment (Cata & Martz, 2015). In addition, the surveyor will also reach out respondents through face-to-face contacts. The airport of Cagliari-Elmas (Italy) has been contacted in order to receive permissions to distribute questionnaires in the airport area by spreading leaflets with a QR code that lead to the questionnaire. Regarding the data collection time, the questionnaire was launched on the 11th of November and closed on the 21st of November, that is, 10 days of data collection.

Scale

By assessing the respondent's experience towards various aspects, the survey would take the form of a multi-item questionnaire. Beside demographic and other complementary questions, a total of 22 indicators will be used to examine the model proposed. Participants shall rate their degree of approval or rejection through a 7-point Likert-type scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). The assessment of the overall judgement will be measured on a single-item scale, ranging from -5 to 5 with an increment of 1, respectively. Overall, other than the overall judgement (OJ1) in "Consequences of User Experience" which is a single-item construct, all others will be measured by two or three indicators.

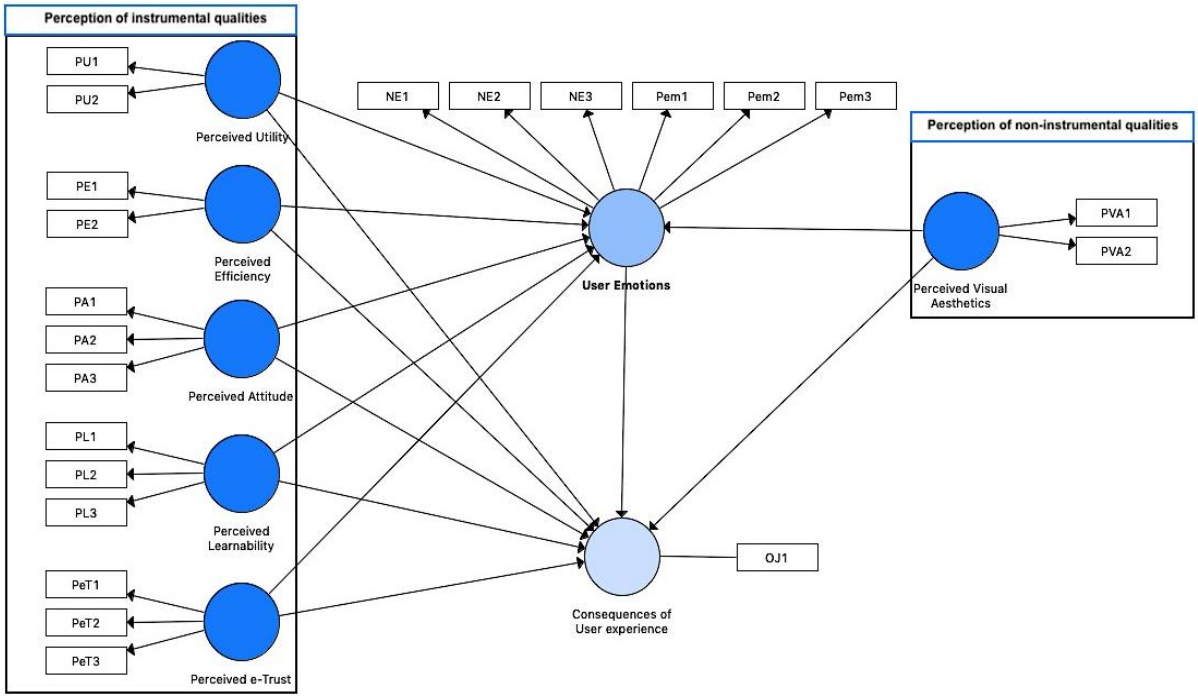
Data Analysis

The adopted research methodology will provide a broad understanding of the study field, but will also accumulate a wealth of quantitative and descriptive data to be analysed. The Structural Equation Modelling (SEM) will be employed by using the "Partial least square" or "PLS path modelling" to examine the relationships that exist among the variables of interest.

By analysing unobservable and hard-to-measure latent variables, this second generation technique focuses on the analysis of variance. SEM considers two sub-models: the inner model involves the relationships between the independent and dependent latent variables, while the outer model considers the relationships between the latent variables and their specific indicators (Wong, 2013). In this study, both sub-models will be measured to check the significance of each dimension and thus, to evaluate the User Experience of Airline Mobile App users. Figure 6 shows the theoretical framework that will be specifically tested by using the software SmartPLS.

Before using the software, the questionnaire data must be coded into an Excel spreadsheet with all indicators (e.g., PU1, PU2, PU3) being placed in the first row. Following, each questionnaire response will be represented by a row.

Figure 6: Conceptual Framework for the study. Smartpls



.

Figure 6

Contributions and Implications

By gathering data through the multi-item questionnaire, the respondents' experience towards different attributes will be measured. The study expects to contribute by analysing both the utilitarian and experiential aspects of Airline Mobile Apps from the point of view of passengers. Moreover, it aims to understand whether this service is enhancing and facilitating their journey.

By concentrating on the key parts of user experience and their interrelations, the model results useful in going beyond already used usability methods. It provides the most important aspects of human–technology interaction and a number of interesting issues for future research.

Despite the empirical nature, several constraints can be identified in the study.

The small sample might represent the first limitation since the number of the participants might not fully reflect the population behaviour. Moreover, the use of social network to distribute the survey might bias the study and lead to a homogeneous sample.

Secondly, this study is cross-sectional, namely the overall judgement of the airline mobile application was assessed only at a single point of time. In order to further conduct the study, a longitudinal strategy shall be embedded with the aim of measuring the airline mobile app user experience before and after the flight.

Future studies may implement also other theories, such as UTAUT (Unified Theory of Acceptance and Use of Technology) or TPB (Theory of Planned Behaviour) incorporating more factors to investigate the passenger experience.

Appendix A: Questionnaire

In order to gather results, the following questionnaire was implied during the study, including 45 items in total.

- **Part 1 - Presentation**

The questionnaire started with a short introduction about the research and few basic information for the respondents.

"Welcome and Thank you for participating!

My name is Letizia Atzeni and I am a master student at the University of Kassel, Germany. This semester I am conducting research on the impact of Airline Mobile Applications on the user experience for my final thesis. Have you ever dowloaded the mobile version app of an Airline when planning, booking or managing your trip? If yes, I'd be interested to hear from you about your travel habits and the experience you had with an Airline mobile app. This would contribute to my research about the existing app and give me insights on which features to prioritise. The survey should only take 5 minutes, and your responses are completely anonymous.

If you have any questions about the survey, please email me: letiziatzeni97@gmail.com"

- Part 2 – User and Smartphones
- Part 3 – Travel Habits
- Part 4 – User Experience

Construct	Item	Source
Instrumental values		
Perceived Utility (PU)	PU1: I consider the Airline Mobile App extremely useful. PU2: Using the Airline Mobile App is advantageous.	Minge et al., 2016
Perceived Efficiency (PE)	PE1: Using the Airline Mobile App enable me to carry out tasks easily. PE2: Using the Airline Mobile App enable me to accomplish tasks related to my trip more quickly.	Norazah & Norbayah, 2017

Perceived Attitude (PA)	PA1: This Airline Mobile App is saving my time. PA2: This Airline Mobile App allow me to identify the precise thing which I'm looking for during all stages of my trip. PA3: This Airline Mobile App provide many options.	Norazah & Norbayah, 2017
Perceived Learnability (PL)	PL1: It is easy to learn how to use an Airline Mobile App PL2: The interaction with an Airline Mobile App does not require a lot of mental effort. PL3: Performing tasks with an Airline Mobile App is straightforward	Chin et al., 1988
Perceived e-Trust (PeT)	PeT1: The chance of having a technical failure in an Airline Mobile App is quite small. PeT2: The Airline Mobile App will perform to the utmost benefit of the customer. PeT3: The Airline Mobile App is trustworthy.	Norazah & Norbayah, 2017
Non-instrumental values		
Perceived Visual Aesthetic (PVA)	PVA1: The Airline Mobile App is creatively designed PVA2: The Airline Mobile App has an attractive interface	Minge et al., 2016
User emotions Subjective Feelings		
Positive Emotions (PEm)	PEm1: The Airline Mobile App relaxes me PEm2: The Airline Mobile App exhilarates me PEm3: When using the Airline Mobile App, I feel cheerful	Minge et al., 2016
Negative Emotions (NE)	NE1: The Airline Mobile App annoys me NE2: The Airline Mobile App frustrates me NE3: When using the Airline Mobile App I feel exhausted	Minge et al., 2016

Consequence of User Experience		
Overall Judgement (OJ)	OJ1: How would you rate the Airline Mobile App overall?	Minge et al., 2016

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