Linnæus University
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Master Thesis in Informatics

Exploring User Experience of IT-artefacts

A Human-centred approach on handheld devices

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Abstract

The Master thesis focuses on the interaction of humans with technology with a special focus on User Experience (UX). Drawing on the theory of Human Computer Interaction, this interpretive research study explores the User Experience of handheld devices acting as IT-artefacts with a Human-Centred Design approach. Specifically, the Master thesis through a series of semi-structured interviews explores the users' perceptions of the current use of Handheld Laser Barcode Scanners which are utilized in a large Swedish food retail chain store. Furthermore, it explores users' desired characteristics of the Handheld Laser Barcode Scanners regarding User Experience, in order to derive suggestions that direct the design of more human-centred handheld IT-artefacts. Through its findings, the research study confirms that users' expectations play an important role in designing technological artefacts, while technology also shapes users' expectations.

Keywords

Usability, User Experience (UX), Human Computer Interaction (HCI), Human-Centred Design (HCD), IT-artefacts, Handheld Devices, Qualitative Research

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List of Abbreviations

ANT: Actor Network Theory
GUI: Graphical User Interface
HCD: Human-Centred Design
HCI: Human-Computer Interaction
HLBS: Handheld Laser Barcode Scanner
ID: Interaction Design
IT: Information Technology
IS: Information Systems
UX: User Experience

Chapter 1

This introductory chapter has the intention to briefly offer all important information to the reader regarding this master thesis, regarding what is going to be studied, where and why am I going to study it and why I think it is important. The first part of this chapter is to introduce the reader to the general context of this research study, giving background information relevant to it and describing the research setting. Consequently, a gap in existing research relevant to this thesis' object of inquiry will be identified, and the purpose and derived research questions of this research study will be presented to the reader. The next part of this chapter informs the reader about the scope of this study and its limitations. This chapter closes by presenting briefly how this master thesis is organized.

1 Introduction

1.1 Introduction and Research Setting

During the last several decades, technology has increasingly become integrated into our daily life. The use of handheld devices in order to complete various tasks became even more evident, and for the last several years, people rely on portable and easy-to-carry devices to carry out everyday tasks. Even more aware of the competencies that technology may offer, organizations utilize technological devices, some of them handheld, as IT-artefacts to create capabilities and boost processes by offering new functionalities and support in their Information System (Peppard & Ward, 2004, p.168).

IT-artefacts are a type of artefact. As artefacts, they can be identified, they have an enduring existence, they operate on a certain context and, through their properties, they offer helpful functionality in terms of attaining goals (Goldkuhl, 2013, p.92). An artefact might be physical or not. Non-physical artefacts have been acknowledged, like thought or sign artefacts. Technological artefacts in IS present a duality in their nature. They possess a set of unique attributes which make them distinct for their functionality, but also, they inherit attributes from the social context in which they are embedded (Kallinikos, 2002, pp. 287-288). IT-artefacts are physical artefacts and what makes them distinguishable is that they are part technical and part informational, which means that they act as mediators in information exchange between people (Goldkuhl, 2013, p.93). Nowadays, IT-artefacts are ubiquitous in almost every organizational context.

The Scandinavian countries are among the first countries to research, develop, use and apply Information Systems (IS) guided by a human-centred approach. The Scandinavian tradition is steered by the notion that users should have real control over the design of an IS, and that an IS is not only a system consisted of technology, but also a social system where humans and machines co-exist. Therefore, the Scandinavian tradition supports that research and design over that field should be more human oriented (Dahlbom, 1996, p.34). Furthermore, its main motive of IS research and design is about how technology, in the form of IT-artefacts, is used to boost human activity systems, with the main goal being to change and improve that use (Dahlbom, 1996, p.42).

In other words, the center of interest in Scandinavian tradition of IS research is the interaction of humans with technology with a special focus on User Experience and Usability. By usability it is meant how capable is technology to be used (Shultz and Hand, 1998; Bevan et al., 2015, p.1).While, User Experience involves a more holistic approach to the interaction of humans with technology including several other aspects like emotional impact, pleasure or aesthetics (Sharp et al., 2015, pp.21-22). The aforementioned concepts have evolved through the years, influenced by the technological advancements (Bevan et al., 2015, pp.1-5; Rogers, 2012, p.1, 7). User Experience has grown to be a broader concept which includes usability, and is more suitable for the Human-Centred rationalization, as it takes into account all possible human traits. A more detailed presentation of these concepts will be given in chapter 2.

Smart mobile devices and Web Interfaces became very popular as objects of inquiry in research studies in Scandinavia and other countries due to the vast amount of capabilities they offer. Additionally, the growing number of publications per year relevant to smartphone devices and web interfaces on the field of usability engineering, shows that research interest regarding interaction with technology has been also greatly influenced by the rising popularity of these technologies (Chen et al., 2015, pp.1-2).

Another thing that is clearly evident in Scandinavian countries, such as Sweden, is the ubiquitous integration of technology to the infrastructure of the community as well as its use in a lot of everyday trivial processes by all age groups. An example of the technological integration in everyday life is the use of handheld devices in large retail chain stores by customers. These devices are practically handheld barcode laser scanners, a feature of their respective IS called självscanning in Swedish or self-scanning in English. Using this specific IT-artefact, the customers are assisted in keeping track of their expenses while they also have the ability to checkout by themselves without the need to interact at all with the staff which can in turn be utilized in other tasks. This specific type of device is representative enough for devices of this caliber, as it offers simple functionality through a number of buttons and a small screen and is, of course, handheld.

Figure 1: Handheld Laser Barcode Scanner Motorola MC-17

This type of technology is vastly utilized in many food retail chains which have stores throughout Sweden (Willys, 2014). Even though the manufacturer brand or model may differ from chain to chain, all devices of this type offer the same functionality. This functionality involves scanning the barcodes of products, showing a list of the purchased products, and keeping track of the current amount spent in order to help customers keep track of their expenses. After the customers are done shopping, they "dock" these devices into checkout terminals where they can use their credit cards to pay.

This research study focuses on the

handheld devices utilized by a retail chain organization located in the Kronoberg region, and specifically the city of Växjö. The food retail chain that owns the specific organization is the leading food retail chain in Sweden with 194 stores throughout Sweden, an average of 4,464 employees and 22,320 MSEK net sales in 2015 (AxFood AB, 2016). The sample population consists of undergraduate or postgraduate students at Linnaeus University, who are customers of the specific retail chain store and have at least once used this IT-artefact.

The device that is studied in this project can be seen at Figure1. It was manufactured by Motorola and the specific model is MC-17 and it was launched at 2007-2008 (Motorola, 2008). The customer can use the two of the six buttons available on this device. One to scan/add a product and one to remove it.

My own personal experience of using this technology and the small number of customers who were observed using this IT-artefact motivated me to conduct a study about how people experience the use of handheld devices utilized to help them achieve tasks. Furthermore, I wish to explore what characteristics should these handheld devices have, according to the people, in order to move towards more usable and more used, by the people, technological artefacts. The human-centredness of Scandinavian research tradition inspired me to study the use and user experience of handheld devices from the peoples' perspective. One could say that Scandinavian research tradition is guided by one of the main tenets of Human-centred design which argues that social expectation plays a great role in designing technology while technology also shapes social expectations (MacKenzie and Wajcman, 1999; Gasson, 2003). I agree with this position in regards to the relationship between humans and technology and wish to contribute towards this direction.

1.2 Identification of the gap

The consequent shift of focus in design from product features towards the user's experience, when interacting with it, and from handheld devices towards smart devices in research interest created a significant gap regarding the user experience of the handheld devices that do not fall into this category.

For the purpose of this study, I define devices of this type as handheld devices that offer an interface and a certain functionality and do not fall into the categories of smartphones, tablets or smart-called devices in general (from now on referred to as *devices)*. The monopolization of interest by mobile phones and web interfaces left the usability, and even more so, the UX concept of these devices forgotten in the ergonomics age. Nevertheless, handheld electronics of this type are still being used in certain contexts, in cases where hardware functionality is either too hard to integrate in smartphones or too expensive to implement in comparison with old-fashioned electronics that can still accomplish the relevant tasks needed.

Furthermore, devices that fall into this category may be used increasingly in certain contexts with a powerful example of this case being the rising trend in using handheld ultrasound devices in the medical sector (Battiste and Effron, 2012). This means that we are not about to lose interest in this type of devices, as they continue to evolve and be used in several contexts. Other examples of this device type that are unlikely to become obsolete are handheld portable X-Ray Fluorescence (XRF) analysers (Olympus Corporation, 2015), and portable biometrics scanning devices or handheld label printers

(Fyke, 2010; Bledsoe et al., 2011).

Additionally, after reviewing previous researches conducted on this field, I found out that the number of qualitative studies following a human-centred approach on how users experience the use of this type of IT-artefacts, were very low. Geven et al. (2006, p. 79) identify the need to qualitatively study User Experience from a holistic perspective using interviews. In their article, they explain why the rationale of approaching UX as a sum of factors is flawed, and they propose asking the interviewees to describe their experience as a whole. Also, Hassenzahl and Tractinsky (2006, pp. 91-92) argue that there is a need for more empirical material- qualitative or quantitative- regarding UX. In their article, Hassenzahl and Tractinsky (2006, p. 95), explain UX and present its multifaceted nature. Nevertheless, they acknowledge the need for HCI to become even more Human-Centred and argue that UX is a way to do so. Thus, in the present study, an attempt to study User Experience, including usability, from a human-centred perspective is made, in order to update and inform HCI research for this particular type of IT-artefact. User Experience and Usability are similar concepts, and my position in this thesis is that usability is an important part of UX, a position which is explained, later on in the second chapter. Even though I could focus only on the concept of User Experience, I choose to address both because it is reflecting my position regarding the importance of usability for User Experience.

1.3 Purpose Statement and Research Questions

To study the User Experience of these devices, I conducted a human-centred research study using an interpretive qualitative approach to explore the users' perceptions of the current use of handheld devices and their desired characteristics of these devices concerning User Experience. Therefore, this research aims at exploring and obtaining knowledge about the users' point of view and of their desired characteristics regarding the use of these IT-artefacts. Ultimately, through my findings, I intend to identify possible improvements in the design and use of handheld devices as IT-artefacts in an IS context.

Thus, the objectives of this research are the following:

- To understand how the use of handheld devices is perceived by the users
- To identify common and relevant to user experience characteristics of handheld devices that users desire

To fulfill this study's purpose and objectives, I attempted to give answers to the research questions presented in this section. In order to move towards Human-centred design instantiations of this type of IT-artefacts, the current situation should firstly be described, and secondly the factors that will be of the outmost importance to achieve the desired situation (social expectations) should be known. With the intention to study the use of handheld devices from the users' perspective, my first research question addresses the need to understand how the users currently perceive its use concerning UX.

Thus, my first research question is:

1. How do users of handheld devices perceive their current use regarding user experience?

Answering this research question will provide information for describing the current situation regarding users' perceptions in terms of User Experience. The second research question has the purpose to further describe the desired characteristics that handheld devices, utilized as IT-artefacts, should have according to the users. So, the second research question is:

2. How do users of these handheld devices describe their desired characteristics regarding user experience?

Answering this question, will enable me to derive a list of users' desired characteristics regarding the User Experience of these handheld devices.

1.4 Topic Justification

I believe that this topic is of great importance because there are still many devices of this class being used in Information Systems, playing an important role as IT-artefacts in organizational processes. As mentioned above, these devices are unlikely to be rendered obsolete by smart devices, and in some occasions they rise in popularity as parts of organizational IT-solutions (Battiste and Effron, 2012).

Additionally, this type of devices should be studied and designed under more recent and updated theories of HCI. It should be made sure that the humans using these particular devices are not left to interact with devices designed under standards that come straight from the 90s. Updating the way of thinking about the UX of these devices will result in better use of these IT-artefacts in IS interventions, a better user experience resulting in an increased intention towards utilizing them, and a more humane way of designing them as IT-solutions.

Also, this study could be classified as an exploratory research, as its purpose is to explore and gain a deeper understanding of the users' perception regarding User Experience for this type of device (Gregor, 2002, p.16). An advancement or development of the respective theory could also inform other kinds of theories such as HCI theories of a prescriptive character (Gregor, 2002, p. 18). In her paper, Gregor (2002) presents a taxonomy of the theories in the IS field, where the theories are categorized by their purpose. She identifies five categories of theories: theories for analysing and describing, theories for understanding, theories for predicting, theories for explaining and predicting and theories for design and action (Gregor, 2002, pp. 15-17). The latest type of theory, design theory, can inform or be informed by the other types of theory, among which the present study is included.

1.5 Scope and Limitations

This research study engages undergraduate and postgraduate students who are enrolled in the Faculty of Technology at Linnaeus University in Växjö, Sweden, and are also users of the particular handheld devices met in convenience stores of the respective area. This choice was made based on the assumption that their knowledge and familiarization with technology would enable me to collect rich data. The specific age and gender of the participants is believed to make no difference in the outcomes of the research.

Also, this study is conducted in the English language, a factor which may be limiting because most of the participants are expected to be native Swedish language speakers.

It should also be noted that since this is a research positioned in the Interpretive paradigm, there is no intention to make generalizations about the results. The intention of this research study is to inform similar studies by providing additional empirical data.

1.6 Thesis Organization

The rest of the master thesis is organized as follows: In the next chapter, Chapter 2 the relevant literature will be reviewed in order to familiarize the reader with the theoretical concepts that guide this research study. Additionally, this will give me the opportunity to position my research study in the academic world of IS Research, and to further clarify how these concepts are approached. A description of the scientific field of Human-Computer Interaction (HCI), where this study is positioned, will be given. Also, a review of Human-Centred Design (HCD) theory which provided the inspiration for the guiding principles of this research study will be presented. Finally, in chapter 2 the concepts of Usability and User Experience (UX) are explained. The next chapter, Chapter 3 is intended to explain the methodological approach of the research study, the philosophical tradition that implies it, and the strategy that will be deployed to collect and analyze rich empirical data. The findings that emerged from the analysis process will be presented in Chapter 4 and discussed in Chapter 5. Chapter 6 will summarize the whole master thesis, describe the limitations and challenges met and also suggest topics for future research. A graphical representation of how this master thesis is organized can be seen in Figure 2.

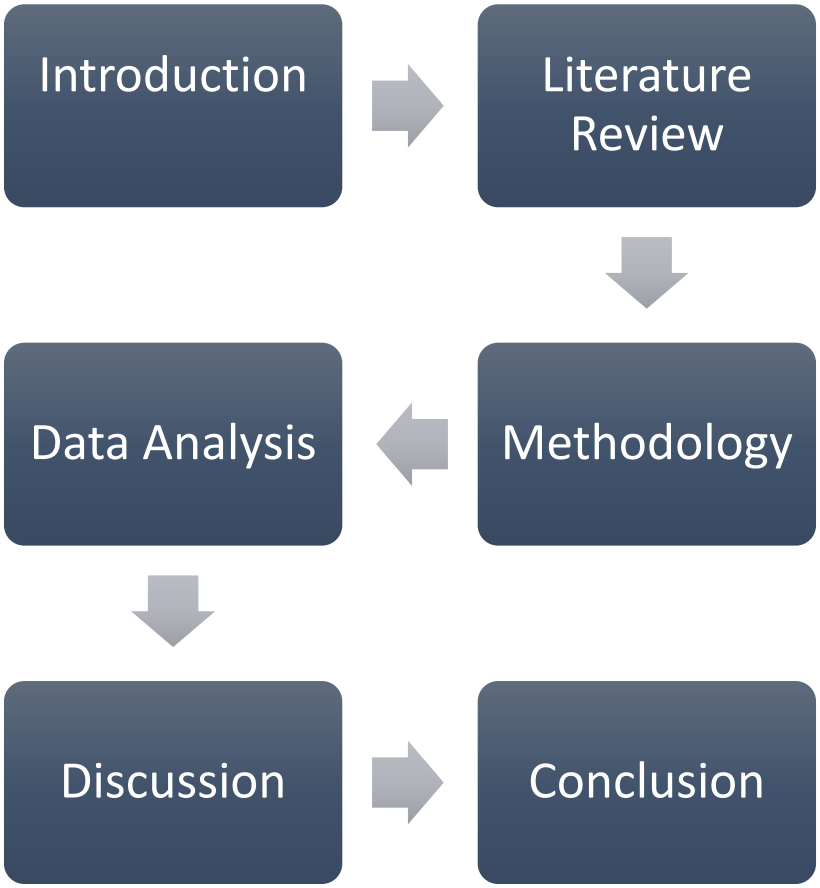

Figure 2: A graphical representation of how this thesis is organized

Chapter 2

In this chapter, the reader will be informed in detail for all the theories involved in this research and the way I approach and use them in my study. For this purpose, the existing literature for all relevant theoretical concepts will be reviewed. Different standpoints will be presented and critically reviewed in conjunction with the research study. Specifically, the approaches to the theoretical concepts relevant to this research study will be presented while concurrently stating which will be adopted in it. Simply put, one of the purposes of this chapter is to answer the question "Which theories are relevant, what meanings do they have in the academia and what meanings do they have for me as a researcher?".

2 Review of the Literature

A thorough review of the literature was made in which printed academic monographs and e-books, scientific journal articles and other sources of knowledge were examined primarily through the Linnaeus University Library and the World Wide Web. A review of the literature will not only help in investigating what has already been done in the respective field of interest, but will also help in positioning my study in the Academic world. The conceptual framework which will guide my investigation is based on Human-Computer Interaction, Human-Centred Design, Usability and User Experience. These theoretical concepts will be developed in this chapter with a top-down approach, from the theories which cover a broader range of topics to the more specific ones. Starting with Human-Computer Interaction, the broadest of theories involved in this study covering several disciplines, I will describe its evolution and current status while positioning my research in it. To further develop this chapter, I will explain how Human-Centred Design, a theory found in the broad range of theories that fall under HCI, informs my approach as a researcher in this subject. The last and most specific theoretical concepts involved in this study are the concepts of Usability and User Experience (UX) which will be the object of inquiry for my research. UX is a broader term that also involves Usability. However, I believe that usability is a vital part of UX, one that should be specially emphasized when studying or designing for UX, a position for which I will argue later on in this chapter. A visual representation of the theoretical framework upon which the present research study is based is presented in Figure 3.

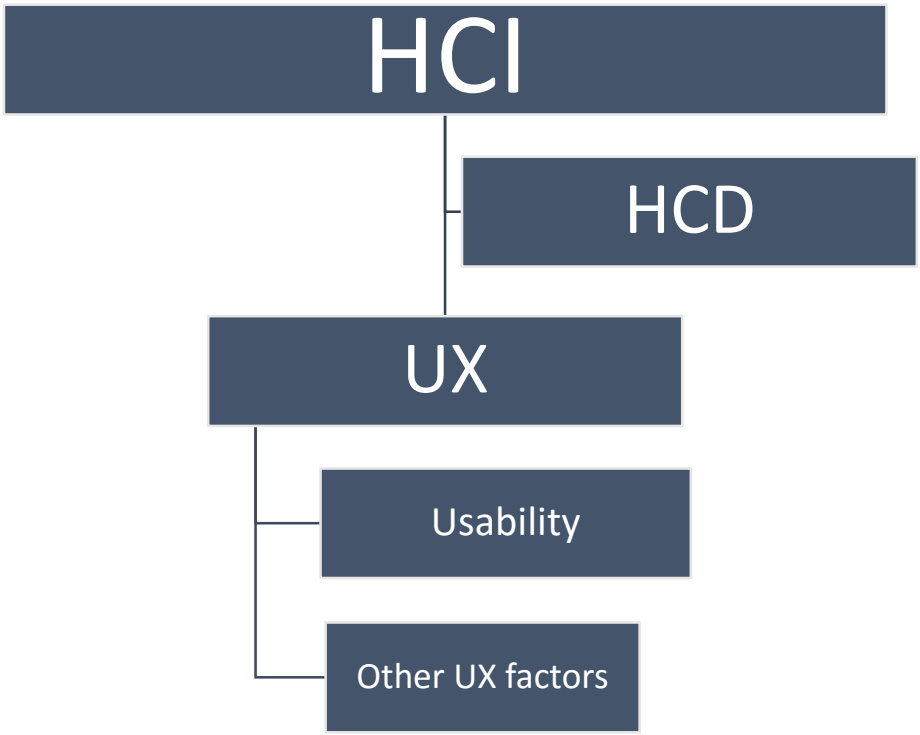

Figure 3: Theoretical Framework of the present research study

Before presenting the theoretical concepts that are involved in the present research study, I would like to clarify how this study is very relevant to the field of Information Systems. In the present study, handheld devices are approached as IT-artefacts which, according to Orlikowski and Iacono (2001, p.130) are the central subject of the Information Systems field. Artefacts in general, have been a subject in many disciplines, and D'Adderio (2011, p.200) argues that there have been three different perspectives regarding artefacts. The Realist, the Constructivist and the Actor Network Theory (ANT) perspective. Each of these perspectives has a different approach to an artefact's properties and how they are formed. The realist perspective claims that properties are inherent in artefacts, while the constructivist perspective argues that the social environment of the artefact bestows properties to it. The ANT perspective takes a balanced approach of the two perspectives mentioned above, as it claims that the properties of an artefact are "*neither inherent, neither socially constructed but relational and emergent*" (D'Adderio, 2011, p.201). Artefacts as well as humans are considered as "actants" and they link and create the emergent properties of the artefacts. IT-artefacts are socio-technical artefacts, created with the purpose of tackling organizational problems (Hevner et al., 2004, p.82). The social nature of an IT-artefact is related to its informational purpose. Actually, what makes an IT-artefact social is exactly its informational purpose, because through it humans share their knowledge (Hevner et al., 2004, p.93). Orlikowski and Iacono (2001, p.126) also provided a very interesting approach towards IT- artefacts and their social side, which is the "*ensemble*" view of IT-artefacts. Through this view, IT-artefacts do not only possess technical properties, but also social ones. An IT-artefact's properties include the social arrangements made for it to be designed, implemented and used. They also include the impact it has on the socio-economic system in which it is implemented (Orlikowski and Iacono, 2001, p.126; D'Adderio, 2011). I believe that this approach of considering a social dimension of IT-artefacts is strongly evident in the Scandinavian tradition, in which IS are approached as socio-technical systems.

Human-Computer Interaction is an interdisciplinary field which is in a continuous process of evolvement that could be described in a historical fashion by three eras: The Classical, the Modern, and the Contemporary era, each one being influenced by paradigms, theories, models etc. (Rogers, 2012, p.1, 7). According to Rogers (2012, p.7) "*the Classical HCI period imported cognitive theory in a rigorous and constrained way"*. While the Modern HCI period utilised a broader range of approaches and theories -from social, phenomenological and cognitive science. Continuing, the Contemporary period was mostly influenced by morals, and it could be interpreted as value-led. Even though these time periods do not have clear boundaries, my study is positioned in the modern era as I am interested in studying the phenomenon of users' experience when using the device.

The historical evolution of Human-Computer Interaction can also be described by three waves, each one bringing its own paradigm. These three paradigms, Human factors, Cognitive Science/Information Processing, and Situated Action called 1st, 2nd and 3rd respectively (Harisson et al., 2007), brought into the centre of attention different issues and assumptions under which the interaction between humans and technology was researched, designed and evaluated. In the human factors paradigm, the priority is to optimize the coupling between humans and machine, while in the 2nd paradigm the designer seeks to optimize communication (information exchange) between human and machine. Both paradigms are focused into specific scenarios, for specific context of use. The main difference of the 3rd paradigm is that it has the purpose to be context free, supporting situated action to emergent problems. It is based on the assumption that each user draws on her/his own experience and subjective meanings to navigate through them.

This study is positioned in the general research field of Human-Computer Interaction (HCI) as its main scientific concern is the interaction between people and technology (Dix et al., 2004, p.4). The research study is also inspired by the Interaction Design field as the concept of user experience (UX) is considered important when studying the use of handheld devices. Interaction design is very much concerned with how to design user experiences (Sharp et al., 2015, p.8). Sharp et al. (2015, pp.9-10) argue that there is a difference between Interaction Design (ID) and Human-Computer Interaction (HCI). That is a difference in scope. They argue that Interaction Design has a broader scope than HCI. It is concerned with the theory, research and practice of designing user experiences, while HCI is concerned with *"the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them"* (ACM SIGCHI, 1992, p.6 cited in Sharp et al., 2015, p.10). Other researchers however, consider emotions and experiences, the critical difference of ID and HCI according to Sharp et al. (2015), as a crucial part of the third wave of HCI (Bødker, 2006, p.5). This means that HCI evolved and cast its net over a much wider area of scientific interest. This research study adopts Bødker's (2006) viewpoint. Therefore, it is positioned in the latest wave, or third paradigm of HCI, where user experience is not a marginal issue but a central one, along with usability (Harrison et al., 2007, p.6).

Usability has been and still is a central concept in HCI. Even though several definitions of Usability exist along with different ways to measure it (Tan, 2009, p.1), the central meaning of this concept always involves how to make technology easier to use. The way usability was perceived and cognized changed through the years, following the evolution of HCI. One could recognize the international standards (set by ISO) for usability as historical landmarks through which we could track the progress of research in the field of HCI. At first, usability was studied as a feature of a product without considering the fact that users also affect usability in their own subjective manner (Bevan et al., 2015, p.2).

This approach to usability is similar to the human-factors paradigm of HCI and is mostly considered as Ergonomics. However, it was discovered that usability was highly relevant to the individual users and their goals, and this approach led to a widely known standard for usability, ISO 9241-11(1998) (Bevan et al., 2015, p.2). In even more recent developments User Experience (UX) evolved from a factor of Usability to a concept of at least the same significance with it (Bardzell and Bardzell, 2015, pp.80-81). While for others it is even more, as good usability is not enough to create a quality experience (Hartson and Pyla, 2012, p.11). User Experience is not something new in the field of HCI, as there were attempts to address this aspect through Usability by emphasizing personal experience over learnability or productivity (Hassenzahl and Tractinsky, 2006, p.91), or by addressing UX with the open ended measure of Personal Satisfaction as in ISO 9241-11 (Hartson and Pyla, 2012, p.11).

Positioning myself at the 3rd paradigm of HCI, I use Human-Centred design as a theoretical framework to guide my research. To achieve Human centredness in an organizational design, one should work towards achieving a flexible system which will give the ability to the people that work with it to shape and manage their work (Gasson, 2003, pp.31-32). Also, even though user-centred design and human-centred design are similar as theories, Gasson (2003, pp. 30-31) argues that User-Centred Design is mostly focused on technology, and how it could be used to solve specific-context problems, while Human-Centred design is focused on how and why technology should be used in order to support human activity systems. Following this rationale and influenced by the Scandinavian philosophical tradition in Informatics, I explore how users experience the interaction with this type of IT-artefact through the meanings they give to it.

In order to understand the users' perceptions of how helpful or well integrated is this IT-artefact to its context of use, the concept of Usability comes at play. The interest in how usable an IT-solution is, started becoming increasingly interesting in the 1980s and 1990s (Bevan et al., 2015, p.1). Usability though, was sought to be designed into a product, thus making it more usable, and a trial-and-error evaluation was taking place with each product release or evaluation testing. This was the approach ISO 9126:1992 had towards usability.

Later on, though, the most widely known ISO 9241-11(1998) standard was published and this one took into consideration that usability was not a feature of the product but, as a matter of fact, it was an emergent feature of the user's interaction with it (Bevan et al., 2015, p.2). The definition of usability that this standard gave was *"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"* (Bevan et al., 2015, p.2). The increased popularity of this standard provided the right conditions for the concept of usability to be understood and applied (Bevan et al., 2015, p.3).

This turn of events led at 2011 to an initiative to revise this standard and further enhance its guidelines. Some issues that are being considered include user experience, avoiding negative outcomes and focused on the user ways to evaluate usability in addition to measures of efficiency and effectiveness (Bevan et al., 2015, pp.3-5). Other authors also give attention to other aspects of usability. Nielsen (2012; 1993) also brings into play the aspects of memorability, learnability and the ability to recover from error, which is highly relevant with the specific IT-artefacts.

However, according to Norman (2004, pp.63-98), usability covers only one of three levels of design, that is behavioural design. The two other levels, visceral and reflective, which

are more deeply connected to our human nature, are much more effectively addressed by User Experience. The visceral level of design is mostly concerned in what we, as humans, feel when seeing a design, while the reflective level of design is connected to the meanings we give to it (Norman, 2004, pp.63-98). In order to understand the perception, the end users have of the IT-artefacts that are of interest in this research study as a whole, the visceral and reflective levels of design should also be taken into account when interviewing the participants of the study.

So, here is where the concept of User Experience comes into play. With strong roots in usability research (Geven et al., 2006, p.79), User Experience has been increasingly gaining popularity in HCI research causing a shift of focus from usability requirements to principles and guidelines for designing experiences (Vermeeren et al., 2016, p.1). This shift of focus was the result of the integration of ICT into our daily lives and its transition from the work environment to our homes (Bardzel and Bardzel, 2015, p. 80; Monk et al., 2002). Eventually, UX has become a broader concept than usability, as it approaches our interaction with technology from a holistic point of view, giving attention not only to the pragmatic value of the IT-artefact, but also takes as much seriously its hedonic values (Hassenzahl, 2003 cited in Geven et al., 2006, p.1). Criteria which are not directly related with utility or usability have become increasingly important in designing and evaluating interactive systems since the 2000s and are related to non-instrumental qualities of a product or service like aesthetics and hedonic quality (Hamborg et al., 2014, p.1).

However, the concept of User Experience is hard to grasp, as it involves a great number of fuzzy and dynamic concepts including emotional affect, personal experience and aesthetics (Sharp et al., 2015, pp. 10, 22). Thus, a widely accepted definition of User Experience is very difficult to be found. User Experience could be seen as a more detailed way to talk about the subjective satisfaction factor of usability (Bevan et al., 2015, p.2), or that *"it differs from usability as it includes previous importance on user performance"* (Allam et al., 2008, p.29), or it can be seen as an overall way to describe the users' perceptions and responses (Allam et al., 2008, p.29). ISO 9241-110:2010 defines User Experience as *"a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service*" (ISO FDIS 9241-210, 2009, cited in Allam et al., 2008, p.29). While, Jetter and Gerken (2007, p.1) argue that user experience incorporates concepts from visual or industrial design, psychology or marketing research in addition to the traditional qualities of reliability, functionality, or usability. A list of desirable and undesirable aspects, which lead to a good or bad User Experience is given by Sharp et al. (2015, p. 22) and is pictured in tables 1 and 2.

Desirable aspects of User Experience (Adopted by Sharp et al., 2015, p. 22)

Table 1: Desirable aspects of User Experience (Adopted by Sharp et al., 2015, p. 22)

DESIRABLE ASPECTS
Satisfying
Enjoyable
Engaging
Pleasurable
Exciting
Entertaining
Helpful
Motivating

Challenging
Enhancing Sociability
Supporting Creativity
Fun
Provocative
Surprising
Rewarding
Emotionally Fulfilling

Table 2: Undesirable aspects of User Experience (Adopted by Sharp et al., 2015, p. 22)

UNDESIRABLE ASPECTS
Boring
Frustrating
Making one feel guilty
Annoying
Childish
Unpleasant
Patronizing
Making one feel stupid
Cutesy
Gimmicky

However, it should be noted that these UX factors are just a list proposed by the authors in regards to the factors which act as building blocks of a positive or negative experience. Several researchers have followed the same approach through which they identify the comprising components which form User Experience (Geven et al., 2006, p.79). Furthermore, the list of the factors making up UX, changes or increases, depending on perspective of the researcher. Even though this approach contributes into a better understanding of UX it might also be problematic, because it is very difficult or even impossible to assess all single factors simultaneously. This is referred to as the *Heisenberg Principle in user experience research* (Geven et al., 2006, p. 80). Furthermore, the same authors argue that even if we solved the methodological problem described above, there is an even more serious flaw to this reasoning which is the fact that this approach does not consider enough the active role a user has when living an experience (Geven et al., 2006, p.80). What makes user experience as a whole- something more than the sum of its factors- is the fact that a user creates the experience lived giving her/his own subjective meaning and interpretation to it (Geven et al., 2006, p.80). That explains why individuals experience differently the same situations. The authors among others express the need to approach User Experience holistically, accessing the subjective meaning the users give to their interaction with a product, service or, in our occasion, an IT-artefact through communication. According to Geven et al. (2006, p. 81), eliciting narratives about personal experiences of the users is a good way to assess UX. In this research study, the same approach will be taken when studying the User Experience of handheld devices.

Therefore, this research study takes the following position regarding User Experience, Usability and the way they are interrelated: User Experience is a broad concept which

includes usability. Norman's (2005, p. 65) three levels of design, where usability addresses the behavioral level, and the visceral and reflective levels are addressed by the concept of UX, is one way to express this position. Another point which also reflects my position is how Hassenzahl and Roto (2007 cited in Hartson and Pyla, 2012, p.12) describe "*the difference between the functional view of usability and the phenomenological view of emotional impact*" by defining *"do-goals"* and *"be-goals"*. Do-goals involve the pragmatic value of a technological products which is its usefulness and usability. While be-goals address the psychological needs of the users such as "*self-identity, being satisfied with life or relatedness to others"* (Hassenzahl and Roto, 2007 cited in Hartson and Pyla, 2012, p.12). The authors find usability to be a vital part of UX, one that has not been made obsolete by any means (Hartson and Pyla, 2012, p.15). Geven et al. (2006, p.79) argue that usability is still important for user experience as the absence of it can lead to a negative User Experience. However, usability alone is not enough to create a positive user experience. Inspired by the aforementioned authors' standpoint I incorporate questions directly related to usability when gathering data, giving adequate emphasis to this concept while studying UX.

In order to deploy a Human-Centred approach when studying the use of these IT-artefacts, I give special focus to the humanistic attributes of usability, like personal satisfaction, learnability or memorability. Positioning this research study in the 3rd paradigm of HCI under a Human-Centred Design approach, the factors that define Usability for the scope of this research will be: Efficiency, Learnability, Memorability, Error Rate and User Satisfaction influenced by UX (Zahidi et al., 2014, p.62).

Chapter 3

In this section a detailed description of the research strategy for empirical material collection and analysis will be given. Starting with the methodological tradition under which I, as a researcher, rationalize and operate, I intend to inform the reader about the ontological and epistemological assumptions that characterize this research study. In the next part of this chapter, the methodological approach -that is the strategy- to collect empirical data will be presented. Further on, the methods and techniques that were used to collect the empirical material will be thoroughly described. Next, the reader will be informed on the way I chose to assure validity and reliability for this research study while also practicing reflexivity to address the issue of a biased data interpretation. This chapter closes by explaining to the reader the principles upon which the research process is based, in order to achieve proper ethical conduct, and the way I chose to ensure that these principles would be followed in my research study.

3 Methodology

3.1 Methodological Tradition

Most of the researches in Information Systems fall under three main research philosophies or paradigms, the positivist, critical and interpretive (Orlikowski and Baroudi, 1993, p.1). Each one of these philosophies comes with its own set of assumptions about the nature of reality (ontology) and the nature of knowledge (epistemology) (Meriam and Tisdell, 2015, p.8). Ontological beliefs are concerned whether reality exists objectively given or whether it is subjectively constructed by humans (Orlikowski and Baroudi, 1993, p.7). Epistemological beliefs are concerned with the question of how we can create and evaluate knowledge in a way that is valid (Orlikowski and Baroudi, 1993, p.8).

Positivism oriented researches assume that reality is objectively given, independent of humans and their actions, waiting to be *"discovered"* (Meriam and Tisdell, 2015, p.9). The proper way to create and evaluate knowledge in positivist traditions is by empirically testing theories which results to either *"verify"* or *"falsify"* them (Orlikowski and Baroudi, 1993, p.10).

Interpretive researchers operate under the ontological assumption that reality is not objectively given, but socially constructed. The term interpretivism is frequently used interchangeably with constructivism which reflects the assumption that humans construct their subjective reality-that is the subjective meanings given to experiences- through interaction with others and through existing social norms (Merriam and Tisdell, 2015, p. 9). In contrast with positivism, interpretive epistemological beliefs assume that the way to create proper knowledge is not by separating people from their natural setting to a laboratory where conditions can be manipulated. An interpretive researcher must emerge herself/himself in the natural setting of the people who are part of the phenomenon under study, so that she/he can access the shared meanings assigned to the phenomenon by people (Orlikowski and Baroudi, 1993, p.14).

Critical philosophy assumes that social reality is historically constructed and interpreted. Shared meanings created and assigned by humans are dominated by the existing social and cultural structures. Critical theory comes with a purpose to inform people about the various forms of social domination and empower them towards change (Orlikowski and Baroudi, 1993, p.19). Thus, valid knowledge in the critical paradigm is the knowledge with the purpose to challenge the existing *status quo* and provide the means to people to take action and change it (Meriam and Tisdell, 2015, p.10). In the critical paradigm the existing epistemological belief is that knowledge *"is grounded in social and historical practices"* (Myers and Heinz, 2011, p.19). According to Orlikowski and Baroudi (1993, p. 20), *"There can be no theory-independent collection and interpretation of evidence to conclusively prove or disprove a theory"*. Thus, even though critical researchers seek to understand the shared meanings people assign to the phenomena of interest, they also operate under the assumption that this is not enough to also access the existing structure of power as people are most of the times unaware of it, and seek to critically analyse it through the theoretical framework they use (Orlikowski and Baroudi, 1993, pp.20-21).

This research stands in the Interpretive paradigm because it is conducted under the assumption that *"people create and associate their own subjective and intersubjective meanings as they interact with the world around them"*(Orlikowski and Baroudi, 1993, p.5). The goal of this research study is to explore how do users perceive the experience of interacting with the certain IT-artefact and gain a deeper understanding of how they, within this specific context, give meanings to the use of it, and therefore act towards it.

Also, this research study is conducted under the assumption that the researcher also operates under his interpretations and meaning of things and, therefore, there is no claim that this research study is value-free nor is there the intention to generalize possible results, but to inform researches on the same setting.

3.2 Methodological Approach

This study will apply a qualitative approach in order to obtain data of greater detail and quality, and have the ability to explore in depth the users' perspective of the IT-artefacts that are of interest. The motivation behind my choice of making a qualitative study is that I assume that each of the participants is unique and, therefore, I intend to give them the chance to be heard and be distinct instead of blunting their uniqueness in an aggregate statistic. I depart on my research with the assumption that each of the participants' perception of how usable an IT-artefact is and how it could be even better is of the same importance and should be studied in depth. Thus, the chosen method for data collection is semi-structured interviews, a matter which will be discussed in a later section (Silverman, 2013, pp.44-48).

3.3 Methods/Techniques for Data Collection and Analysis

The present research study takes place in the premises of Linnaeus University, during the spring of 2016. Linnaeus University is located in Sweden, and is comprised by several departments covering different disciplines. Six users who have interacted with the specific type of handheld devices for at least one time will participate in a semi-structured interview. In favor of feasibility, purposive sampling will be conducted, in the University's campus, a place where it is expected that most of the inhabitants are customers of at least one convenience store which utilizes this IT-artefact and users of the

respective technology (Patton, 2002; Creswell, 2009). The choice of purposive sampling was made with the intention to gather even richer data, by allowing me to choose participants whose information could make a difference. Half of the participants are postgraduate students in the field of Informatics. Through their studies they have obtained knowledge on Information Systems and IT-artefacts. The knowledge they have accumulated through their studies combined with a more advanced way of interpreting their experiences, was very promising in regards to the information they could give me. The other half of the sample consists of undergraduate students. Two of them were known to be genuinely fascinated by technology and, in extent, IT-artefacts. The remaining participant was known to have a very positive opinion about the device under study, but oddly enough, he was not using it anymore. The reasons for this will be revealed in the fourth chapter of this master thesis.

The study is inspired by Nielsen's (1993) definition of usability. Nielsen (1993) defines usability as "*a multidimensional concept that consists of five major quality components: easy to learn, efficient to use, easy to remember, low error rate, and user satisfaction*". Based on these five major components, the questions of a semi-structured interview will be formed, for the part of usability. The other questions of this interview will aim to capture how the users perceive UX. Using a holistic approach, and always with the intention to elicit narratives by the participants, I will attempt to generate rich data in regards to UX. I will also try to further explore the experiences shared by the users, using follow up questions intended to provoke the participants into revealing more details about their stories, or even share new ones.

I chose to do semi-structured over structured interviews in order to have the freedom to further explore the answers that will be given, thus gaining a deeper and greater understanding of the users' perspectives. I have also chosen semi-structured interviews opposed to open, because I wanted the interview to have a general direction guided by the five major components of usability according to Nielsen. The participants' consent was requested in order to audio record their interviews.

As I will be looking for certain patterns and common factors that affect the perceptions of UX by the users' point of view, I believe that a thematic or a conventional content analysis of the gathered data will be the most appropriate (Lichtman, 2013). In order to start the analysis process, the interviews must be transcribed. This will be done with the intention to also include non-verbal cues in the transcriptions. After this preparation step, I will use thematic analysis as described in Lichtman (2013, pp. 250-255), to make meanings out of the empirical material. In the process described by Lichtman (2013), codes are generated out of the raw data at first. Then, the generated codes will be sorted in categories from which the key concepts will be derived. These key concepts will help me generate a list of the most important criteria for the users which affect their experience of this IT-artefact, and also the most desired characteristics this type of device should have according to its users, in terms of User Experience. A visual representation of the Analysis process is presented in Figure 4.

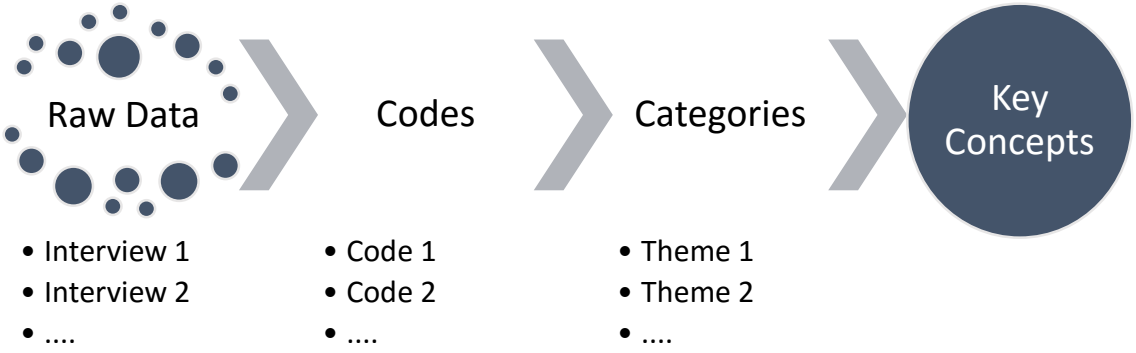

Figure 1: The Thematic Analysis Process

3.4 Validity, Reflexivity, and Reliability

A research study's effectiveness in either practice or theory is determined by how rigorously it is conducted (Meriam and Tisdell, 2015, p.238). Validity and reliability have always been the key factors regarding the trustworthiness of a research study (Meriam and Tisdell, 2015, p.238). Even though both reliability and validity have been a main concern for researchers of both qualitative and quantitative studies, the way researchers argue for these concepts changes depending on whether the study is qualitative or quantitative. That is because the way these concepts are conceived is highly dependent on the underlying philosophical assumptions under which the researcher conducts her or his study (Meriam and Tisdell, 2015, p.238). There are several strategies to pursue reliability and validity in qualitative research studies some of which will be deployed in this research study, to achieve methodological rigor and enhance its authenticity and trustworthiness.

3.4.1 Internal Validity and Credibility

The concept of internal validity describes how good the match between research findings and reality is. Internal validity was originally concerned with the question of how accurately the collected data depict reality. Given the underlying philosophical assumptions of qualitative studies, including this one, which assumes that reality is not objectively given but can be explored through a multiplicity of different world views, the original meaning of internal validity is quite inappropriate. Thus, the notion of "credibility" seems more appropriate. That is, concerned with the question of whether the findings are credible given the data presented (Meriam and Tisdell, 2015, p. 242). The strategies that will be followed to enhance credibility of the present research study will be briefly explained in this section.

Firstly, I will interview individuals with different worldviews. In this way, I am addressing the concern that my findings will be coming from a single source or perspective and thus I am increasing credibility of the present research (Meriam and Tisdell, 2015, p.245).

The second way to increase the validity of this study is the strategy of adequate engagement in data collection. This strategy addresses the question of how many people should be interviewed to come as close as possible to the participants' understanding of the phenomenon under question (Meriam and Tisdell, 2015, p.246). One way to know

that I have collected enough data is by noticing that the data feel saturated. That is, I am getting the same information over and over again. According to Meriam and Tisdell (2015, p.248), *"Adequate time spent collecting data should also be coupled with purposefully looking for variation in the understanding of the phenomenon"*. So, I will purposefully look for other ways to understand the phenomenon under study.

Another way of demonstrating my integrity as a researcher and thus, promoting the credibility of this research study is by making the reader aware of my position as a researcher, a concept called reflexivity. This means that I will make the reader aware of my own assumptions and worldview which affect this research study. Thus, the reader will be able to understand how I reached the interpretation of the data (Meriam and Tisdell, 2015, p.249).

3.4.2 External Validity and Transferability

External Validity or generalizability is concerned with whether the results of a research can be applied to similar situations. Even though generalizability in its original statistical sense does not apply in qualitative studies, what makes sense according to Meriam and Tisdell (2015, p.256) is the better placed term of "transferability". The concept of transferability is concerned with whether one research study can be applied to similar cases. However, the responsibility of finding out whether the findings of one study are applicable to another situation lies mostly on the reader. Nevertheless, the researcher writing the original study has to give as much detailed information as possible about the context of the research, in order to provide the readers with better means to judge for themselves about the transferability of the study (Meriam and Tisdell, 2015, p.256). One way to achieve this is by providing a thick or rich description of the study's setting and its findings. Thus, I provide a detailed description of the research setting and its participants, while also providing adequate evidence of the findings by bringing in quotes from the participant interviews (Silverman, 2015, p.285; Meriam and Tisdell, 2015, p.257).

3.4.3 Reliability, Dependability and Consistency

Reliability is concerned with the question of whether one could reach the same findings if done the research in the same way. This notion doesn't fit well with qualitative studies, because every individual is different from one another, and to further fortify this point, the same individual may be different from time to time. As Meriam and Tisdell (2015, p. 250) put it, *"there is no benchmark by which to take repeated measures and establish reliability in the traditional sense"*. If reliability then is not appropriate for a research with interpretive philosophical assumptions, the question to ask is how consistent are the results with the data collected. That is, to convince the reader that given the data collected, the findings are sensible (Meriam and Tisdell, 2015, p.251), which is addressed by the concept of "dependability" or "consistency".

3.5 Ethical Considerations

This research study takes place under strict rules of ethical conduct (Lichtman, 2010, pp.54-57; Silverman, 2013, p.161). These rules governing my behaviour as a researcher

could be epitomized in the intention to *"do good and avoid evil"* (Lichtman, 2010, p.54). Specifically, this research follows the principles listed and explained below:

- Do no harm

  The cornerstone of the professional conduct under which I operate as a researcher is the active protection of the research subjects from harm. Since this is a qualitative study using semi-structured interviews, no physical harm is expected to threaten the participants. However, I will constantly be alert for adverse reactions, and if encountered, the interview will stop immediately (Lictman, 2010, p.54). Also, this research will be conducted so that the interests of the participants will not be damaged because of it.

  Finally, special attention will be given in the way my research will be communicated in order to avoid misunderstandings of the results or the use of them from third parties against the interests of the participants (Silverman, 2013, pp.162-163).

- Protect privacy and anonymity

  In this research the privacy and anonymity of both the convenience store that uses this specific IT-artefact and the participants' will be protected. Identifying information about the users and the convenience store will be discarded, and the data collected will not be accessible from the general public. Caution will be exercised to avoid any indirect way that could make the identification of the participants or the organization possible (Lichtman, 2010, pp.54-55).

- Protect confidentiality

  The information extracted by the data collection will be kept confidential (Silverman, 2013, p.162). The recorded audio and the interview transcripts will be kept under my protection in my laptop which can be accessed only by me, my supervisor and my examiner. Both transcripts and audio recordings will be erased when they are no longer of use.

- Have informed consent

  Participants will be fully informed about the intention of this study, the methods that will be followed and how this research could be used. Participants will also be informed about the consequences of their participation in this research study and whether risks are involved in it (Silverman, 2013, p.162). This information will be provided in written form and the participants' signature will be asked for. The main motive behind this principle is to *"conduct research openly and without deception"* (Silverman, 2013, p.162). The users will be also informed that they can participate on their own free will and that they will be able to withdraw whenever they want with no consequences (Silverman, 2013, p.162).

- Avoid intrusiveness and inappropriate behaviour

  Caution will be exercised in order to not intrude in the time, personal space or personal lives of the participants. Estimating each interview to take 45-60

minutes, and informing the participants about the time needed for their participation is to ensure that I will not be intrusive regarding their time. The interviews will not be conducted at the participants' personal space, unless the participant wants to. This is to avoid intrusiveness on the participants' personal space. Regarding the personal lives of the participants, care will be taken, to any extent possible to me in order to not discuss sensitive for the participant subjects. (Lichtman, 2010, p.57). Regarding inappropriate behaviour, treating all participants with respect is the first priority.

- Data interpretation

  Data analysis will be conducted with the best possible effort to avoid misunderstandings, misinterpretations and fraudulent analysis (Lichtman, 2010, p.57). It is expected that my own conceptions and beliefs will influence the interpretation of the data collected. However, data interpretation will be conducted with the intention to only describe what is revealed by data and not try to present a picture not evident in it (Lichtman, 2010, p.57).

Chapter 4

This chapter presents the analysis process adopted. Firstly, section 4.1 discusses the process taken to analyse the gathered data and the type of analysis used, which was thematic analysis. Through the identification of patterns and key themes within the data collected, I will try to make sense of the views of the participants in regards to the User Experience of the device under study. The next section 4.2, presents the findings which emerged from the data analysis and the identified themes and key concepts.

4 Analysis of the Empirical Material and Findings

4.1 Analysis process

The present research study used a thematic analysis in order to 'make sense' of the data collected (Lichtman, 2013, p.243). Through this, it was identified that the rich amount of data collected by the respondents' answers, could be analysed in a concise manner and retain the vast amounts of information gathered via interviews. Thematic analysis through the close reading of texts offers the researcher the opportunity to discover patterns (Thomas, 2006, pp.241-242) between participants' views through coding and categorizing (Lichtman, 2013, p.248).

Firstly, the recordings were copied into a laptop, played back and transcribed. The transcripts were then printed and each one was studied carefully. Occasionally, the recordings were played back in order to hear the tone of voice and the way participants were responding (e.g.: rhetorical questions) as this could act as additional findings in such research were face-to-face interviews are carried out (Ozdemir and Koc, 2012, p.116).

After these preparatory steps, the first stage of the analysis process, the coding, took place. Each of the transcripts was read more than once, and during this process, words, phrases and sometimes chunks of text were highlighted, under the condition that it was relevant to the research questions. Besides highlighting, additional notes were made next to the responses where it was of interest to discover key concepts and the responses associated with them. For example, one of the participants referred to the device as convenient because it saves him time from queuing. The word convenient was underlined and highlighted. Therefore, it became apparent that when the interviewee was describing the device as "convenient" he was actually referring to the utility of the device and its impact on his overall shopping experience. A note was made next to that response in relation to the word 'convenient' and what this was related to in order to identify key concepts and patterns within the transcripts and between participants' responses.

This process was carried out in an iterative manner, until no new codes were emerging. The identified codes for each participant were copied on a new page by hand. Meanwhile, codes were renamed or checked for redundancy. Through this filtering and sorting process, 20-25 categories/themes were identified among the participants. While checking for redundancies, filtering and sorting codes into categories, I counted the frequency of each theme identified in the participants' responses to different questions by each

participant. This procedure gave me a clear picture of the importance of each concept for each participant and also helped me identify patterns between their interviews something which led to the identification of the key concepts. For example, in every participant's interview, codes relevant to the concept named "Organizational Context/ IS" were found. I also had a clear picture of how many times a participant had referred to the same concept.

It became apparent that common responses were being repeated by different participants, in the similarity of words or phrases used. For instance, the device was seen as time efficient by all participants, as it was described to "save time". Saving time was relevant to the impact this device had to the participants' overall shopping experience, so it was always lined to the category/theme of "Utility". Thus, "Utility" became an obvious theme. The identification of patterns, codes and themes was seen as crucial in the study as through them a greater understanding of User Experience, as perceived by the users, can be gained. The key concepts that were identified through the participants' responses show which factors of User Experience are considered important or desirable by the users, and also how the same users perceive User Experience. This knowledge can add to existing findings in regards to the factors that are key in relation to experiencing such devices. This will lead to a better appreciation of how experience can affect emotions towards such a device.

4.2 Findings

The analysis process described in the previous section revealed several key themes relevant to User Experience which kept coming up through the interviews. Some important factors for User Experience, which came up through the analytical process, were not anticipated. Nevertheless, these key themes make some very interesting findings. Hence, this section will present the findings that emerged from the analysis process, along with some themes which, even not being popular among the participants, still give some interesting insights to User Experience.

Six key concepts were identified:
Key concept 1: Utility,
Key concept 2: Organizational Context/Information System,
Key concept 3: The feeling of control,
Key concept 4: Errors/Malfunctions,
Key concept 5: Usability & Practicality, and
Key concept 6: Personality

All participants used positive words to describe their experience using the Handheld Laser Barcode Scanner. For example, when participant 2 was asked to share her opinion about her interaction with the HLBS she responded: "*I think overall it is a quite pleasant experience because it is easy to use and quick*". And, when she was asked to describe her experience with the HLBS using only a few words she responded with "*pleasant, exciting, enjoyable*". Another participant, when asked the same question, used the words "*enjoyable, fast and efficient*". In another question participant 3 stated that he "*would never go back to using the cashier…never*".

4.2.1 Utility

The first key concept identified in all the participants' interviews was the concept of Utility. Utility, also described as usefulness, is concerned with the impact that an IT-artefact has in a human activity system, in terms of being the right tool for the job. In other words, Utility has to do with whether individuals find it helpful when using it to perform a task. In this particular occasion, the first thing each of the participants referred to when asked to share their thoughts on the particular device under study, was the concept of Utility. In addition, the same concept kept coming up by the participants, in a positive manner, throughout the whole interview. For example, participant 4 was asked why she prefers to use the HLBS when shopping. She responded:

> *"Because then I will know how much it will cost, so if it is too expensive then I can remove it from my basket or change it"*.

Later on, when asked to share her opinion on her interaction with this device, participant 4 brought up the concept of utility again:

> *"…I think it makes my grocery shopping very smooth"*.

When participant 2, who had used this device for the first time earlier in the same day, was asked if she found it easy to use she responded:

> "*Yeah, I think it is really convenient. Especially I like the part that I can know the price… I can know the price exactly at my device, and I think it is good for controlling my budget*".

The same reaction was noticed by participant 5 who responded in a similar manner when asked about his interaction with the HLBS. His exact response was:

> "*I think that it is quite convenient that you first of all see directly the price that the product costs. For example, if it is a product that is priced by the kg or gr and more if there is a discount and, of course, the total amount that I have to pay…and apart from that… I don't have to stand in the queue…at the cashier desks… I can directly go to the machines and type in my pin code of my credit card and pay"*.

The machines mentioned in participant's 5 response refer to the check-out terminals which a user of the HLBS has to use in order to pay for his wares when completing shopping. The check-out terminals are another IT-artefact utilized in the organization's IS, and they are a part of the second key concept that was discovered in the empirical material, the "Organizational Context/ IS".

Another participant 3, when asked to share a definitely positive experience he had using this device, also referred to the concept of utility. He answered:

> "*…when I was shopping for a big dinner for my wife's family I felt like doing all the shopping manually...without the device it would be so much more work. I would be in the store for like 2 hours collecting all that*".

Utility also appeared as a desired characteristic of UX for future improvements. Participants 2, 3, and 6 proposed improvements that included features of this device which would further boost the efficiency of the overall shopping experience. Participants 2 and 3 had the same idea which was to connect this device to their bank account so that they would not have to use the check-out terminals. Specifically, when participant 2 was talking about her idea of this device being more like a watch or a bracelet, she later on added:

> "*I think in the future this bracelet, maybe, if I do something, it just connects to my credit card, I just press some buttons and I don't have to go to that checking point. I just go out".*

Participant 3 desired the same feature of this device:

> "…*what I would want is a personal handheld 'thing' that is connected to my bank so I could go in, and put my things in the check-out without swiping a card or something*".

Participant 6 would like a feature in the HLBS which would better help him in his shopping in another way:

> *"…maybe the software could bring up with a few buttons the discounts of the week, because you don't always see everything in the store".*

4.2.2 Organizational Context/ Information System

Another key concept which played an important role in the perception of UX for the users was something I described as "Organizational Context/IS". Specifically, even though this concept is not directly relevant to the device itself, it seriously affected the users' perception of UX regarding the device under study. With the term "Organizational Context/IS" I am describing the external factors relevant to the Information System of the organization which utilizes the HLBS. These factors could include the staff, promotional strategies the store utilizes, or other IT-artefacts which influence the UX of the HLBS. One example when the "Organizational Context/IS" affected the overall UX of the device in a negative way was described by participant 6. Participant 6 was very positive about the HLBS. When asked to describe his experience with this device, his response was:

> "…*mostly positive*".

While in a question regarding his opinion of his interaction with the device he replied:

> "*Very nice…"*. However, when asked if he prefers using the device his answer was "*I used to before*", and when asked to elaborate on what happened he explained:

> "*I was a little sloppy with scanning and there was a control issue and there was a difference between what I had scanned and what the total sum was and since then they kind of control every time I use it, so I don't save time at all. So, I stopped using it* ".

Another participant, participant 3 has brought up the same issue. Specifically, when asked to share his opinion about his interaction with the HLBS he answered:

> *"I have two opinions really. The first times I used it I always got stopped and checked...for like about 30 times in a row. So I was like "this is taking longer time than going to the cashier"...so...at first I really didn't like it, but when that didn't happen every time, I started to really like it".*

Later on, when asked to describe a negative experience with this device, the same issues arose:

> "*…every time I got stopped in the control. Since I don't really think staff at stores has a course or something in customer relations, they are always acting like "you are a thief or something"… and I think it is really bad".*

He also talked about the difference that can be noticed between different stores. More specifically, he said

> "*...the big problem is the different routines for this check-ups in the different stores…and if you do that in (brand name) you are going to stand there for 30 minutes*".

Participant 3 also provided insights in how technology, relevant to the device under study, could influence its UX. Specifically when he was asked if it was easy for him to use the HLBS for the first time he responded:

> "*…yeah, it was very easy to understand the handheld device. The thing I had problem understanding is the check-out as that User Interface wasn't really developed just yet*"... "*...it is not easy enough to use it yet*".

Another example of how other IT-artefacts may negatively influence the UX of the device under study is the experience described by participant 1. Specifically, he mentioned that:

> "*I think it was because they hadn't added the product, and that they have a data base, so it (the product) didn't come up; and therefore needed to be done manually*".

In other occasions, Organizational Context/IS was found to also influence the users' perception of UX in a positive way. In this occasion, users would perceive errors as less serious because of the very good assistance they received from the staff of the store. For example, participant 4 encountered a malfunctioning device when shopping. She said:

> "*…one device was freezing one time. It stopped working. So, I got help with that"*.

In the follow up question on whether she thought that this error was serious, she responded negatively. However, later on, when reminded that she had to seek help to resolve this, she responded:

> "*…yeah, it was serious because I couldn't solve it by myself. But it was solved very quickly and the things I had already scanned were still in the device*".

Though, at this point, it would be interesting to note that in the follow up question of how would she feel if the list in the device was lost, she answered:

> *"I would have been irritated. I am not sure if I would have done it again"*.

This is relevant to another key concept, the concept of "Errors/Malfunctions", which will be described later in this chapter.

A similar response was also expressed by participant 1 referring to the occasion when the users: *"haven't scanned the things properly"*. He added that:

> "*Luckily the shop we live nearby, always has a helpdesk which is open for this kind of things. So it was easily resolved"*.

Another occasion where the "Organizational Context/IS" affects the perceived User Experience of the HLBS is the promotional strategies deployed by the stores. Participant 6, when asked to share a positive experience using this device, said among other things:

> "*…also…when using that thing (the HLBS) sometimes you have a special discount just for using it*", "*...but sometimes this thing unlocks some discounts as well, but this is more towards (brand name)… they really use this device as like a special member thing*".

4.2.3 The feeling of control

The key concept of "Control/Empowerment feeling" illustrates the users' feelings when interacting with the device. In almost all cases the words control or empowerment were used. While, in other cases similar words such as "freedom" were used. The same feeling was also described with phrases such as "*you just feel more in charge of your shopping trip*". This was participant's 1 response when asked to elaborate on what he meant with the description of his experience as "enjoyable".

Participant 2 used similar words and expressions when asked to describe how she feels when using the HLBS. She responded:

> "*I like the feeling of...kinda…like I am controlling it", "…so, I am in charge of my things…so I know exactly what I am doing So, I like it anyway"*.

A similar description was expressed by participant 4 when asked the same question. Specifically, she said:

> "*I really like to be in control and know what is happening and have everything very easily...put…very structured…", "…it gets me very calm when I use it because I can see directly what's happening on it".*

Participant 1 used different words to describe the same thing. He used the word empowerment, and when asked about feelings that come to mind when using the HLBS he answered:

> "*…honestly, the first feeling that comes to mind would be empowerment...that I am able to do this by myself…I don't need anyone else's help. This allows me to*

do it on my own if I so choose…and, I think, empowerment and convenience are definitely two keywords for me in terms of using that device".

This feeling of independence and control over the shopping experience was also described by participant 3, when he was asked if he became more efficient and quick when using this device. His answer included the words:

> "*I felt a sense of freedom while shopping.... I am free to do whatever I want…shop whatever I want"*.

Participant 6 also used similar wording when discussing a negative experience:

> "*…the store gives you, the user, a lot of responsibility and power"*.

4.2.4 Errors/Malfunctions

Another factor that appeared to influence the perceived UX was the encounters with errors or malfunctions of the HLBS. Usually associated with experiences which were coloured negative by the participants, malfunctions and, in some occasions, errors by pushing the wrong buttons appeared in almost every participant's stories.

A malfunctioning device led to one of participant's 6 negative experiences. When he was asked to share a negative experience that he had with the HLBS, he answered: "… well as mentioned before, when I didn't use it properly, and it was malfunctioning and things like that…". Earlier in the interview he had explained how this device was malfunctioning:

> *"…it was that...there is a "minus" thing where you remove…. The thing is the device itself when scanning…it always scanned twice...for some reason...I don't know...and then when I removed stuff I tried to remove only one but it removed two instead…I don't know...it was a broken device"*.

When asked for any suggestions for improvement, he also mentioned another malfunction:

> "*…sometimes the software inside is not keeping up with the device I suppose. One time I unlocked this device and it was just showing a blue screen… so I had to change*".

This comment hints that one of the desired characteristics of UX regarding the use of these devices is safety from errors. The same opinion was expressed by participant 2, who didn't encounter a malfunction of the device but rather a button pushed by accident:

> "*I remember it showed up some random things like the information about a product…but I…we didn't have to do it because it just showed up randomly and I don't know what happened"*.

In a follow up question, she was asked if she thought that it was a serious error. She replied: "*yeah…I think that if they improve it, that would be better*".

Participant 4 also associated negative experiences with a device malfunction. When asked to describe a negative experience she had with the HLBS, she replied:

> "*I think the only negative I' ve been experienced was when the device was frozen, when it was an error…I think that is the only negative…*".

However, it should be noted that device malfunctions don't have the same impact on every user's UX. Participant 3 encountered an error that could be seen as serious:

> "*the first times I was pressing all the buttons to test the system out*", "*I went into the system's DOS mode…so I pretty much crashed the first device I had"*, "*I lost all the data I collected from…beeping"*.

The system's DOS mode is the most basic interaction mode with any device, including personal computers, where the user can only write commands to the machine. People used to interact with computers using the DOS mode in the early 90s. When he was asked if this discouraged him from using this device he said "*no",* in contrast with participant 4, who would have possibly not repeated the process of shopping again. A possible explanation for this was that maybe participant 3 thought that this error was justified. Earlier, when discussing the same error, he was saying:

> "*I was trying to do something else from what was meant"*.

Another factor that might influence the perceived severity of an error would be the individual herself/himself. In addition to participant 2, participant 5 also had encounters with buttons pushed accidentally, even more than once:

> "*I usually have the device in my jacket and sometimes a button gets pressed there*", participant 5 said.

He, however doesn't seem to find these errors as serious as participant 2, as he later on explains:

> "*…but, then, I think it just shows you…you press another button and it just shows you… I don't know the price…the grams or some information about the product too*".

When asked if he thought that this error was serious he replied negatively. This different way that errors are perceived by different users also hints that UX as a whole is also affected by the individual using that device. This concept, the concept of "Personality", was discovered in the empirical material gathered. I will present the concept of "Personality" more thoroughly later in this chapter.

4.2.5 Usability & Practicality

Practical issues seemed to influence every participant's perception of UX. It also became apparent that they are also frequently brought up in the suggestions for improvement given by the participants. This key concept was expressed through various ways, with three main key issues related to it standing out. These issues were "Handheld

Practicality", "Simplicity of the Interface", and "Device Features" which will be presented separately in this subsection.

4.2.5.1 Handheld practicality

It seems that one of the major issues most of the users had with the HLBS was the fact that it was handheld, and they had to hold it. This creates some practical issues according to the users. When participant 5 was asked if he remembered any negative experience when using the HLBS, he answered:

> "*I usually use the shopping basket, the one that you can roll on the floor and you have one hand pulling that behind you and on the other hand you have the device, and then you don't have any hand left to get the product off the shelf…and even if you have one hand free it is hard to open the door from the cooling thing…and I think it is more convenient if you have both hands free to get the product out".*

Later on, he (participant 5) described another negative experience related to the same concept:

> "*…as I said, I usually put it in my jacket and then I had to put them in my bag because it was full and the device couldn't fit into my pocket anymore…and that is a negative experience I had…and it also happened to me when I had a hat in my jacket…I put the device inside and at one point it fell out on the floor*".

Participant 4 also considers the same matter of practicality as important. She prefers using big shopping carts when shopping because they have a holder for the device:

> "*…it is easier to use it if I have this shopping cart...you know the big one with the wheels because it has a holder for it (the device)".*

When asked if there would be a problem if she didn't have the cart she replied:

> "*…then you have to hold it in your hand instead, you cannot check your shopping list and put down your groceries at the same time*".

The matter seems to also be important in her future UX with this type of device, as when asked for any suggestions for improvement, she said among others:

> "*I think it is quite big. So, I think it could be made smaller…but then it would not fit in the holder".*

So, it seems that he holder is important for her because she doesn't want to hold the device while shopping.

Participant 2 expressed another improvement related to the same issue:

> "*I hope that in the future maybe this machine can be smaller…like more…I think it is still too big…maybe like the size of a watch", "so it is easy to carry…I don't have to hold anything".*

4.2.5.2 Simplicity of the Interface

Complex interfaces, including the Graphical User Interface (GUI) or the button layout, appeared to influence how UX was perceived by the participants. When participant 1 was asked to share his opinion about his interaction with the HLBS, he said among others:

> "*I do think it is a good device, it is very convenient for its actual purpose. However, I think that, some of its design is really counter-intuitive. You don't really know what they do, some of these buttons".*

He was asked to elaborate in the follow-up question, so he further explained:

> "*The thing is that it is easy to use it, but it is a bit difficult to edit…so let's say you picked a product which you don't want anymore. You don't know which one of the buttons to the sides is the one to remove. So it is a little bit of distraction there…and that can be a little bit discouraging when you are a new user"*.

His feelings towards the complexity of the interface were revealed even more, when participant 1 was asked if his willingness to use this device would be influenced if it had more buttons and a mistake was easier to be made. His reply was:

> "*Absolutely...If I don't know the device well enough to use it properly and without a high risk of error…that would definitely dissuade me from doing it, no matter how great the potential convenience benefit would be, cause I need to know what I am doing before I am doing it*".

The same issue was brought up by the same participant, participant 1 when asked for any suggestion of improvement:

> "*…absolutely the interface could be made more clear...just you know… maybe some more description regarding what the buttons do…those to the side".*

Participant's 4 UX seemed to also be influenced by the device layout, this time in a positive manner. When asked if it was easy for her to learn how the device works, she answered:

> "*I think it was very easy because there are very few buttons…and it felt natural. I think that the remove button was at the right…and the add button was in the middle…so it felt natural. So it was very easy to learn".*

In a follow up question, she was asked what would be her opinion if the device had more buttons, or if it was more complicated. Her answer sheds some light on the feelings this would provoke:

> "*I would be a bit…. not frightened…but I wouldn't be as happy to use it if it had more buttons…because it kinda feels secure that I can't do much wrong with it now", "there are so few buttons I can't really do something wrong with it, but if there were more buttons maybe…I don't know what the functions would be, but maybe, if it was an on/off button, then that would make me insecure, then maybe I would press that one, and then I will not know what to do".*

The same question was given to participant 3 regarding his opinion about the device if it had more buttons. He responded with:

> "*That there is a button too much. Or two rather...it is confusing having buttons that don't have a use for the end user*".

Removal of the unnecessary buttons, and therefore a simpler interface, was also proposed as an improvement by participant 3:

> "*…and removal of the unnecessary buttons since I would think you could enter the system, or the operating system through connecting it to a hub or something, so I don't know why that is needed at all*".

4.2.5.3 Device Features

The third key issue that was related to the key concept of practicality is concerning the features of the device. Most of the participants shared suggestions for improvement of these devices which included upgraded features of the device. Participant 3 argued that the screen, and therefore the font, of this device should get bigger because then it would be easier to read, especially by people with problems in sight:

> "*I proposed a bigger screen and with the bigger screen I proposed also a bigger font since those go hand in hand…because people with…not so good vision or sight…. could really benefit from it being more clear…and making the final price of all the products a little bigger than the rest of the fonts*".

In his response, participant 3, proposes two improvements, both relevant to features of the device that would help with practical issues. The second improvement proposed, seems to have to do with how easy will be for the user to find more easily the total price when checking the device.

Participant 4 suggested other improvements, all regarding the features of this device and all related to practicality:

> "*I would like to choose if the groceries could be put in alphabetical order in the device, it would make it simpler for me, so I would like to have that choice*",
> "*I think that it could be also made better with more colours…like vegetables are in green or something".*

Another suggestion for improvement that participant 4 proposed has also an impact in practicality. She proposed a touch display for this device. Among other reasons why she would like this feature on the device, she also explained:

> "*I think it would be easier to scroll the list in that display, it could be faster*".

4.2.6 Personality

The last key concept that emerged during the analysis process, is the concept of "Personality". When analysing the empirical material, it became apparent that the UX of

each participant, was influenced by the participant's personality. Already, two examples have been mentioned when discussing the previous key concepts. The same error encountered by participant 5 and participant 2, an accidentally pushed button, was perceived differently by them in terms of severity. Participant 3 in contrast with Participant 4, who would theoretically abandon the shopping process, was not discouraged by a device malfunction that led to a loss of the list of bought items.

The impact that personality has to UX can be also noticed in participant's 3 answer when asked why he felt curious about using this device:

> "*…to me all types of technology create some type of curiosity but this device created real curiosity as I love to cook food and I love to shop food…so this really picked my interest".*

Participant's 3 love for cooking and buying food, a personal interest of his, enhanced the already existing feeling of curiosity towards technology.

Participant's 1 personal interests, including leisure time activities, were apparently affecting the UX of the HLBS. This time in terms of how easy was it for him to learn this device and become efficient using it. Specifically, he said:

> "*It was quite easy…but then again I am grown up near devices…I have been…you know playing on consoles and computers. So, electronic devices for me is really second nature.*"

Participant's 1 accumulated experience on using electronics, made it easier for him to become efficient with this device according to him.

Participant 2, when asked about who she would think that would benefit from using this device, answered:

> "*Anyone who loves technology*" and she later on explained: *"they would be happy using new technology and seeing it improving"*.

Participant's 4 taste in technology in conjunction with her ideas of modernity seem also to influence the desired characteristics of UX. As mentioned before, when asked for improvements she requested, among others, a touch display. In addition to the practical reason presented in the relevant subsection before, she also gave two other explanations as well:

> "*I think because I always like touch display*", "*I think it is also because it would feel more modern, because usually we don't push buttons today…we always have touch screens on everything, so actually that is one of the few buttons I push except for my keyboard to my pc*".

Participant's 4 preference to touch screens and her personal beliefs that all technology should be feeling like modern, are apparent in why she requested the specific improvement.

The key concepts identified through the analysis of the empirical material illustrate the users' perceptions of the current use of Handheld Laser Barcode regarding User

Experience. Through these key concepts and also through the suggestions for improvement provided by the participants, a list of the desired characteristics of UX was derived in order to direct the design of the handheld devices towards a more human-centred approach. Additionally, the interdependence of the users' perceived UX factors and their desired characteristics became apparent through the analysis process. The factors and desired characteristics which emerged as findings, give a clear picture of the social expectations relevant to handheld IT-artefacts.

Table 3 presents the top factors that influence UX which were drawn by the users' perceptions. Table 4 presents the desired characteristics of UX according to the users.

Table 3: Key factors influencing UX

Key factors affecting UX
Utility
Organizational Context/IS
The feeling of Control
Errors/Malfunctions
Usability & Practicality
Personality

Table 4: The most popular characteristics of UX desired by the users

Users' desired characteristics of UX
Handheld devices must be useful
Seizing benefits while avoiding implications
Expectation to feel in control
Safety from errors and malfunctions
Easy to use, Hands free
Characteristics interdepended with social expectations from technological artefacts

Chapter 5

In the previous chapter six key concepts regarding the User Experience of handheld devices were identified. In this chapter these concepts will be discussed in relevance to the aims, objectives and research questions of the present research study. To achieve better coherence, the organization of this chapter is based on the key concepts that were presented in Chapter 4.

5 Discussion

The aim of this research study was to explore the users' perceptions of what makes a good or bad User Experience in regards to handheld devices. The present study was driven by the notion that the evolution of technology is greatly influenced by the social system in which it is integrated. Furthermore, the relationship of technology and society, which was described above, is bidirectional. This means that also technology influences the social expectations of it (MacKenzie and Wajcman, 1999; Gasson, 2003). Exploring the social part of this relationship was the aim of the present study. Identifying important factors which influence the perceived UX by the users was the first objective of this study. Identifying the desired characteristics of UX for these devices, according to the users, was the second objective. The findings, which emerged from the analysis process, gave answers to both research questions. In this section, the relevance of each key concept to the research questions will be presented. The research questions of this study were:

1. How do users of handheld devices perceive their current use regarding User Experience?
2. How do users of these handheld devices describe their desired characteristics regarding user experience?

Utility was revealed to be the most important factor affecting the way users understand their experiences and perceive the use through interaction with the handheld devices under study. The fact that this IT-artefact proves to be useful to the users creates positive feelings. All participants used most of their interview time talking about how useful the HLBS was, and how this made them want to use it. When positive feelings and positive experiences were associated with this factor, all participants seemed to really appreciate the usefulness of handheld devices. In regards to how users describe their desired characteristics of handheld devices related to UX, utility also plays an important part. Also, although users were satisfied with the usefulness of this device, they expressed the desire for improved utility in the future. This finding confirms that a helpful IT-artefact is a desirable aspect of UX as presented by Sharp et al. (2015, p. 22).

"you are satisfied because actually you are using this thing and it is actually helping you" (participant 6)

Another important factor which emerged as a finding is the factor of Organizational Context/ Information System. In regards to the first research question, the environment in which the User Experience was taking place proved to also affect the users' perception of their interaction with the handheld devices. The environment includes the factors which are not directly relevant to the device itself, but are stemming from the Information System in which the IT-artefact is embedded. Most of the users either referred to bad experiences, caused by the store's security policies, or good experiences such as loyalty rewarding and promotional strategies which motivated them to use the device. Other IT-artefacts which cooperate with the device under study also seemed to influence the UX, especially when making things more complicated, as for example the checkout terminals mentioned in the previous chapters. The emergence of the organizational context as an important factor of the interaction of humans with technological artefacts comes to support and justify the shift of interest in HCI towards UX. Specifically, the environment in which an interaction with an IT-artefact takes place, even though not directly relevant to the IT-artefact, is still affecting the UX as a whole (Hassenzahl and Tractinsky, 2006, p. 95).

Regarding users' desired characteristics in terms of UX when interacting with handheld devices, organizational context/IS also played a role, as shown from the suggestions for improvements proposed by the participants. Participants would like to further avoid interacting with "more technology" such as the checkout terminals related to the particular device as this made things more complicated. While, one of the participants suggested to include features in the device which would help him take a better advantage of the organization's promotional strategies and discounts. Thus, regarding Organizational Context/IS, I come to the conclusion that users would like to benefit from the organizational context while avoiding implications.

Another concept which appeared to be influencing UX and one that could be included in the emotional part of UX is the feeling of control. The feeling of control emerged as another important factor in how UX of handheld devices is perceived by the users. Users of these handheld devices felt in control of it, empowered or free to do as they please. Handheld devices offer to the users the ability to perform tasks on their own, without anyone's help, and this leads to positive feelings like empowerment, freedom, and ultimately happiness.

> *"...you just feel more in charge of your shopping trip than you normally are" (participant 1)*

Something which really caught my attention was the fact that all participants remembered instances when an error or a malfunction of the handheld device was encountered, and all associated these encounters with a broad range of negative feelings. These negative feelings ranged from mild indifference to strong insecurity or irritation, and they are affected by several other factors such as the individual's personality, the impact of this error/malfunction or by whether the user thinks she/he is responsible for what happened. Also, as presented in previous chapter, participants expressed the desire to be safe from errors or malfunction in the future. Therefore, errors and malfunctions, when met, affect

negatively the perceived by the users UX of handheld devices. This means that safety from errors and malfunctions was articulated as a desired characteristic of future User Experiences with such devices.

Moving on to another concept, the concept of Usability and Practicality was expected to be encountered in the participants' experiences. Through the interviews it became apparent that usability is an important factor of User Experience. However, the concept of Usability appeared as an important factor of UX in terms of Practicality. Usability and Practicality are mostly relevant with the ease-of-use of these handheld devices. However, this concept was expressed in various ways, including satisfaction, efficiency and effectiveness of use. And, as it concerned almost all participants, it proved to be an important factor on how users' experience their interaction with these devices.

More specifically, some of the participants were annoyed by the fact that they had to carry the HLBS while shopping or they were considering complexity of the interface as a negative stimulus in terms of UX. However, it also became apparent that in a very simple and easy to use device, the concept of usability becomes transparent. This comes to further support the claim that good usability is not enough to make a good UX, but bad usability is enough to ruin it.

Regarding the way users of handheld devices desire their UX to be, the concept of practicality and ease-of-use also played an important role. Users of handheld devices wanted to interact with devices which made technology transparent while making available all functionality. One of the participants wanted to locate her bought wares faster when looking at the HLBS, so she requested alphabetical or colour sorting of the items on screen. Other participants were not satisfied by holding in hand the device, so they desired hands-free solutions. Ease- of-use and practicality should definitely be a part of future User Experiences with handheld devices. Moreover, if possible, these devices should be hands-free.

The fact that the concepts of Usability and Errors/Malfunctions emerged as important factors of UX, comes to confirm the argument that even though good usability is not enough for a good UX, bad usability is enough to ruin UX, as Geven et al. (2006, p.79) claim. The participants expressed their desire to interact with IT-artefacts which are easier to use, but they were also displeased when they encountered an error.

Finally, another factor which has an important influence over the perceived UX of handheld devices, is the participants' personality. Personality traits like love for and familiarity with technology, confidence in using technological artefacts, or familiarity in playing game consoles might influence various parts of UX. This supports the claim that each individual experiences or perceives situations in her/his own way including interactions with IT-artefacts. That is human beings subconsciously reflect on past experiences when going through experiences in the present. Therefore, the users' perception of the current UX with handheld devices was strongly affected by their own personality.

The emergence of personality as an important factor of UX comes to provide further support to the notion of a holistic approach to UX as proposed by Geven et al. (2006, p. 80). A sum-of-factors approach to UX would make it highly possible to oversee the concept of personality and how it affects UX because the researcher would most likely focus on the parts UX consists of.

In regards to answering the second research question, the finding of the personality factor made the task of identifying desired characteristics of UX extremely challenging. However, one of the participants gave an interesting hint when she requested a touch screen as an improvement. In addition to her personal preference to touch screens, she also expressed the following argument: "*we usually don't push buttons today…we always have touch screens on everything*". This argument implies that there is a social expectation on modern devices to have specific features, in this case a touch screen. Also, according to the interpretivist paradigm, reality is a social construct, and part of our personalities is also influenced by the social world we live in. Therefore, the social world might be the place to look for clues on what makes a good or bad experience for most of the users.

In the concluding part of this chapter, I would like to mention some interesting themes which were expressed during the interviews but were not supported enough as patterns in order to emerge as findings. Participant 3, when expressing his improvement suggestions for the HLBS, mentioned the concept of aesthetics in addition to the practical improvement of bigger screen and fonts. He also referred with disgust to a silicone layer that exists in the handle of the device, which makes me assume that he would probably want this to be also changed. I find his comment quite important, as aesthetics is a factor of User Experience usually met in the relevant literature. Another participant, participant 5, was also annoyed by the beeping noise that the HLBS makes when it successfully scans a product. He was also annoyed by the beeps of the other customers. This gives me the opportunity to reflect on two things. The first one is that, apparently, the sounds a device makes affects UX, and this might also be the reason that modern pc operating systems change their sound cues, among others. Secondly, it also might refer to the concept of personality. For example, many users of this device might be wearing headphones while using it or might expect this device to make a sound, so they do not even notice.

In this chapter the findings of the present research were discussed. The key-concepts identified in the analysis process, give valuable information regarding the Research Questions of the present study. Firstly, these key-concepts represent the most important factors that affect how do users perceive UX of the devices under study. Secondly, these key-concepts are also connected with the desired characteristics that these devices should have in terms of UX. Both, important factors and desired characteristics of UX are interdependent, as shown in Table 5.

Table 5: Key factors of UX and their relevant desired characteristics

Key factors affecting UX	Desired characteristics of UX
Utility	Handheld devices must be useful
Organizational Context/IS	Seizing benefits while avoiding implications
The feeling of Control	Expectation of feeling in control
Errors/Malfunctions	Safety from errors and malfunctions
Usability & Practicality	Easy to use, Hands free
Personality	Characteristics interdepended with social expectations from technological artefacts

Chapter 6

This chapter draws conclusions on the whole research study and proposes some ideas that would be interested for future relevant researches. It also discusses the challenges I encountered while conducting this research along with its limitations.

6 Conclusions and future research

6.1 Conclusion

The research study attempted to explore the User Experience of handheld devices, used as IT-artefacts in Information Systems. An approach inspired by Human Centred Design was taken for the present study, so the perspective of the users towards the User Experience of handheld devices was the priority.

I attempted to answer two research questions which would provide better insights in how users perceive UX for these devices, and how they desired it to be. For this purpose, a suitable research setting was selected. This research setting was food retail stores which utilized a handheld device, the Handheld Laser Barcode Scanner. This device, was intended for use by the customers of the stores. Therefore, the sample consisted of six customers who had, at least once, used the device. More specifically, the purposive sample consisted of undergraduate and postgraduate students of Linnaeus University in Sweden whom their knowledge or familiarity with technology was expected to provide rich data. Empirical material was collected through semi-structured interviews, and thematic analysis was applied to identify key concepts.

Through the findings of this research study, I learnt that the users give special attention to the usefulness and ease-of-use of these devices. Encounters with malfunctions and errors affect UX of handheld devices in a negative way. Users of handheld devices want to utilize the devices' functionality without effort while avoiding malfunctions and errors. They want to interact with devices that are really helping them to complete their tasks. Users of these devices enjoy a feeling of control when using them. However, their experience is greatly affected by the Information system, in its sociotechnical sense, in which this experience takes place. Lastly, the User Experience is perceived differently by each individual as all aforementioned factors are influenced by each individual's personality.

6.2 Contributions

I believe that understanding and identifying the most important factors that make a device's use appealing to the user will add valuable empirical data to existing theory of

handheld IT-artefacts. As written in the literature review, there is a need for studies that use a holistic approach towards User Experience. The present study is an attempt to help fill that gap in existing research. I studied UX of handheld devices by not approaching UX as a sum of factors, but as a whole. The most important factors which affect UX of handheld devices, according to the users, were discovered.

Also, through the second research question, the desired UX for handheld devices was explored. The participants gave rich data in how they would like UX of handheld devices to be in the future. These findings could serve in informing similar settings, with a human-centred approach, which would be used to derive design principles for this type of IT-artefacts. Thus, the design of handheld devices could ultimately move more towards a human-centred design rationale.

Exploring how people see their interaction with this type of technology at its current form, could give some valuable insights on its design research and practices. The first step in going forward is to explore and obtain knowledge about the current situation. The part of the interview answered by the first research question helped achieve this step. After obtaining knowledge about the current situation, the next step is to understand how the situation we want to achieve looks like. The part of this study which is answered by the second research question, helped achieving this step. Also, studying user experience for this specific type of technology with a qualitative approach using HCD as a theoretical lens is something new that could inform following researches.

Additionally, designing devices that achieve a better fulfillment of the users' expectations is expected to increase user satisfaction and usage of this specific technology, resulting in several positive outcomes like increased Return on Investment (ROI) to respective stakeholders, better integration of IT-artefacts of this specific class to the organization's IS and, last but not least, a much more pleasant user experience.

Finally, the empirical material was generated by a multicultural sample. For me, the researcher, it was fascinating how people from different places and societies, had similar views and even used the same words when describing their experiences with the device under study.

6.3 Limitations and Challenges

Writing my master thesis taught me several things in addition to the concepts of Human Computer Interaction, Human-Centred Design, User Experience and Usability. It gave me a solid experience of how research is conducted, including how to review and manage literature, how to generate good empirical material through interviews, and how to make sense out of a large amount of data. Also, when started writing my master thesis, I was mostly interested in the concept of usability. Reviewing the literature and conducting my own research gave me a solid proof that the world, academic and business, has moved on to the broader concept of User Experience which includes also Usability.

One major challenge that I faced when trying to generate empirical material, was exploring the part of User Experience which involved feelings and emotions. During my first two interviews I realized that asking my participants directly to describe their emotions did not produce any results, as the participants were finding the question strange and awkward. So, I had to change the way I was phrasing my question, and when not understood, I had to form it on the go, a task which required tremendous concentration.

Also, the participants of this research study were all roughly in the same age group, as they were students of Linnaeus University. Three out of six of my participants, during the interviews, expressed concerns about older people who are not that much familiar with technology. In our days, elderly people are a special group when it comes to interaction with technology. However, they are not represented in the present study.

This research study was written and conducted in English while living in the country of Sweden. The language used for the present study was not the native language of any of the participants and neither of the researcher. This created minor challenges in communication with my participants and put barriers in approaching other potentially interesting participants such as the elderly population.

Another limitation of this research study is the fact that all participants found the selected handheld device as simple and easy to use. This made the task of identifying usability factors more difficult because good usability is transparent, and the users do not notice it, in contrast to bad usability.

6.4 Suggestions for future research

As mentioned in the previous subsection, elderly people are a group of special interest when it comes to interacting with technology. The digitalization of several services and the rapid integration of technology in our lives, might make these people feel left behind. In the present research study, this age group is not represented by any participant. However, the age group of elderly might have additional or different expectations from experiencing handheld devices than younger people. I believe that a research using the same approach on the specific age group would provide very interesting findings.

Also, this research study focused only on a specific type of handheld device, utilized in a specific organizational context. Other researches, using the same approach in different handheld devices used in different contexts, could help completing the puzzle of understanding User Experience for handheld devices.

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Appendices

Appendix A. Interview Design

The interview design is written in this part (adopted from Galletta, A., 2012. *Mastering the semi-structured interview and beyond: from research design to analysis and publication*. New York: NYU Press. [e-Book] Available through: Linnaeus University Library Website <http://lnu.se/ub> [Accessed 7 March 2016].)

Before starting the Interview:

Hello, my name is Efthymios Platanias and I am conducting a research for my thesis in Linnaeus University. Thank you for agreeing to participate in this interview. Before we begin please read this consent form and sign if you agree (give consent form to the interviewee).

This research study is about exploring the users' experiences when interacting with technology, and specifically when using the Handheld Laser Barcode Scanner when shopping at the convenience store. Additionally, I will explore the users' desired characteristics of these handheld devices. I assure you that, the contents of this interview will be accessible only by me, my supervisor and my examiner, and that this data will be handled with the outmost confidentiality (explain why I chose the participants).

I would also like to ask for your permission to audio record this interview.

Before starting the interview, would you like to ask any questions about what I said?

Opening segment: Introducing the interviewee to the focus of the interview with open-ended questions to elicit storytelling and capture the meaning that the interviewee gave to her/his experiences with the handheld device. It is also intended to create comfort and set the stage for follow-up questions. The purpose of this segment is also to answer the UX part of the interview.

1. Could you please introduce yourself by stating only your first name, your status (undergraduate or postgraduate student), and how many years have you been studying at Linnaeus University?
2. How many years have you been staying in the Kronoberg region, and specifically in the city of Växjö?
3. Do you usually do your shopping from food retail stores by yourself?
4. How often do you visit the food retail stores of your area?
5. When shopping at the food retail store, do you prefer to use the Handheld Laser Barcode Scanner?

(At this point, I will show each interviewee a photo of the Handheld Laser Barcode Scanner)

Middle Segment:

6. Could you please share with me your opinion about your interaction with the Handheld Laser Barcode Scanner?

7. How easy was it for you to use the device for the first time? (with this question I aim to explore the learnability of the device)
8. When you are using this device after a period of not using it, how easily can you remember how to use it? (with this question I aim to explore the memorability of the device)
9. Once you learnt how this device works, how quickly did you do your shopping with it? (with this question I aim to explore the efficiency of the device)
10. Have you made any mistakes when using this device? Were they serious? How easy was it to fix them? (with this question I aim to explore the errors of the device)
11. Have you ever noticed feeling emotions when interacting with a device like that?
12. Do you remember any positive experience when using this device? Could you please provide an example?
13. Do you remember any negative experience when using this device? Could you please provide an example?
14. What do you think could be changed or improved regarding the use of the Handheld Laser Barcode Scanner? (features that need to be changed or improved)
15. Could you think of a recent interaction/example with a user who would have benefited from enhanced functions/features of the Handheld Laser Barcode Scanner?
16. How would you describe your experience with this device using just a few words?

Concluding Segment: This part is to give me the opportunity to return to points noted during the earlier stages of the interview and to work towards closure of the interview.

17. Would you like to add something else or share some additional thoughts?

(Thank the participant and give emphasis to her/his contribution to this study)

Appendix B. Consent Form

Consent form for participation in a research Interview (Adopted from: CODEX, Rules and Guidelines for research, 2016, *Informed Consent* [online] Available at: http://www.codex.vr.se/en/manniska2.shtml [Accessed 1st May 2016]).

I agree to participate in this research interview led by Efthymios Platanias from the Linnaeus University, Sweden. In this document the terms of my participation in this interview are specified.

This interview is a part of a research which aims to study the concepts of User Experience and Usability of handheld devices from the user's point of view. The current and the desired characteristics of these handheld devices will be studied through the representative example of Handheld Laser Barcode Scanners utilized by food retail convenience store chains. The data collected will be later analysed in order to identify key concepts and meanings the users of these devices share.

Regarding the terms of my participation I have also been informed about the following:

- I have been adequately informed about this research study. The interviewer has informed me adequately about the purpose of my participation as an interviewee.
- My participation in this interview is voluntary and there will be no reward for my participation.
- I have the right not to participate in this research, or to withdraw whenever I want from the interviewing process.
- I have been informed that notes will be taken during this interview by the interviewer and that also this interview will be audio recorded. If I do not agree to my interview being taped, I cannot participate in this research.
- I have been informed on how the interview material and my personal information will be handled, and I have been given explicit guarantee by the interviewer that security and confidentiality will be the first priority when handling the empirical data.
- I have read and understood the points and statements in this document. The interviewer has answered adequately all my questions, and I voluntarily agree to participate in this research.

X_____

The Participant

X_____

The Researcher