Mobile Attachment

Investigating Emotional Attachment to Mobile Devices and Services from an HCI Perspective

von

DI Alexander Meschtscherjakov

Salzburg, Mai, 2011

Betreuer und Erstgutachter	:	Univ.-Prof. Dr. Manfred Tscheligi
Zweitbetreuer	:	Univ.-Prof. Mag. Dr. Helge Hagenauer
		Fachbereich Computerwissenschaften
		Universität Salzburg, Austria
Zweitgutachter	:	Prof. Dr. Matt Jones
		Department of Computer Science
		Swansea University, UK

To my wife Caroline and my daughter Lilly-Sophie.

Acknowledgments

Above all I want to thank my family without whose support and understanding this work would not have been possible. I thank my wife Caroline who believes in me and had to bear my mood changes during writing this thesis as well as my daughter Lilly-Sophie who makes my life worthwhile. I love you!

I would also like to thank my mother and father for their support, my foster mother, as well as my wife's family. Thank you!

I am most grateful to my supervisors, Univ.-Prof. Dr. Manfred Tscheligi and Univ.-Prof. Mag. Dr. Helge Hagenauer, Department of Computer Science of the University of Salzburg. My mentor Prof. Tscheligi gave me the possibility to write this thesis and supported me from the beginning to the end of my work. He advised and guided me through all stages (including reviewing) and his advice was highly valuable. I thank Prof. Hagenauer for supporting me in writing the thesis. I wish to express my gratitude to the second official referee of the dissertation Prof. Jones of Swansea University, who gave valuable feedback.

I owe my warmest gratitude to various colleagues, who worked with me on different projects and had a huge impact on my thesis. Especially I want to thank the following colleagues and friends (in alphabetical order): Axel Baumgartner for his support in realizing the Maestro approach, for programming the CES server, and the great cooperation within the Research In Motion (in the following RIM) and A1 Telekom Austria (in the following A1) projects. Dr. Andy Fugard, who gave me friendly support during the last phase of the work, for great hints regarding mobile attachment and revising the language of this dissertation. Hermann Huber for his technical support in many studies, as well as valuable comments on the Maestro architecture. DI (FH) Philipp Losbichler for his support within the RIM project, especially in the first study and for the honor to co-supervise his thesis. DI Thomas Mirlacher for his cooperation within the RIM project, and for his contributions to the Maestro concept.

Abstract

This thesis deals with the phenomenon of people's emotional attachment to mobile devices and services. It's overall research goal is to provide insights about the nature of this bond from an Human-Computer Interaction (HCI) perspective. It coins the term "mobile attachment" to describe this phenomenon and provides a definition along with an exhaustive discussion of it. The definition claims that mobile attachment is a bond between a person's self and a mobile device that varies in strength. An extended literature review from various perspectives (psychology, consumer research, design, HCI) builds the basis for the construction of a conceptual and temporal mobile attachment model. The conceptual model identifies causes, influencing factors, and consequences of mobile attachment. Based on the definition, it argues that mobile attachment emerges when the mobile device becomes part of the user's self concept. This linkage again may be fostered when the mobile device empowers, enriches, or gratifies the user's self. The temporal model describes the rise and fall of mobile attachment over time by illustrating different phases for mobile attachment. Additionally, this thesis introduces a mobile attachment questionnaire (FeatMo), along with the concept of user behavior driven and context triggered experience sampling (Maestro) as a method for evaluating mobile attachment over time. Three empirical studies were carried out to show the feasibility of the proposed questionnaire and method and built a basis for the conceptual and temporal mobile attachment model. Finally, the thesis proposes design implications to foster mobile attachment, which in return is assumed to support a more sustainable HCI.

Zusammenfassung

Die Dissertation behandelt das Phänomen der emotionalen Bindung von Menschen zu ihren Mobiletelefonen und den damit verbundenen Diensten. Das generelle Forschungsziel ist es Einsichten über das Wesen dieser Bindung aus einer Mensch-Computer Interaktionssichtweise zu erlangen. In der Dissertation wird der Begriff "Mobile Attachment" geprägt, um dieses Phänomen zu beschreiben. Es wird eine Definition von Mobile Attachment vorgestellt, welche auch ausgiebig diskutiert wird. Diese Definition beschreibt Mobile Attachment als die Stärke eine Bindung zwischen dem Selbstverständnis einer Person und einem Mobiltelefon. Eine erschöpfende Literaturdiskussion aus verschiedenen Betrachtungswinkeln (Psychologie, Konsumforschung, Design, Mensch-Computer Interaktion) bilden die Basis für die Entwicklung eines konzeptionellen und temporalen Mobile Attachment Modells. Das konzeptionelle Modell beschreibt Gründe, Einflussfaktoren und Auswirkungen von Mobile Attachment. Basierend auf der Definition wird argumentiert, dass Mobile Attachment entsteht, wenn das Mobile Gerät Teil des Selbstkonzepts des Benutzers wird. Diese Verknüpfung wird verstärkt, wenn das Mobilgerät es versteht das Selbst des Nutzers zu etwas zu befähigen, das Selbst zu bereichern, oder das Selbst zu erfreuen. Das temporale Modell beschreibt die Entwicklung von Mobile Attachment über einen längeren Zeitraum durch die Unterteilung von Mobile Attachment in verschiedene Phasen. Weiters wird ein Mobile Attachment Fragebogen (FeatMo) entwickelt und validiert. Um Mobile Attachment über längere Zeit zu evaluieren wird die Methode "user behavior driven and context triggered experience sampling" (Maestro) vorgestellt. Um die Durchführbarkeit des Fragebogens und der Maestro Methode zu zeigen werden drei empirische Studien beschrieben. Die Ergebnisse dieser Studien bilden auch die Basis für das oben beschriebene konzeptionelle und temporale Mobile Attachment Modell. Abschließend werden Design Implikationen vorgestellt, welche die Emergenz von Mobile Attachment unterstützen.

Contents

»A cell phone is 'a pacifier for adults'.
It makes you feel connected, that you're not alone in this planet.«
Maira Kalman (Louie, 1999)

Introduction

In August 2010 my wife, my daughter and I visited some friends in Oslo, Norway. We had a great time and did a lot of sightseeing. One day we went to the Holmenkollen Ski Jump – one of the world's most famous sporting arenas – to marvel at the astonishing architecture and enjoy a wonderful view over Oslo. While I was playing with our daughter, my wife went to the toilet. When she came back she was distressed and had tears in her eyes. She reported that her loved white iPhone has fallen into the toilet! It was completely wet and did not work any more. In desperation she complained that all her contacts, photos, messages, apps, and notes (e.g., the diopter number of her contact lenses) were lost. Above all she was no longer reachable for the remaining holiday. Throughout the rest of the day, she was really upset.

In the evening I did some research on wet iPhones and to my surprise I found a lot of posts in different bulletin boards about iPhones that people lost in their toilets, in washing machines, in bathtubs, and even in lakes. Some people reported that they were distressed, others were angry at themselves. I found a lot of hints how to open and dry wet iPhones. Some people suggested to put it into an oven or plastic bag together with rice to dehumidify the iPhone (see Figure 1.1 on the following page). We did both, and surprisingly after one week in the plastic bag with rice it worked again! Although the display is brighter than it was before, my wife was very happy to have her iPhone back. This episode confirmed my belief that some people experience a deep emotional bonding to their mobile phones.

When a child is born, a special bond between the baby and its caregiver is formed. Psychologists have been studying this phenomenon and have labeled it "attachment" (Bowlby, 1969). When the child grows older it often becomes attached to different

Figure 1.1: My wife's wet iPhone in a plastic bag with rice for dehumidification

people. When it reaches puberty a very strong attachment to another person may occur – the adolescent may fall in love. Although the roots of attachment theory lie in interpersonal relationships, other forms of emotional attachment like place attachment (Inalhan and Finch, 2004), brand attachment (Fournier, 1998), or even avatar attachment (Wolfendale, 2007) have been investigated over the past years.

Another kind of attachment is the attachment people have to individual possessions and devices of everyday use. Since the beginning of human development, human beings have developed and exploited tools to enable and enrich their lives. Some of these instruments have become more favorable by their owners than others. Hence, people have developed long-term relationships with a variety of devices of everyday use – they have become emotionally attached to them. During the last years above all mobile devices like mobile phones and MP3 players have become essential parts of many peoples lives. Users have developed a more emotional relationship with their mobile phones than with any other form of computational device (Vincent and Harper, 2003).

The research in this thesis investigates the phenomenon of *mobile attachment* – the relationship between users and their mobile devices and services – from a Human-Computer Interaction (HCI) perspective. In order to develop a solid conceptual foundation of mobile attachment, it provides a definition of mobile attachment and develops a conceptional and temporal mobile attachment model. Factors that create and influence mobile attachment are identified and effects of mobile attachment on user behavior are discussed. Finally, this thesis provides methods and measurements to evaluate mobile attachment.

1.1 Motivation

No human technological inventions have been spread around the globe as fast and enduring as mobile phones. By 1999, there were approximately 500 million mobile phones in use throughout the world (Townsend, 2002). In December 2008, over 4 billion mobile subscriptions worldwide were counted (Central Intelligence Agency, 2009), with a billion new subscriptions added in eighteen months before (International Telecommunication Union, 2008, p. 38). In 2009, there were 4.6 billion mobile phone subscriptions reported (Ahonen, 2010, p. 5), which is equivalent to approximately 67.6% of the world population[1].

In comparison to this, there were an estimated 1.27 billion fixed lines and 1.54 billion Internet users at the end of 2008 (International Telecommunication Union, 2008, p. 38). Ahonen (2010) reports that in 2009 there were approximately 1.7 Internet users worldwide, 1.2 billion personal computers, 1.6 billion television sets, and 1.4 billion people with at least one credit card. More than a billion new mobile phones are sold every year, compared with approximately 300 million new TV sets or 280 million new personal computers per year. According to Ahonen (2007), compared to 4 billion mobile subscriptions in 2008, only 800 million automobiles were registered. He states that adding all gaming consoles (e.g., Playstation, Xbox, Wii), MP3 players (e.g., iPod, Zune), digital cameras, and camcorders sold up to the year 2007 will not reach a billion. Aside from this, there are more mobile phones with built in cameras than digital and analog cameras ever manufactured. To put it in a nutshell: mobile phones are by far the most bought and used technological goods ever!

This is not only true for the industrialized world but for the developing nations as well. Since the first public commercial mobile phone networks in the 1970s and the mass adoption of mobile devices in the 1990s, mobile phones have reached human beings all over the world. Industrialized countries often have reached a penetration rate of mobile phone subscribers above 100% (e.g., Russia: 146.8%, Hong Kong: 150.5%, Germany: 130.1%)[1]. Today, 30% of all mobile phone owners have two or more subscriptions (Ahonen, 2010). Regarding absolute numbers, emerging markets and new industrializing countries already overtook developed countries. China, for instance has approximately 796 million, India has 617 million, and Brazil has 183 million mobile phones in use, while there are only 285 million subscriptions within the

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[1]These number were retrieved from the Wikipedia article "List of countries by number of mobile phones in use" on July 12th 2010,
http://en.wikipedia.org/wiki/List_of_countries_by_number_of_mobile_phones_in_use.

United States[1]. The developing world is catching up. Africa has become the fastest growing mobile market in the world with 280.7 million mobile phone subscribers at the end of 2007 representing a penetration rate of 30.4%. Nigeria, South Africa and Egypt so far are the fastest growing markets (Blycroft Publishing, 2008).

Additional to the fact that mobile phones have reached every geographical corner, they are widespread throughout all social strata. The global shares in the distribution of mobile subscribers by national income classification are as follows: 16% of all mobile subscribers have a low income, 32% have a lower middle income, 21% have an upper middle income, and 31% have a high income (International Telecommunication Union, 2008, p. 39). This high global penetration rate of mobile communication devices is one motivation why research on users' relation to their mobile devices is highly important. The other reason is the specific characteristics of the mobile phone as a very special device to their owners.

For most of the more than 5 billion[2] mobile phone users today, their phones have become an indispensable and sometimes beloved part of their everyday life for various reasons. Some need it as a business tool to be constantly available and able to react immediately. For others, it provides a way of staying in contact with relatives and friends; while others use it as a status symbol or an expression of their personality. Mobile phones led to a fundamental transformation of people's perception of the self and the world. As Matt Jones and Gary Marsden phrase it:

> *"This most pervasive of devices has been used in many times of great tragedy and personal loss [. . .] in joy and excitement; and, more banally, in many simple moments of commuter boredom. It's a device that is truly a personal technology, helping people to feel safer, less lonely, more human."* (Jones and Marsden, 2006, p. 4)

Given the facts that mobile devices are used by nearly everybody, spread around the globe through all social classes, and have become essential parts of their owners make researching the attachment to mobile devices and services a challenging but also worthwhile endeavor.

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[2]On July 8th 2010 Wireless Intelligence has reported that the number of global mobile connections surpassed the 5 billion mark, and forecasted that the the 6 billion global connections milestone will be achieved in the first half of 2012 (Gillet, 2011). Graham Presland, Business Development Manager at Wireless Intelligence, told me in an email that at the end of 2010 Wireless Intelligence estimates that there were 5,389,318,220 mobile connections worldwide.

1.2 Scope, Aim and Methods

Various studies have investigated the user's emotional attachment to mobile devices from different perspectives (e.g., Vincent, 2005; Wehmeyer, 2007; Palen and Hughes, 2007) but a comprehensive understanding of this phenomenon, including a solid conceptual foundation, is still missing. Interest in exploring the influence of emotion as a major factor of the overall user experience (UX) has increased in HCI over the last decade. Nevertheless, research on the effect of user's emotional state during product handling, affecting the product's desirability and the user's emotional attachment to the product from an HCI perspective, is still in its infancy (Meschtscherjakov et al., 2008).

Consumer research has been focusing on brand attachment and its effect on marketing (e.g., Park et al., 2006a; Kleine and Baker, 2004), whereas the design community has investigated product attachment and its influence on product design (e.g., Schifferstein et al., 2003; Mugge, 2008). Both disciplines have focused on possessions or everyday products in general, including mobile phones as one of many. However, none of them has taken into account the special role mobile phones play today. Although some of the proposed assumptions and models may be applied to the mobile domain as well, so far neither causes or consequences, nor the development of people's relationship with their mobile devices has been researched sufficiently.

This thesis aims at investigating the relationship between users and their mobile devices from an HCI perspective. It introduces *mobile attachment* as the strength of the emotional bond a consumer experiences with a specific mobile device. Within the context of this thesis, mobile devices basically include all kinds of mobile information and communication technologies (ICTs). Although most parts of this thesis are applicable to all types of mobile ICTs like notebooks, netbooks, tablet computers, PDAs, MP3 players and similar devices, it preferentially deals with mobile phones and smartphones and their particular characteristics (e.g., mobility, always on, communication and information capabilities).

Concerning attachment nomenclature, in literature terms like "product attachment" (Mugge, 2008) and "possession attachment" (Kleine and Baker, 2004) are used to entitle the users tie to a product. For the denotation of emotional attachment to mobile devices, so far no expression has become prevalent. Most times descriptive expressions like "emotional attachment to mobile phones" (Vincent, 2005) have been used. Wehmeyer (2008) suggest to use the term "user-device attachment", which might also

be applicable to other user devices. I, therefore, coin the term "mobile attachment" to refer to a person's emotional attachment to his or her mobile device[3].

The overall research goal (RG) of this thesis is to broaden the understanding of mobile attachment with a special focus on HCI relevant aspects. To capture the essence of mobile attachment, a number of serious considerations have to be made. For a common understanding of mobile attachment, a definition has to be elaborated (RG1). Based on this definition, a conceptual model including causes and consequences, as well as influencing factors has to be developed (RG2). To gain a deeper understanding of how mobile attachment evolves over time, a temporal mobile attachment model has to be established (RG3). Furthermore, there is a need for an instrument to measure mobile attachment (RG4). Additionally, methodological considerations of how to evaluate mobile attachment over time have to be made (RG5). Further on, empirical studies should strengthen the understanding of mobile attachment and assessing the feasibility of the proposed models, questionnaire (RG6). These insights could illuminate how attachment influences the overall user experience and how this experience may support well being. implications can be developed on how mobile attachment can be fostered through design (RG7). Consequently, the research goals of this thesis are as follows:

RG1 Providing a definition of mobile attachment along with a discussion from an HCI perspective.

RG2 Development of a conceptual model of mobile attachment including determinants influencing the strength of mobile attachment.

RG3 Constitution of a temporal mobile attachment model in order to understand the mobile attachment life cycle.

RG4 Construction and validation of an instrument (questionnaire) to measure the degree of mobile attachment.

RG5 Development and implementation of an in-situ evaluation method to assess the development of mobile attachment over time.

RG6 Strengthening the understanding of mobile attachment and assessing the feasibility of the proposed models, questionnaire, and method by means of empirical studies.

RG7 Elaboration of design implications in order to facilitate the emergence of mobile attachment.

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[3]Within this thesis the term "attachment" mostly is meant as an emotional bond between two entities – not to be confused with an attachment in computer science, which usually has the meaning of a computer file sent along with an email.
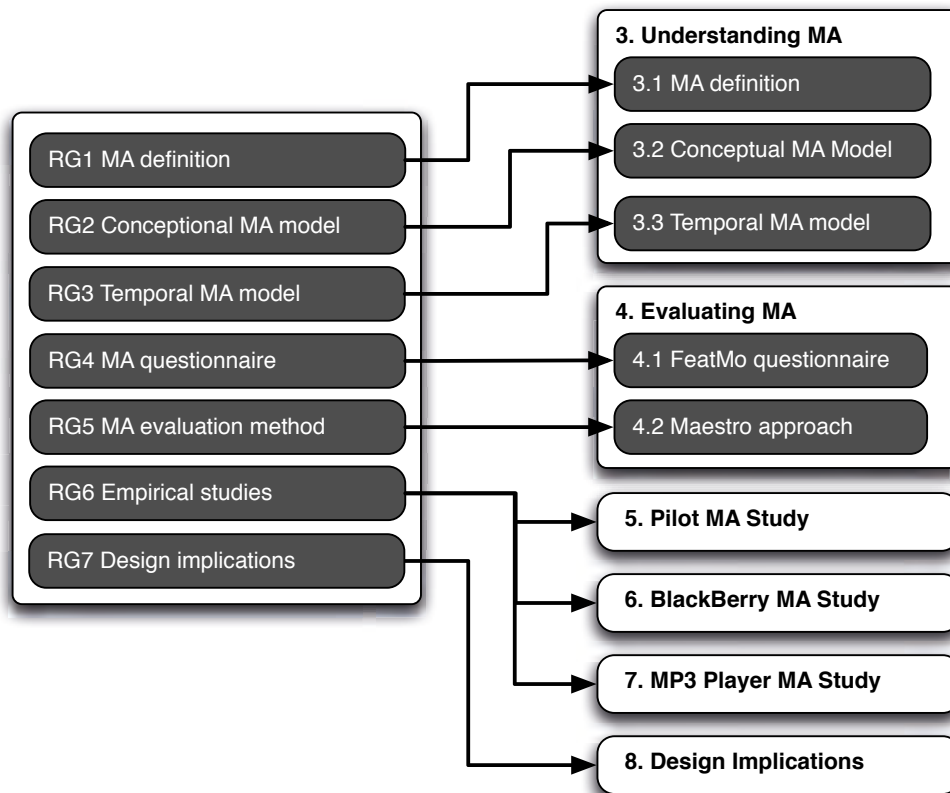
Figure 1.2: Overview in which chapter research goals (RG1-7) are addressed; MA denotes mobile attachment

Figure 1.2 illustrates in which chapter the different research goals will be elaborated. To reach RG1-RG7 and get a comprehensive understanding of mobile attachment, a thorough review of related work is necessary. First, a close look at general attachment constructs from a psychological perspective is reasonable. The primal attachment theory deals with the bonding a child has to its caregiver. It originates in the work of John Bowlby (1969) and is a psychological and evolutionary theory that provides an explanatory framework for understanding interpersonal relationships between human beings. Second, the relationship between humans and meaningful objects in general needs to be explored from various perspectives. This includes a consumer research related view on cherished products and the consumer-brand relationship, as well as a design research related view on emotional design and pleasurable artifacts. Third, it is necessary to investigate the role of attachment and related constructs within the HCI community accurately – with a special focus on user experience (UX) research. Naturally, a fourth focus has to be laid on reviewing related literature on peoples' attachment to mobile devices and services.

The review on related work will build the basis for the definition of mobile attachment, as well as the construction of a conceptual model and a temporal model of mobile attachment. The conceptual model comprises determinants and influencing factors which may affect the strength of mobile attachment together with emotional and behavioral consequences of mobile attachment. The temporal model illustrates different phases for mobile attachment. Additionally, mobile attachment will be differentiated from several other constructs (e.g., attitude, love, satisfaction). Its relationship with user experience (UX) will especially be explored.

Another focus of this thesis lies in the evaluation of mobile attachment. Based on literature, a questionnaire (*FeatMo*) as a measurement tool for mobile attachment is developed and evaluated. Since mobile attachment often evolves and changes over time, an in-situ study method is required to get a comprehensive understanding of this phenomenon. I present *Maestro* – a concept to study behavior in realistic environments based on the experience sampling method (ESM). It constitutes a variation of ESM by giving researchers the possibility to dynamically and remotely 'orchestrate' experience-sampling studies for evaluating usage behavior in various contexts. Maestro allows user behavior driven and context triggered experience sampling by using a client-server architecture. The Maestro concept has been presented in Meschtscherjakov, Reitberger, and Tscheligi (2010).

To deepen the understanding of mobile attachment and assess the feasibility of the proposed models, FeatMo questionnaire and Maestro evaluation method three empirical studies are presented. Additionally, these studies helped the construction of both the conceptual and temporal model. The first study aimed at researching users' emotional relationship with their own mobile devices and services. Therefore, we studied the experience of users when handling their own mobile devices in a one-week field study. The second study built upon the results of the fist study and investigated the emergence of a relationship between users and new BlackBerry devices. In this study the previously mentioned FeatMo questionnaire as well as the Maestro concept were used. The focus of the third study was evaluating emotional attachment to MP3 players. To address this topic we utilized an adapted version of the FeatMo questionnaire and carried out an online survey.

Derived from the conceptual and temporal mobile attachment models and the three empirical studies, I will present design implications for the purpose of facilitating mobile attachment. These design implications should not only provide a basis for mobile phone manufacturers to produce and sell more devices, but also help designers in

designing a better and longer life of products. Enabling people to have more intense experiences with products could make them keep the products for a longer time and engage in long-term relationships with them (Chapman, 2005). Since consumer-product relationship plays an important role in replacement purchases, a better understanding of mobile attachment may contribute to the discussion on sustainable HCI. Schifferstein and Zwartkruis-Pelgrim (2008) argues that from a viewpoint of sustainability it may be worthwhile to extend the life time of many durable consumer products. This is especially true for mobile devices, keeping in mind the enormous number of produced mobile phones discussed in Chapter 1.1.

1.3 Contribution

This thesis addresses areas of mobile HCI, user experience (UX) research and the topic of sustainability in HCI. It is motivated by the pervasion of everyday life with mobile devices and the increasing importance of UX within the mobile realm. So far, a thorough understanding of mobile attachment is missing. Understanding and facilitating user's relationship with mobile devices represents a fundamental issue for the mobile HCI community. This thesis deals with a special form of relationship between users and their mobile devices – the phenomenon of mobile attachment. Therefore, its main purpose is to provide an informed discussion on people's relationship with their mobile phones especially for the mobile HCI community. Providing a theoretical foundation of mobile attachment along with evaluation tools will enable designers to build more cherished mobile products. This could lead to an extended ownership, which in return could lead to more sustainability. Additionally, the emerging area of UX research could benefit from a thorough understanding of emotional attachment research from an HCI perspective. Since HCI is a interdisciplinary research field, it contributes to different research areas and the mobile phone industry as well:

1. It contributes to the research field of mobile HCI by sharpening the commonly rather vague understanding of mobile attachment. It provides a definition of mobile attachment, which can serve as a common basis for future mobile attachment research. The conceptional model helps researchers to better understand causes and consequences of mobile attachment. The conceptual model and the temporal model describe how mobile attachment evolves and vanishes. Additionally, it interrelates the attachment construct with UX research.

2. The mobile HCI community will benefit from an even deeper understanding of

emotional attachment as the insights could lead to an overall better user experience with mobile devices and services. Being emotionally connected to their mobile devices could be rewarding for the user and thus promote people's well being.

3. It contributes to methods of mobile HCI by providing a validated mobile attachment measuring instrument. The FeatMo questionnaire is capable of measuring the overall strength of mobile attachment. This thesis additionally provides, with the Maestro concept, the architecture and implementation of a user behavior driven and context triggered experience sampling tool. This tool is not only capable of evaluating mobile attachment in-situ over an extended period of time, but also has proven to be feasible to evaluate the dynamic nature of UX over time (e.g., Meschtscherjakov, Moser, and Tscheligi, 2010).

4. This thesis contributes to the field of mobile interaction design and the mobile phone industry by providing design implications with the purpose to facilitate mobile attachment with a focus on sustainable HCI. In order to develop desirable mobile devices, designers need to understand what users value on their mobile devices and where they should focus their attention. Knowledge on how experiences arise from person-product interactions can provide insights with which to design for experiences (Russo et al., 2011). People who are strongly attached to their mobile devices could keep hold of their devices longer and thus reduce the impact of these products on the environment.

5. Last but not least, the mobile phone industry could benefit from enhanced knowledge on mobile attachment for an enhanced user segmentation for means of marketing mobile services or devices (Wehmeyer, 2008). As an example, different types of mobile devices could be developed for users with high or low levels of mobile attachment. Additionally, it contributes to research on mobile advertising and its effectiveness.

1.4 Thesis Structure

Chapter 1 The introductory chapter consists of four sections, the first being motivation why researching mobile attachment is worthwhile. The second includes the thesis' scope, aim, and seven research goals as well as the methods, with which these research goals are addressed. Further on, its contribution to the mobile HCI, UX, and design community, as well as the mobile phone industry and the

users themselves is demonstrated. Finally, the structure of the thesis is outlined.

Chapter 2 The second chapter provides a detailed analysis of background and related work. The original concept of emotional attachment is described from the viewpoint of psychology. Possession and product attachment research from a consumer-research and design perspective is presented. Thereafter, attachment and related constructs in HCI are depicted. This is followed by a background section with a special focus on mobile attachment. Finally, user experience (UX) as a related concept in HCI is examined.

Chapter 3 The third chapter deals with the understanding of mobile attachment. It presents a definition of mobile attachment along with an extended discussion of implications. A conceptual mobile attachment model is developed. Causes, consequences and influencing factors of mobile attachment are elaborated. The temporal mobile attachment model will show how mobile attachment develops over time and how it ends. Finally, mobile attachment will be differentiated from several other constructs (e.g., attitude, love, satisfaction) and its relationship with UX will be explored.

Chapter 4 Within the fourth chapter mobile UX evaluation literature is reviewed. The development of the FeatMo mobile attachment questionnaire will be presented and an outlook on an improved version FeatMo2 will be given. Furthermore, the concept and architecture of Maestro is introduced. Maestro provides a method to evaluate mobile attachment over time. Finally, an implementation of Maestro on BlackBerry devices will be demonstrated.

Chapter 5 The fifth chapter is the first of three chapters that present three mobile attachment studies. The first study is a pilot mobile attachment field study with mobile phones as target objects. It provides initial insights on mobile attachment in general and on how to evaluate mobile attachment.

Chapter 6 The second mobile attachment field study had BlackBerry mobile phones as target objects. Both the mobile attachment questionnaire FeatMo and the Maestro concept are used in this study. Results of mobile attachment to BlackBerry devices and services are presented, in addition to methodical findings.

Chapter 7 The third study focuses on MP3 player attachment. The setup and results of an online questionnaire utilizing an adapted FeatMo questionnaire are presented. Additionally, conclusions of emotional attachment to MP3 players on sustainability are drawn.

Chapter 8 In the eighth chapter, design implications are presented in order to inform the design of mobile devices to strengthen mobile attachment. These design implications are deduced from the presented mobile attachment models, as well as form the three empirical studies.

Chapter 9 Within the ninth chapter results to research goals (RG1-RG7) are subsumed.

Chapter 10 The final chapter provides a conclusion to this thesis along with a discussion on the influence of mobile attachment to sustainable HCI, and identifies possible future research streams.
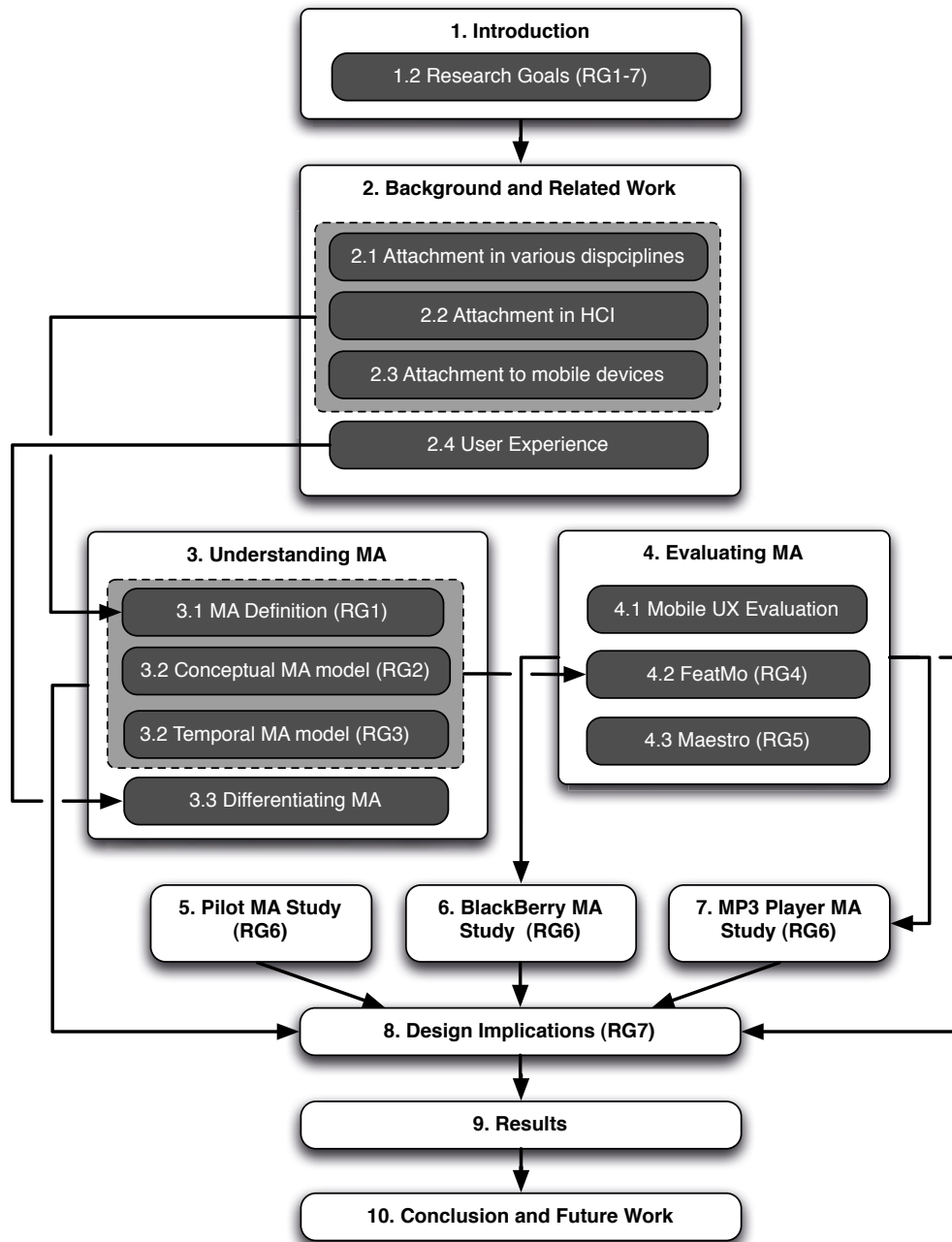
Figure 1.3: Thesis overview and structure

Background and Related Work

In this chapter, background literature and related work relevant for this thesis are presented. It starts with a section on different concepts of attachment and other related constructs from the viewpoint of various disciplines. Attachment related research within the HCI community is extensively discussed, followed by relevant research on attachment to mobile devices is presented. Finally, research on user experience (UX) as an attachment related concept in HCI will be outlined.

2.1 Emotional Attachment: Origins, Theories and Forms

The term "attachment" has been broadly used in a variety of different academic fields. In psychology, attachment is mostly related to Bowlby's (1969) *attachment theory*, which describes the way in which infants are attached to their caregivers. The relationship between humans and their possessions has been researched from a psychology perspective by Csikszentmihalyi and Rochberg-Halton (1981) who investigated the *meaning of things* and Belk (1988) who explored the *extended self*. Consumer and marketing research have studied *material possession attachment* (Kleine and Baker, 2004) and *brand attachment* (Park et al., 2006a). From a design perspective, *consumer product attachment* has been researched to conceive the emotional bonding with products (Mugge, 2008). In the following these concepts and their relevance for mobile attachment are discussed.

2.1.1 From a Psychology Perspective: Attachment Theory

To get a comprehensive understanding of mobile attachment, a look behind to the origins of attachment theory is valuable. Attachment theory is a psychological construct providing a framework to understand interpersonal relationships. It states that attachment is a developmental process based on the evolved adaptive tendency for young children to maintain proximity to a familiar person (Bowlby, 1969).

Attachment theory is the joint work of John Bowlby, who formulated the basic tenets of the theory, and Mary Ainsworth, who provided methodological and theoretical contributions (Bretherton, 1992). In his paper "The nature of a child's tie to his mother", Bowlby (1958) introduced the idea that the strong bond between a child and a parent is explained best as a biologically based affectionate tie that has evolved in a Darwinian sense in order to assure the survival of the species. An infant has a need for a secure relationship with his or her adult caregiver, without which a normal social and emotional development would not occur.

The main work on attachment theory constitutes Bowlby's magnum opus "Attachment and Loss" (1969), which was followed by another two volumes later on. Bowlby proposes that human infants are born with a set of attachment behaviors, like the seeking for proximity to an attachment figure as a predictable outcome. It's evolutionary function is a protection of the infant from physical and psychological threats. Bowlby explains that attachment has its own motivation and is in no way deduced from systems subserving mating and feeding. This opinion built a contradiction to the Freudian theory that an infant's attempts to stay near a familiar person is motivated only through feeding experiences. Once attached, infants are able to use the attachment figure as a secure base for exploration of the environment and as a safe haven to which to return for reassurance (Bretherton, 1992).

Bowlby (1969) argues that often repeated interactions with primary caregivers under conditions of infant distress lay the templates for 'internal working models' – in HCI terms 'mental models'. A child whose caregiver responds sensitively and consistently to the infant's signals of distress will develop an internal working model of himself or herself as lovable and effective, as well as of the caregiver as loving, reliable, and responsive. Over time, the child's attachment system moves from a behavioral system in infancy where security of attachment is dependent on the actual physical availability and contact between parent and child, to a representational system, where security of attachment can be represented in mind and expressed in language (Stovall-McClough, 2003).

Ainsworth et al. (1978) operationalized Bowlby's concept of attachment by carrying out a set of labor studies following the 'strange situation' procedure. During a series of eight increasingly stressful 3-minute episodes, infants were exposed to an unknown person within an unfamiliar environment, undergoing two brief separations and reunions with their primary care givers. The differences in infant behavior during the reunion episodes were categorized in three attachment patterns. First, *secure* attached infants actively seek proximity to caregivers during reunion and use caregiver as a secure base. Second, *avoidant* attached infants actively avoid the caregiver upon reunion. Third, *resistant* attached infants respond with extreme distress, when the caregiver leaves the room. Later a forth category was added, which includes *disorganized* attached infants who do not reflect an organized strategy (Main and Solomon, 1990). Once developed, these different attachment styles impact future relationships.

Attachment itself is not over when the child becomes an adult, but the functions and dynamics of the behavioral system are assumed to be virtually the same across life span (Hazan and Shaver, 1994). In adulthood, attachment is measured using the standardized Adult Attachment Interview (AAI) which requires the subject to describe their early relationship with their parents to provide specific memories (Hesse, 1999). Adult attachment differs from infant attachment in various ways. For instance, infant attachment is directed from the child to a caregiver, whereas adult attachment relationships are typically reciprocal. Adults are often able to derive comfort from the mere knowledge that their attachment figures can be contacted if needed, whereas infants may require true physical contact (Hazan and Shaver, 1994).

With regard to mobile attachment, some important aspects of attachment theory can be deduced. Beforehand, it should be emphasized that the focus of this thesis does not lay in the categorization of different attachment behaviors (e.g., secure, avoidant), but in researching mobile attachment as a characteristic of a particular relationship between a user and his or her mobile device. Nevertheless, the importance of three aspects of attachment theory regarding mobile attachment should be stressed. Foremost, attachment is not a bipolar property but is a continuum. Humans are not merely attached or not attached but the attachment varies in strength. Some people are very strong attached, others may feel a lightweight attachment, others again are not attached at all. Second, attachment is not stable but evolves and changes over time. It may even result in a detachment[1] (Hazan and Shaver, 1994). People may feel very attached in the beginning of a relationship, then the weakens, then it may grow stronger again.

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[1] Within this thesis attachment is always used in a positive form. Negative attachment is referred as detachment.

Finally, the degree of attachment may be identified by infants' behavior, which can be characterized by at least four distinctive behavioral indicators of attachment:

➤ *Proximity maintenance:* the will to be near the attachment figure

➤ *Separation distress:* the anxiety during unwanted separation

➤ *Save haven:* the attachment figure serves as a source of comfort and security

➤ *Secure base:* the attachment figure serves as a base from which to explore the world

2.1.2 The Meaning of Things and the Extended Self

Infants are not only attached to their caregivers and adults to one another, but people are also attached to their possessions. Although interpersonal attachment may differ from attachment to an object in several ways, the fundamental conceptual properties and behavioral consequences are assumed to be rather similar (Park et al., 2006). Based on the concept of the *self*, psychologists have investigated how and why people relate to things in their immediate environment (Csikszentmihalyi and Rochberg-Halton, 1981). Consumer researchers have developed the concept of the *extended self* (Belk, 1988). These approaches lay a basis for a better understanding of human-object relationships in general and the connection between users and their mobile devices.

The Meaning of Things

Humans can be defined by the sum of their possessions. Already at the end of the 19th century, William James laid the foundations for modern conception of the self:

> *"A man's Self is the sum total of all he can call his, not only his body and his psychic powers, but his clothes and his house, his wife and children, his ancestors and friends, his reputation and works, his lands, and yacht and bank account. All these things give him the same emotions [. . .] not necessarily in the same degree for each thing, but in much the same way for all."* (James, 1890, p. 291-292)

Following these thoughts, Csikszentmihalyi and Rochberg-Halton (1981) examined the role of objects in people's definition of who they are, of who they have been, and who they wish to become. Based on over 300 interviews about cherished things, they concluded that people invest emotional energy into objects because they are expressions of the self. They report about the vast differences in the range of meanings that

people derive from the objects with which they interact. The same object might provide only fleeting comfort to one person, whereas to another it might signify complex emotional and cognitive ties to other people or ideas. The authors concluded that the significance of objects is realized in a process of actively cultivating a world of meanings, which help create the ultimate goals of one's existence .

The Extended Self

From another perspective, Belk (1988) examined the relationship between possessions and the sense of self. The self-concept is generally described as the collection of characteristics, traits, and memberships that cognitively represent an individual in memory (Greenwald and Pratkanis, 1984). Belk (1988) introduced the concept of *the extended self* and described it as not limited to external objects and personal possessions, but to also include persons, places and group possessions, as well as body parts and vital organs, ideas and experiences. External objects may be viewed as part of self, when one is able to control them and they act as reminders and confirmers of one's identities. An unintentional loss should be regarded as a loss or lessening of self. For example, Niederland and Sholevar (1981) suggest that the automobile is a part of the extended selves of young american males. When a car is damaged, the owners react as if they were injured themselves. By creating or altering objects and directing effort, time, and attention into it, these objects become part of the self. Hence, attachment to an object develops through a process of identity construction (Belk, 1988).

Another focus of Belk's work (1988, p. 145-150) lays in the functions the extended self may provide. On the one hand, objects in our possessions may literally extend the self, as when a tool allows us to do things of which we would otherwise be incapable. Consequently, it serves as an enhancement of the personal power. On the other hand, possessions may be convenient means of storing memories and feelings providing a sense of who we are by linking them to our past. Another meaning of objects, which represent the extended self, is often a symbolic one. The object either serves as a symbol of who we are or to which group we belong (Belk, 1988).

Ahuvia (2005) went one step further and investigated the concept of *love* in the consumption context. Drawing on Belk's notion of the extended self, he states that loved objects have a strong influence on our sense of who we are. He argues that loved objects may help to resolve conflicts and tensions in the consumer's identity narrative. Love objects may symbolically serve to support a desired identity, that combines potentially conflicting aspects of the self.

Following Belk's definition, mobile devices can be seen as part of the extended self. First, they may extend the self by providing desired functions. Second, mobile devices can serve as a container for valuable memories (e.g., pictures, text messages) as various studies have shown (e.g., Taylor and Harper, 2002). And finally, they may provide symbolic functions to support the owner's identity.

2.1.3 From a Consumer Research Perspective: Material Possession Attachment and Brand Attachment

Based on the previously described concepts, recent research in consumer behavior has emphasized the importance of a strong consumer product bond for marketing purposes. Concepts like *material possession attachment* (Kleine and Baker, 2004) and *brand attachment* (Park et al., 2006a) have become increasingly important. Since mobile devices fall into the category possessions, a reflection of marketing research in this area is reasonable for a thorough understanding of mobile attachment.

Material Possession Attachment

Contrary to the concept of the extended self, research on material possession attachment focuses on objects to which consumers are strongly or weakly attached (Schultz et al., 1989). The Gallup Organization carried out a survey that showed that customers develop emotional, even passionate, ties to an extremely broad range of products and services they use (Gallup Organization, 2001). These findings suggest that companies in almost any industry can attract life-long customers. Their findings show that surveyed customers' emotional attachment were remarkably consistent across different industries, ranging from 27% for mass retailing to a high of 37% for consumer banking. Some 29% of consumer electronics customers were emotionally attached.

Kleine and Baker (2004) define *material possession attachment* as "a multifaceted property of the relationship between an individual or group of individuals and a specific material object that has been psychologically appropriated, decommodified, and singularized through person-object interaction". Along with this definition, they provide nine characteristics to further characterize material possession attachment:

➤ *Specific material object:* attachment forms with specific material objects, not with product classes or brands (e.g., with a personalized black Porsche Cayenne rather than with cars or the brand Porsche)

➤ *Psychologically appropriated material object:* attachment does not require legal

or physical possession, only psychological appropriation (e.g., students taking possession of 'their' chair in a classroom for the term)

➤ *A type of self-extension:* attachment is one of many other types of the above described concept of the extended self (e.g., the extension of the self through a cherished object like a particular car)

➤ *Decommodified, singular possessions:* attachment forms to decommodified, singularized, and personalized particular material objects symbolizing autobiographical meanings (e.g., a wedding ring)

➤ *Personal history between person and material possession:* attachment evolves over time when particular goods become irreplaceable via possession rituals (e.g., using, displaying, cleaning, storing, discussing, comparing) that extract meaning from and give meaning to the goods

➤ *Attachment has strength:* attachment to a possession can be relatively strong or weak (e.g., one can have a strong attachment to the inherited watch of one's father or a weak attachment to the new TV)

➤ *Attachment is multifaceted:* attachment is a complex concept; for example, Schultz et al. (1989) describe attachment to have facets of affiliation, autonomy, as well as past, present and future temporal orientations for each individual

➤ *Attachment is emotionally complex:* attachment is emotional in experience quality, recorded in a cognitive-emotive understanding of the possession's symbolic, autobiographical, personalized meaning formed via a history between self and object

➤ *Attachment is dynamic:* meaning associated with a possession and the intensity of attachment to it does not remain static but evolves as the person's self evolves and the autobiographical function of the object changes

Since mobile devices can be seen as one category of material possessions, it can be argued that mobile attachment is a special case of material possession attachment. Consequently, the above mentioned characteristics also apply to mobile attachment. Due to special properties of mobile devices like their omnipresence, a discussion about these characteristics with special focus on mobile devices will be done in Chapter 3.1.3.

Brand Attachment

Aside from researching the bond customers experience towards material possessions, marketing research has investigated the relationship between consumers and brands. Fournier (1998) has highlighted the importance of relationship theory in the consumer brand context. She presents a typology of consumer-brand relationship consisting of 15 forms like, for example, best friendships (voluntary union based on reciprocity principle, characterized by revelation of true self and intimacy) or dependencies (obsessive, highly emotional, feeling that the other is irreplaceable, separation yields anxiety). Some relationships are characterized by a high degree of attachment (e.g., best friendships, secret affairs, committed partnerships), others by a low degree of attachment (e.g., casual friends, arranged marriages, enslavements). Fournier (1998) argues that emotional attachment lies at the "core of all strong brand relationships". Thus, attachment itself may serve as a higher order construct for the different relationship forms identified by Fournier (Park et al., 2006).

A definition of *brand attachment* as "the strength of the cognitive and affective bond connecting the brand with the self" was provided by Park et al. (2006). They highlight that their definition consists of two essential elements: First, the connectedness between the brand and the self. Second, a cognitive and emotional bond between the customer and the brand. Further, they propose a conceptual model of brand attachment consisting of three strategies for the brand-self associations (*gratifying the self*, *enabling the self*, and *enriching the self*) eventually leading to a certain degree of brand attachment. The strength of attachment is dependent on the connectedness between the brand and the self and the automatic retrieval of positive thoughts and feelings. A strong brand attachment results in brand commitment (the behavioral intention to maintain the relationship with the brand) and actual behavior patterns (e.g., the customer's willingness to sacrifice resources to continue their relationship with the brand). Such brand supporting behavior includes the repeated purchasing of objects from the attached brand company, the paying of a premium price, the recommendation of the brand to others, and the participation in a brand community. An extended conceptual model including causes, construct, and consequences of brand attachment can be found in Park et al. (2006a). Both, the definition of brand attachment as well as the conceptual model will serve as a basis for the conceptual mobile attachment model presented in Chapter 3.2.

Regarding measuring brand attachment, Park et al. (2006, p. 25) suggest to measure the degree of brand-self connectedness based on statements that reflect the personal

relationship between the consumer and the brand. This includes statements like "emotional bonding" and "part of me". Furthermore, they recommend to use agreement scales to measure the automaticity of thoughts and feelings such as "positive thoughts and feelings of (the brand) come to me automatically and naturally". An earlier attachment scale was developed by Thomson et al. (2005). Their 10-item scale includes three dimensions (connection, passion and affection) which could be mapped onto the second-order emotional attachment construct. Sweeney and Soutar (2001) have focused on the value construct for their perceived value scale (PERVAL) in order to calculate customers' perceptions of the product value at a brand level. The PERVAL scale consists of four dimensions (quality, price, emotional, and social) and 19 items. The authors argue that consumers assess products not only in functional terms of expected performance, value for money and versatility, but also in hedonic terms deduced from the product (emotional value) and the social consequences that the product communicates to others (social value).

Other concepts related to brand attachment in consumer research are *brand love* (e.g., Carroll and Ahuvia, 2006; Keh et al., 2007), *brand passion* (e.g., Bauer et al., 2007; Yim et al., 2008), and *consumer devotion* (e.g., Pimentel and Reynolds, 2004; Pichler and Hemetsberger, 2008). Carroll and Ahuvia (2006) define brand love as the degree of passionate emotional attachment a satisfied consumer has for a particular trade name. Their findings suggest that hedonic values (in comparison to utilitarian) of product categories and symbolic benefits of brands lead to an increased brand love, which is linked to higher levels of brand loyalty and positive word-of-mouth. Keh et al. (2007) characterize brand love as a three-dimensional construct, which can be broken down into intimacy, passion, and commitment. Bauer et al. (2007) developed a causal model incorporating brand- and consumer-related antecedents and purchase-determining consequences of brand passion. Their findings show that brand related determinants such as brand prestige, uniqueness, or a self-expressive brand influence brand passion. Brand passion, in turn, leads to purchase intension, positive word-of-mouth, and the willingness to pay a premium price. Yim et al. (2008) emphasize the importance of intimacy and passion as two underestimated components of customer-company affection that influence customer loyalty. Pimentel and Reynolds (2004) introduced the notion of consumer devotion as a concept with an extremely high level of emotional bonding with the brand. Pichler and Hemetsberger (2008) developed a tripartite view of brand devotion consisting of passion, intimacy, and dedication.

An interesting theoretical work was presented by Bidmon (2007). She built a link between traditional attachment theory and consumer satisfaction research to show that

different psychological attachment styles of consumers (e.g., secure, ambivalent) have important consequences for customer satisfaction and retention. For example, secure attached people are more satisfied as a customer with a brand than ambivalent attached people. These insights may also be mapped onto mobile attachment. Various attachment styles of mobile phone owners may have an influence on the perceived mobile attachment.

Since most mobile devices are highly correlated with a specific brand, the connection between brand attachment and mobile attachment is apparent. Rondeau (2005) reports on the relationship between branding and the design of mobile devices and applications. As a successful example of mobile device branding, he names Apple's iPod, which does not only look 'cool' but is useful and easy to use as well. The author argues that the texture, size, color, and appearance of the device are all part of the branding and the physical perceptions of user experience. It can also be observed with the iPhone hype when people camp in front of Apple stores to get the new iPhone (see Figure 3.7 on page 94). It will be essential to take research on brand attachment into account for a comprehensive understanding of mobile attachment.

2.1.4 From a Design Perspective: Emotional Design, Product Attachment and Designing for the Self

Aside from marketing, research in design also has addressed the topic of emotional attachment to products. While consumer research often focuses on the effects of attachment in terms of purchase behavior (e.g., purchase intention, pay a premium price, positive word-of-mouth) and the consequences for brands (e.g., commitment, brand loyalty, brand attachment), designers take a different perspective. They investigate how design may influence the degree of product attachment (Mugge, 2008) through emotional product design (e.g., Norman, 2004; McDonagh et al., 2004). In doing so, they focus not only at the acquisition of the product, but also investigate the consumer-product relationship during ownership. Since mobile devices are said to be fashion objects and status symbols, the design perspective is highly important for the understanding of mobile attachment.

Emotional Design

Within the last decade, the way in which we emotionally relate to products has become of increasing interest and importance. Conference series like "Design and Emotion" (Overbeeke and Hekkert, 1999) and "Designing Pleasurable Products and Inter-

faces" (Forlizzi and Hanington, 2003) have highlighted the importance of affective and emotional design. Books like Jordan's "Designing Pleasurable Products" (2000) and Norman's classics "The Design of Everyday Things" (2002) and "Emotional Design" (2004) have shown the development within the last decade from usable to pleasurable designs.

A successful design is dependent on the emotional relationship created between the object and the user incorporating social and cultural concerns (Klauser and Walker, 2007). By designing everyday objects aesthetically pleasing, they should not only increase usability – which was demonstrate by Tractinsky et al. (2000) – but also become desirable and meaningful to their owners. Donald Norman explains:

> *"Special objects turned out to be those with special memories or associations, those that helped evoke a special feeling in their owners. Special items all evoked stories. Seldom was the focus upon the item itself: what mattered was the story, an occasion recalled. [. . .] We become attached to things if they have a significant personal association, if they bring to mind pleasant, comforting moments. Perhaps more significant, however, is our attachment to places: favorite corners of our homes, favorite locations, favorite views. Our attachment is really not to the thing, it is to the relationship, to the meanings and feelings the thing represents."* (Norman, 2004, p. 48)

Based on these assumptions various artifacts have been developed to be desirable and meaningful to their owners. Danhope-Smith and Patel (2005) have created "Pollen", an artifact and a service that provides companionship through the exchange and sharing of meaningful information. The Pollen artifact (see Figure 2.1(a) on the next page), which looks like an artificial flower, has a digital memory embedded allowing the user to record messages. The Pollen service distributes the artifact among participating users. Another example is No. 21, an affective and desirable alarm clock presented by Klauser and Walker (2007). Based on a user-centered design approach, the authors designed the database driven alarm clock (see Figure 2.1(b) on the following page) to develop a dependent relationship between the user and the clock. This is achieved by continued interaction. Each day a new personalized greeting (e.g., photo of a friend, important calendar date, current event) is presented to the user suggesting that the clock knows the user. The alarm clock reflects the owner's values and concerns, as well as that of the society of which the owner is a part. The resulting intimacy generates an empathetic relationship as the information becomes more tailored.

(a)   (b)
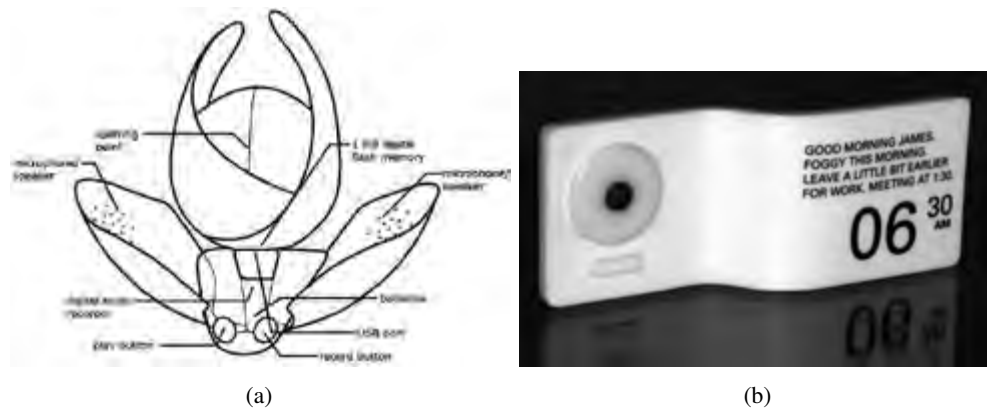
Figure 2.1: (a) Pollen by Danhope-Smith and Patel (2005); (b) No. 21 by Klauser and Walker (2007)

Desmet et al. (2001) have presented a user-centered design approach for creating products with added emotional value and applied it to the design of mobile phones. Based on an initial user study, two types of emotional responses to mobile devices were categorized. One group of users preferred a 'calm-pleasant' response to mobile phones, while the other group favored an 'excited-pleasant' response. A follow up study revealed two types of users: trend followers and security seekers. Their findings show that different models elicit very different emotional responses in security seekers and trend followers.

Another focus of research from a design perspective is the impact of visual appearance of mobile devices. Nanda et al. (2008) have shown that varying the aesthetics of the BlackBerry Pearl has an impact on the emotional reaction of males. Quinn and Tran (2010) argue that attractive mobile phones are even rated higher in their usability, suggesting that a high attractiveness could compensate for ineffective and inefficient performance.

Product Attachment

While the previously mentioned authors used the term "attachment" in in common use, other designers have utilized it as a distinct concept. Contrary to consumer researchers who introduced terms like "material possession attachment" or "possession attachment" to label the consumer-object bond, the design community uses terms like "consumer-product attachment" (Schifferstein et al., 2003) or only "product attachment" (Mugge, 2008) to denote this relationship.

Product attachment is defined as "the strength of the emotional bond a consumer experiences with a specific product" (Schifferstein et al., 2003). Similar to the definition of brand attachment by Park et al. (2006), two implications of this definition can be derived. First, it suggests that a strong tie exists between the consumer and the product. Second, it implies that the product triggers emotions within the consumer. An additional third implication is that experiencing attachment to products is a matter of degree (Kleine and Baker, 2004). Schifferstein and Zwartkruis-Pelgrim (2008) proposed a conceptual model of consumer-product attachment. Based on Greenwald's (1988) four facets of the self (*the diffuse self*, *the private self*, *the public self*, and *the collective self*), they state that different product meanings emerge from these facets. The four resulting determinants of product attachment (enjoyment, individual autonomy, group affiliation, and life vision) reveal the different ways in which products support the owner's self leading to an increased consumer-product attachment.

Mugge (2008) provides an excellent overview of product attachment from a design perspective. She states that people develop attachment to products that convey a special meaning to them and provides an overview of different meanings product may have to their owners. These meanings include the reinforcement of a person's identity, the representation of one's ties with other people, the symbolization of one's personal history, the intrinsic qualities of a product (e.g., design, uniqueness), the utilitarian meaning, the evocation of enjoyment, financial related meanings, cultural-religious meanings, and personification. She additionally proposes four product meanings as possible determinants of product attachment to ordinary durables:

- ➢ *Self-expression:* the product expresses one's unique identity
- ➢ *Group affiliation:* the product expresses one's belonging to a group
- ➢ *Memories:* the product is a reminder of the past
- ➢ *Pleasure:* the product provides pleasure

Regarding mobile attachment and the consumer research concept of possession attachment, it has been argued previously that the former is a special case of the latter. The same argument holds true for product attachment. Mobile devices are a special category of general products and, therefore, Mugge's determinants may also be influencing factors for mobile attachment.

A related, but yet different concept to product attachment was proposed by Russo et al. (2011). They discussed *person-product love* as a deep and multifaceted phenomenon that surpasses the boundaries of desire, attraction, attachment, and consumer passions. Their analysis of true-life stories about products people love showed that

people describe their love for products as very rewarding, long-term, and dynamic. Russo and Hekkert (2007) state that "love is a strong affection for products that arises out of relationships and personal ties", which is not only expressed metaphorically but real. They present five design principles that trigger the experience of love:

➢ *Fluent Interaction*: people love to use products that interact fluently without annoying disturbances

➢ *Affective Memory Recall*: people love to use products that hold affective memories and act like reminders of these memories

➢ *Symbolic (Social) Meaning*: people love to use products that comprise symbolic meanings

➢ *Shared Moral Values*: people love to use products through which they can share moral and ethical values

➢ *Pleasant Physical Interaction*: people love to interact with products that are physically pleasant

These principles may not act all together, although the love experienced seems to be stronger when several principles work jointly together. The authors also stress the fact that to simply design following these principles may not be enough to evoke the experience of love. Russo (2010) highlights the difference of love and attachment. In her view the bond of attachment refers in a love relationship solely to the commitment component of love. A more detailed analysis on the differences between mobile attachment and love will be given in Chapter 3.4.2.

Product Attachment Studies

Various studies have been reported to investigate aspects of product attachment. Schifferstein et al. (2003) studied the degree of attachment to specific objects (lamps, clocks, cars and ornaments). Their findings show that feelings of attachment are often related to the memories evoked by the product and the enjoyment provided by (using) the product. They argue that enjoyment may be particular important for attachment to new products and memories may have more influence on older products. Govers and Mugge (2004) examined the influence of congruity between the personality of a person and the personality of their product (i.e., product-personality congruence) on product attachment. A scenario based study with different sandwich toasters as attachment products and two types of personality (extrovert and conscientious) indicated stronger attachments to products that were congruent with the owner's personality.

A more explorative approach was conducted by Savaş (2003). He investigated reasons of product attachment and detachment through individual interviews. Respondents were asked to identify one of their products to which they feel attached and another to which they feel detached. Named product types included cars, computers and personal goods. Reasons for attachment and detachment to those products were the personal past, positive experiences, utilitarian, personal and social reasons, and style among other things. Damazio et al. (2007) investigated people's relationship with brands that incorporate meaningful experiences and evoke positive feelings from a design perspective. In their view, brands could be seen as synonymous with their products. They present reflections based on personal stories about 'brands that touch' gathered from interviews and conversations along with the analysis of classic writings on theory of anthropology of consumption.

Designing for The Self

A completely new approach on designing loved things from an interaction design perspective has been brought to the HCI community by John Zimmerman (2009). Based on Belk's (1988) extended self concept, his approach *designing for the self* focuses on the question "How to design products with the goal of helping people become the person they desire to be through their interaction with these products?". Thereby, he differentiates between role enhancement and role transition. The former refers to the design of products that help people move closer to their idealized sense of self, while the latter specifies the design of products that support the process of discovering and inventing yourself in a new role. By applying attachment theory to the process of interaction design, he created a set of design patterns which help designers to create products that engage people in their identity construction activities. He built six framing constructs based on these design patterns, which revealed opportunities designers have to apply product attachment theory to the interaction design of a specific product (i.e., role engagement, control, affiliation, ability & bad habits, long-term goals, ritual).

Examples of artifacts which follow the designing for the self approach are the "Reverse Alarm Clock" and "Shared Moments" (Zimmerman, 2009). The Reverse Alarm Clock keeps young children from waking their parents at night (Ozenc et al., 2007). It consists of different interaction artifacts, which communicate time information to children in a very special way to help them to become more responsible and to give parents more control over their lives. The Shared Moments mobile phone application

strengthen Zen Buddhists' connection to their *Sanga* (community) (Sterling and Zimmerman, 2007). It allows users to remotely participate in mediation with members who are physically present at the Zen Center, holds possibilities for staying in contact with the community, and provides reminders of Zen Center related precepts (codes of ethics).

2.2 Attachment Related Research in HCI

Aside from the above described design view on product attachment, the HCI community has addressed human-computer relationships in different ways. On the one hand, the attachment to different groups of artifacts like avatar attachment (Wolfendale, 2007) and robot attachment (Levy, 2007) has been investigated. On the other hand, theoretical concepts which can be considered related to attachment like enchantment (McCarthy et al., 2006) and place attachment (Brunette et al., 2005), as well as ways to enhance attachment by the means of personalization (Mugge et al., 2004) have been discussed. Since the aim of this thesis is to research mobile attachment from an HCI perspective it is relevant to provide an overview on attachment studies from an HCI perspective. This section provides an exhaustive literature review on existing attachment research within the HCI community.

2.2.1 Attachment in HCI

As demonstrated previously, the term "attachment" is mostly used in a connection with a preceded noun as a specification of the entity a person is attached to (e.g., product attachment, brand attachment). In HCI literature, it is often used as a single term to describe a bonding between a human and an artifact. Sometimes other terms like "human-robotic relationship" (Friedman et al., 2003) are used. The HCI community has researched people's attachment to a variety of artificial entities among other relational (Bickmore and Picard, 2005) and migratable agents (Ogawa and Ono, 2005), avatars (Wolfendale, 2007), humanoid robots (Levy, 2007), artificial pets (Friedman et al., 2003), and domestic robots (Sung et al., 2007).

Attachment to Virtual Artifacts

Bickmore and Picard (2005) have presented relational agents as computational artifacts designed to establish and maintain long-term social-emotional relationships with their users. They have developed and evaluated a humanoid animated agent, which

incorporates the ability to remember relational information about users and refer back to such in subsequent dialogues. Their findings show that users will readily engage in relational dialogue with a software agent, and that this has a positive impact on users' perceived relationship with the agent. Ogawa and Ono (2005) proposed an integrated agent for communication system (ITACO), which tries to support a user by providing a migratable agent which is context-sensitive and gives continuous assistance. Their focus laid in the construction of a relationship between the user and the agent. Their findings showed that the subjects' attachment to the media as well as the relationship was succeeded through the media by the agent migration. Wolfendale (2007) discusses the phenomenon of avatar attachment. Whereas the previously described relational agents represent a computational artifact as a counterpart, an avatar often refers to the graphic representation of a person's self – mainly in online games. Wolfendale argues that avatar attachment is linked to personal narratives, identity and self-conception and, therefore, morally significant.

Human-Robot Relationships

Nass et al. (1994) suggested that people respond to robots as social actors with their own identity and assign human qualities to machines such as gender or politeness. A variety of studies have been conducted to describe human-robot relationships with a broad range of different types of robots from intimate home appliances (Sung et al., 2007) to robotic pets (Friedman et al., 2003) to humanoid robots (Levy, 2007). Based on an online study of a related forum and ensuing interviews, Sung et al. (2007) have found that people developed intimate relationships with their domestic vacuuming robots Roomba (see Figure 2.3 on page 36). They reported that participants derived increased pleasure from cleaning, expended effort to fit Roomba into their homes, and shared it with others.

A variety of studies have explored human relationship with artificial pets. Friedman et al. (2003) have investigated the relationship between Sony's robotic dog AIBO (see Figure 2.2(a) on the following page) and their owners by collecting data from postings in online AIBO discussion forums. Participants admitted the presence of a mental life for AIBO and that it evokes a form of social relationship and emotional connection ("I am already amazed at how attached I have become to him."). Marti et al. (2005) investigated interaction dynamics with the artificial pet seal robot PARO in therapeutic contexts. They demonstrated a clear role of the robot in mediating social exchange and stimulating attachment and engagement. Nevertheless, they admitted that it is not clear

which behavioral and physical qualities of the robot successfully foster interaction and attachment. They argued that even a small plastic key-chain egg with simple animations on a low-resolution screen now known as Tamagotchi facilitate extreme emotional attachment (see Figure 2.2(b)).

(a)   (b)

Figure 2.2: (a) Sony's AIBO (private picture); (b) A Tamagotchi family by Mrs Piggy** retrieved from Flickr

An even stronger attachment to robots in the future is predicted by Levy (2007). He argued that intimate relationships with artificial partners will arise as natural extensions of more conventional human feelings of attraction. He envisions a world in which future generations will embrace robots as companions, friends, and artificial partners (including a sexual relationship). In return, robots will be programmed to be attracted to humans, fall in love with them in order to maximize the satisfaction, and enjoyment for their human partners.

2.2.2 Related Concepts in HCI

Apart from the previously described forms of attachment related concepts like *the self* (Hassenzahl, 2004), *enchantment* (McCarthy et al., 2006), *love* (Pujol and Umemuro, 2009), and *place attachment* (Brunette et al., 2005) have been in the focus of HCI research within the last years. This section provides a reflection on these studies and approaches.

The Self

The psychological concept of *the self* has been addressed by HCI researchers in different ways. Hassenzahl (2004) has addressed the role of beauty of objects as a desired extension of the self and the importance of its research in the field of HCI. Dunne and Smyth (2007) have discussed the metal mechanisms of wearability by exploring the connection of physical sensation and psychological representations of self to identify characteristics of objects that allow a worn object to be perceived as part of the body itself, rather than a distinct entity. They conclude that "a perfect wearable device is instantly integrated into the body schema, and remains such part until it is removed from the body".

Enchantment

McCarthy et al. (2006) introduced *enchantment* into HCI as a useful concept to facilitate closer relationships between people and technology in order to increase user experience. Following Bennett's (2001) description of enchantment as a condition of exhilaration or acute sensory activity (both caught up and carried away), enchantment can be seen as a combination of emotional attachment together with a sense of being disoriented. Based on a literature review of the enchantment of films and mobile phones for teenagers, McCarthy et al. (2006) present guidelines – in their terms "sensibilities" – for an HCI interested enchanting interactive experience. They describe contemporary designs of digital jewelry (e.g., rings which react to interaction between people through sensors causing an illumination, or a toe ring that acts as a signal transmitter, facilitating navigation around a city). Ross et al. (2008) discussed design for enchantment through the lens of their concept called design for meaningful mediation. In this design concept, objects are seen in terms of their capability of playing a mediating role in people's everyday lives. For example, a mobile audio device like an iPod changes the way people experience the world. On the one hand, it allows to enjoy music everywhere we go, but on the other hand, it may create a social barrier that restrains the interaction with other people.

Love

Contrary to Russo et al. (2011), who investigated the concept of love between a person and a product from a design perspective (see Chapter 2.1.4), Pujol and Umemuro (2009) researched how affective technology can improve loving relationships between

two people. They presented guidelines for designing technology that promotes productive love (e.g., preservation of individuality and freedom). Since mobile phones often offer possibilities to communicate between lovers and are, therefore, cherished themselves, these guidelines may also be valuable for mobile application design.

Place Attachment

Another attachment concept, which has been used in HCI research is *place attachment*. It refers to the bond between a person and a place. Brunette et al. (2005) presented a set of technologies called "Meeteetse" designed to facilitate social well-being through place attachment among elderly. Meeteetse builds a connection between individual homes and a local community center by providing location-aware digital cameras and a large public display to strengthen shared identity between members of a community center. Additionally, touch-screen scheduling devices and a digital picture frames were placed in seniors' homes in order to create a tangible community presence. "Co-Collage" is another placed-based community technology presented by Farnham et al. (2009). CoCollage consists of a public display located in a café, which serves both as a physical window into the community by increasing people's awareness of people currently in the café, and a virtual window, facilitating awareness and asynchronous interactions among those who are not currently present. As a measure for the degree of place attachment, three dimensions are suggested: functional dependency, commitment to continue using the café, and identification with the self.

2.2.3 Personalization

One way to build or strengthen the bonding between a user and an artifact is assumed to be possible through *personalization*[2]. Blom and Monk (2003) define personalization as a process of changing the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to an individual. This definition stresses four important characteristics of personalization. First, it is a process rather than a mere feature or function. Second, the attribute of personal relevance implies that personalization bears significantly on the persona of the user (e.g., goals, identity, personality, strivings, life projects). Third, it implies that personal relevance is achieved

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[2]Personalization and customization are sometimes regarded as different concepts, the former thought of as user controlled modifications, the latter as machine-controlled. Similar to Jørstad et al. (2005), in this thesis, personalization is assumed to be a kind of individualization in order to fit a specific person's needs independent form any specific mechanism to this end. Thus, customization can be regarded as one way of personalization.

only in interaction with the system by changing the way it looks or behaves. Finally, it assumes that personalization behavior is not restricted to special personalization features purposefully designed for that purpose.

Blom (2000) states that motivations for personalization can be divided into those that are primarily to facilitate the work (i.e. enabling information access, accommodating work goals, accommodating individual differences) and those that are primarily to accommodate social requirements (i.e. eliciting an emotional response, expressing identity). For example, he describes the personalization of a mobile phone by changing its appearance (e.g., changing cover or attach a sticker) may be motivated by an emotional response (e.g., attachment to the phone). Continuative studies on why people personalized the appearance of their PCs and mobile phones and what effects this has on their subsequent perception of those devices resulted in a theory of personalization (Blom and Monk, 2003). Employing grounded theory analysis, they identified user-dependent, system-dependent, and contextual dispositions (triggering reasons and conditions) as well as cognitive, social, and emotional effects (behavioral, social, and experienced outcomes) of personalization.

Oulasvirta and Blom (2008) argue that personalization can align psychological resources with the user's action and enhance performance and enjoyment of use. First, personalization can promote autonomy and the sense of being an original and, therefore, transform technology to 'my technology'. Second, it can support competence by increasing the effectiveness of user's actions. Third, through its appearance functions, technology can support the basic need of relatedness through expression of emotion and identity, ego-involvement, and territory marking. Relatedness, in turn, is the need to establish close emotional attachments with other people, and it reflects the desire to be interpersonally involved in warm relationships (Oulasvirta and Blom, 2008).

Product Personalization

Mugge et al. (2004) examined the effect of personalizing a product's appearance on the degree of product attachment. They presented a conceptual model for the relationships between the process of product personalization, self-expression, and product attachment together with the results of a questionnaire study concerning bicycles. Their results show that product personalization requires a person to invest energy in the product. In return, the product is used as an expression of the self. The degree of self-expression, in turn, positively affects the experienced degree of attachment to the product.

Sung et al. (2009) presented a study in which they argue that households personalize their domestic vacuuming robot Roomba to express its identity, to show its value to the household, and to make it prominent. As an impact of personalization, the households felt more connected to the robot, seeing it as "more like *our* Roomba instead of *a* Roomba" suggesting an increased attachment with the product (see Figure 2.3(a)). Others use their Roombas as artists. In the Flickr Group Roomba Art long-exposure photographs of swarming Roombas, each with a differently colored LED on top can be admired (see Figure 2.3(b)).

(a)   (b)

Figure 2.3: (a) Personalized Roomba by Sung et al. (2009); (b) Roomba Art by IBR Algorithm Group and Braunschweig University of Technology retrieved from Flickr

A more implicit way how personalization could enhance product attachment was described by Parmar et al. (2009). They presented a tangible user interface which was designed for Indian rural women to access personal health information using traditional metaphors. Their findings show that getting involved in the design process using local materials, patterns and colors created a feeling of personal ownership and lead to an increased involvement.

Mobile Personalization

Since the introduction of exchangeable covers, freely selectable themes and background images, as well as downloadable ringtones cell phone industry has gained a lot of money by exploiting users' desire to personalize their mobile devices. People hang luck charms on their cell phones, purchase the newest ringtones, and even create customized skins from professional services like skinit.com (Sung et al., 2009). Existing empirical studies find that this type of personalization leads to increases in

ownership satisfaction and perceived ease of use Blom (2000). In Japan, the aesthetic decoration of mobile phones even is assumed to be an art and is labeled "Deco-Den", which is a combination of the words "decoration" and *denwa*, which is Japanese for phone (Oulasvirta and Blom, 2008). Katz and Suygiyama (2005) reports that in Asia attaching jewelry on mobile phones adds a cultural and spiritual dimension to the device. Figure 2.4 visualizes Deco-Den art.

(a)   (b)

Figure 2.4: (a) Deco-Den iPhone by Violet Le Baux retrieved from Flickr; (b) Deco-Den by unknown retrieved from Flickr

Häkkilä and Chatfield (2006) examined the process of mobile phone personalization from a scientific perspective. Their user study showed that most personalization (50%) occurred during the first day with personalized aesthetic (e.g., ring tones, background images) and functional (e.g., shortcuts) features. They found out that a strong motivation for personalization was to change the appearance of the phone to match to user's personal style and reflect their interaction preferences. Personalization was often done to make the phone resemble the one the user had used before. Jørstad et al. (2005) discuss challenges and mechanisms to support the personalization of mobile services with a special focus on work facilitation. They describe personalization of a service as a mechanisms that allows a user to adapt, or produce, a service to fit user needs, and that all subsequent service rendering by this service towards this user is changed accordingly. Their theoretical work focus on challenges and mechanisms to support personalization.

Mobile phone personalization is not only achieved by changing the visual appearance (e.g., covers, background images, decorative elements) or enhancing the phone

with novel features (e.g., adding Apps) but also by denominating devices. For example, Lavelle et al. (2007) collected friendly names in use on almost 10.000 Bluetooth enabled devices. Their findings show that many users name their devices with their own first or last name in order to allow broad interaction with the device or use nicknames. Kindberg and Jones (2007) presented the results of a study of Bluetooth naming practices revealing that there is a significant culture of giving Bluetooth names to mobile phones in the UK. They showed that Bluetooth on mobile phones is used as a projection of personal identity. On the one hand, Bluetooth names on mobile phones are used as an identifier of the personal identity. On the other hand, the given names emphasize the users belonging to a specific social group.

These studies show that mobile devices are very personal objects to their owners. User try to change the appearance of their device to fit their personality and to serve as a status symbol. These functions are often achieved through personalization.

2.3 Research on Attachment to Mobile Devices and Services

Aside from the above presented work on product attachment, the relationship between mobile devices and their owners have been in the focus of various discussions and studies. Concerning the emotional attachment towards mobile phones, users seam to have more emotional relationship with their mobile devices than they do with other computational or communication devices (Vincent, 2006). Previous research showed that only a few people attribute their mobile phones (the consumption entity) with emotional terms, but the information contained and transmitted as the usage of mobile phones is focused on achieving emotional goals (Vincent and Harper, 2003). The device is an icon for the user that can be customized in various ways. Furthermore, it reflects the relationship with the user's environment as the device serves as a platform to be connected with others (friends, family), who provide the stimuli for the user's attachment to the device. Research on product love revealed that people even love their mobile phones and MP3 players (Russo, 2010).

Generally, it can be stated that the relationship between users and their mobile devices has been researched at least from two major perspectives. One, the emotional attachment to mobile phones (e.g., Vincent, 2005) have been discussed. Two, the relationship between teenagers and their mobile phones have been especially examined (e.g., McCarthy et al., 2006). This section reviews the literature on both topics.

2.3.1 General Research on Emotional Attachment to Mobile Phones

Townsend (2002) examined the powerful relationship that form between individuals and their mobile phones and its impact on modern society. He argues that marketing and advertising are powerful forces that both influence and reflect people's relationship with new mobile devices. For women, a mobile phone is often portrayed as an object which provides security and serves as a tie to friends and family; whereas for man it symbolizes power and virility (Katz, 1999). The associations of technological artifacts and sexuality lead to a next stage of man-machine symbiosis: the mobile phone as an extension of the body (Townsend, 2002). Even before Apple's iPhone was introduced to the market Katz and Suygiyama (2005) analyzed mobile phones as fashion statements. They clustered buyers of mobile phones into those who purchase one simply as a communication tool and those who buy one in part because of the status that a design or brand imparts. The latter seek to individualize their mobile phones and integrate them into their own cultural meaning.

Based on surveys in Europe Fortunati (2002) states that mobile phones contribute to dissolving traditional separations between the internal and external, as well as the public and the private. The mobile phone allows us to capture the intimacy of interpersonal relations while moving in public spaces. Additional to that, Fortunati's research shows that exchange via the mobile phone is often an expression of connectedness to a peer group. In this sense, giving a person your cell phone number can be seen as an act of friendship.

Vincent (2005) used the expression "emotional attachment to mobile phones" when she presented her research on the extraordinary relationship between mobile phones and their owners. She argued that this attachment rises out of the omnipresence and capabilities of mobile phones in society today. For instance, mobile phones enable people to stay in touch with family and friends in an emotional and spontaneous way. Field studies have shown that people employ their mobile devices to achieve emotional goals and use emotional language categories to explain their mobile usage. These categories include panic when being separated from the device, thrill about the novelty of a new mobile phone, and anxiety of not knowing and wanting to know about others (Vincent and Harper, 2003). Vincent (2006) provides two possible explanation for this behavior. First, the mobile phone acts as an icon for the user, reflecting the user's life, holding memories and sentiments that are associated with text massages, pictures, and ringtones. Second, attachment is not the result of a solitary pre-occupation with the

device but its relationship with others – as an icon of the social group with whom the user communicates. Thus, mobile phones are

> *"an important part of our emotional cache in that it is a repository for storing links to things that engender emotional response, as well as performing a functional role in the management of day-to-day life."* (Vincent, 2006, p. 120)

Other studies suggest that users are not only strongly attached to their phones but also to the content on their devices, which includes address books, ringtones, texts, pictures, music, games, and other applications. In a survey, users reported that losing their phone would cause their social life to suffer and is more painful than breaking up with a boyfriend or girlfriend (FusionOne, 2010).

Wehmeyer (2007 and 2008) uses the term "user-device attachment" to describe the relationship between users and their mobile device. He proposes three dimensions of user-device attachment: symbolism, aesthetics, and perceived necessity. The first dimension symbolism reflects the symbolic meaning of the device for the user as a status symbol. The second dimension assumes that attachment to a mobile device is reflected in perception of its beauty and aesthetics. The third dimension covers the level of a close integration of the device in everyday life. Based on these dimensions he presents an instrument for measuring user-device attachment.

2.3.2 Mobile Attachment in Teenagers

Different studies have discussed the role of mobile devices in the life of children and teenagers. Vincent (2004) reports that mobile phones are key features in the maturing of 11 to 16 year olds serving as a symbol for the 'coming of age'. Children in this age do not have a daily need for making and receiving communications on mobile phones but a need for the device to be 'always with me' when away from home. Children use their mobile phone when they want to be independent of their parents knowing that they could always call for assistance. Palen and Hughes (2007) have investigated attachment to mobile phones from a parental point of view. They report that parents use mobile phones to extend the idea of their home base. Mobile phones are used to make themselves available to children and use them to maintain an emotional connection. Parents loosen their physical attachment to their phones only in the presence of their children. One participant stated: "I can't be a mom and not have a phone."

In Norway Ling and Yttri (2002) reported that teenage interviewees see their mobile phone as a big part of their life and an expression of their personality. Respondents

state that it is stressful not knowing what is happening, when the mobile phone is absent. They use their mobile phones not only for functional and instrumental activities (e.g., coordination for everyday activities), but also for social and emotional communication (e.g., integration within the group via the use of mobile phones). McCarthy et al. (2006) provided teenagers with the potential for combining various aspects of interpersonal contact in creative ways, and of carving out a cultural medium to distinguish them from older generations.

One of the most used and loved applications among teenagers in Europe and Asia is the short message service (SMS). Kasesniemi and Rautiainen (2002) report practices of Finnish teenagers such as collecting messages, chain-message circulation, and collective reading and composing. They found that some of the teenagers attach strong emotional significance to keeping these messages in their original form. Taylor and Harper (2002) investigated the practice of gift-giving between teenage mobile phone users. Based on an ethnographic study in England, they claim that teenagers treat text messages or even their mobile phones themselves as gifts. Text messages resemble gifts in so far as they carry a symbolic meaning. As one participant stated: "[. . .] it's not the same having them written down [. . .] cause it's not from him anymore [. . .]" (Taylor and Harper, 2002). The authors highlight the obligations of exchange: to give, accept and reciprocate. Following or avoiding this ritual demonstrates friendship or rivalries. Allowing other people to read messages is often a sign of trust and friendship, or even intimacy.

Boase and Kobayashi (2008) report on the role of mobile phone email in Japan to bond, bridge, and break social ties. Their study shows that email on mobile phones is used to maintain contact with their peers throughout the day (bond) and even more fundamentally it helps to form new relationships (bridge). In addition to that, they revealed that the increased amount of social relationships did not lead to a break with weak ties.

Based on Taylor and Harper's (2002) previously described ethnographic studies and the gift-giving practices among teenagers, Berg et al. (2003) provided a design of future mobile devices mainly for young people. Their conceptual design aims at supporting teenagers' social practices through novel multimedia messaging and an augmentation of the phone's address book. Amin et al. (2005) presented "SenseMS", an enhanced SMS application designed to support affective communication. Their approach included the possibility for facial expression, self-presentation, message personalization and context awareness.

These studies show that researchers have investigated the phenomenon of mobile attachment from different perspectives. Nevertheless, a conceptual model, which identifies causes for mobile attachment as well as the development of mobile attachment over time, has not been addressed sufficiently. Before proceeding to develop a definition as well as conceptional model of mobile attachment, another prominent topic in HCI has to be reviewed since it seems to be closely related to mobile attachment: UX.

2.4 User Experience

Emotional attachment and user experience (UX) are related constructs in HCI. For example, Karapanos et al. (2009) provides a conceptual model of temporality of UX, which consists of three forces: an increasing familiarity, functional dependency, and emotional attachment. The European COST Action 294: MAUSE (Towards the MAturation of Information Technology USability Evaluation) research group conducted a survey to gain a common agreement on the nature and scope of UX (COST294-MAUSE, 2010). Among the 23 statements about UX within this survey, one item stated that "UX is equal to emotional attachment". This statement had to be rated on a five-point scale ("strongly disagree", "disagree", "neutral", "agree", "strongly agree"). It seems the UX community assumes that there is a connection between the concepts of user experience and emotional attachment and that both these concepts might be equal. To be able to discuss this connection and answer the question if both concepts are the same, a review on UX research is necessary.

This section provides a discussion on UX definitions, characteristics and models as well as their relevance for mobile attachment. The presented related work will not only help to identify similarities and differences between UX and emotional attachment, but will also reveal insights for a better understanding of mobile attachment. Above this some of the henceforth presented UX models will serve as a theoretical basis for the conceptual mobile attachment model (see Chapter 3.2) and the temporal mobile attachment model (see Chapter 3.3). The results of the above mentioned survey and an additional discussion on the interrelation between UX and emotional attachment with a special focus on mobile attachment will be discussed in Chapter 3.4.1.

2.4.1 UX Definitions

Since it become clear that a number of qualities of a product go beyond the instrumental aspects of product use, the HCI community has been undergoing a broaden-

ing of scope from ergonomic and usability principles to the much broader concept of UX in the last years (Zimmerman, 2009). In order to improve people's lives across a broad range of contexts (e.g., at home, at work, in transit), aspects such as fun, enjoyment, emotion, sociability and other factors have been researched and UX research has evolved (e.g., Hassenzahl and Tractinsky, 2006; Buxton, 2007).

Nevertheless, there is still a lack of an adequate and overall definition of UX (e.g., Law et al., 2006; Law et al., 2008; Law et al., 2009). Diverse ideas have been recently generated in scientific activities that aim to develop a common understanding about the meaning and scope of UX. One of the first definitions was presented by Alben (1996) who define *experience* within the interaction realm as

> *"[. . .] all the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they are using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it."* (Alben, 1996)

A more precise definition was given by Hassenzahl and Tractinsky (2006):

> *"UX is a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g., complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g., organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.)."* (Hassenzahl and Tractinsky, 2006, p. 95)

The International Organization for Standardization is currently working on a definition of UX. According to this definition, User Experience is:

> *"A person's perceptions and responses that result from the use or anticipated use of a product, system or service. User experience includes all the user's emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments. User experience is a consequence of the presentation, functionality, system performance, interactive behavior, and assistive capabilities of the interactive system. It is also a consequence of the user's prior experiences, attitudes, skills and personality. Usability, when interpreted from the perspective of the user's personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience."* (ISO DIS 9241-210:2008, 2008)

These definitions and descriptions have in common that UX is 'something' that evolves within a user when he or she is interacting (or anticipates to interact) with a product, system or service. What the 'something' exactly is seems not to be clear. It includes emotions, perceptions, responses, and behaviors and is influenced by the characteristics of the user, the properties of the product or service, and the environment within which the interaction occurs. The definition of product attachment by Schifferstein et al. (2003) suggests that emotional attachment is also 'something' within a user (often described as an experience), which is targeted at a specific product, implying emotions within the user (see Chapter 2.1.4). Combining these essences it can be argued that (emotional) product attachment is a special form of user experience, which requires the existence of emotions within the user.

2.4.2 UX Characteristics

Aside from the previously mentioned definitions of UX a broad range of UX characteristics have been proposed. In this section, a sample of related work is presented.

Hassenzahl, Lai-Chong Law, and Hvannberg (2006) mention three characteristics of user experience, which differentiate it from traditional usability. First, compared to usability which deals with task related (also mentioned as instrumental, pragmatic, utilitarian, or functional) aspects, UX takes a more holistic approach, including non-task related (also mentioned as non-instrumental or hedonic) aspects of product possession and use (e.g., beauty, challenge, stimulation, self-expression). Second, UX is subjective. This means that UX focuses on the way people experience and judge products they use. Thus, it does not matter how good a product is objectively unless it is not experienced (in a positive way). Finally, UX deals with the importance of positive outcomes of technology use (e.g., positive emotions like joy, pride, excitement, or simply value). This is in contrast with usability, which focuses on problems, barriers, frustration, or stress. Consequently, this means that positive does not necessarily equate with an absence of the negative. All three characteristics can also be identified with the concept of product attachment.

Law et al. (2009) presented a discussion on key aspects of UX. They state that UX has a dynamic nature, due to the ever-changing internal state of a person which affects the experience as well as due to differences in experience during and after an interaction with a product. Second, UX emphasizes also non-utilitarian aspects (e.g., affect, sensation, meaning, and values) and is highly subjective which is contrary to the concept of usability. It is based on the perception of the characteristics of an artifact, but

not on the characteristics per se. Thus, an objective user experience is not possible. Third, they state that UX is an individual experience which can be influenced by a social context. If a group of users interacts with a product, system or service, it is still the individual who has the experience. Nevertheless, the individual experience of a group member can be affected by the expressions of the experience by other group members. Thus, the social aspect of UX is an important influencing contextual factor. These factors (the dynamic nature, the accentuation of non-utilitarian qualities, the individual experience) are also important aspects of product attachment, which strengthens the assumption of a close relationship between product attachment and UX.

Regarding the relation between UX and other experiences, Law et al. (2009) recommend that UX may be applied to products, systems, services, and objects that a person interacts with through a user interface (see Figure 2.5). However, brand experience, product experience or service experience are different constructs. In their view, brand experience is broader than UX. It includes not only interaction with the branded products, but interaction with the company and all its products and services. Product experience, in turn, has a narrower scope than user experience, since it only includes commercial products and focuses on the artifact itself. This categorization falls short in the case of experiences with mobile phones, not to mention mobile attachment. First, mobile phones are almost always strongly related with the manufacturer, as our findings from the pilot mobile attachment study show (see Chapter 5). Brand experience plays an decisive role in the user experience with mobile phones. Imagine the close connection between an iPhone and Apple. Second, the mobile phone and the provided services (e.g., telephone, SMS) are closely related to each other. Mobile attachment is often targeted towards the mobile device but equally towards the emotional goals this device enables and towards the provided services (Vincent and Harper, 2003).
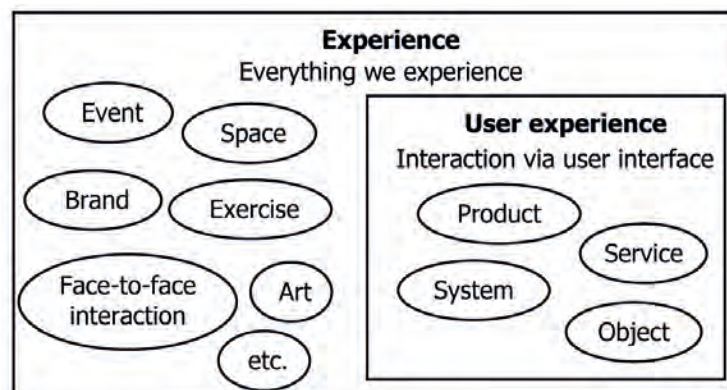
Figure 2.5: UX in relation to other experiences that we can study (Law et al., 2009)

A commonly known design related approach to characterize people's experiences with products was presented by Norman (2004). He argues that the interaction between people and artifacts evokes emotional reactions – user experience episodes with a device in various contexts. These user experience episodes can be categorized into three dimensions which occur when people use products. The *visceral level* describes the impression of a product through its appearance. At this level, people do not think about it; feelings occur automatically and spontaneous judgments take place. At the *behavioral level*, individuals use and experience a product. They appraise its functions, discover how well the functions fulfill their needs, and how easily the product can be used. This level includes pleasure and effectiveness of use. Neither appearance nor rationale, only performance matters (Norman, 2004, p. 69). At the *reflective level*, consciousness takes part in the process. People understand and interpret things. They remember past experiences and use their experiences for future actions. Within the reflective level the meaning of things, the self-image and the message a product sends to others take place (Norman, 2004, p. 83 f.). Regarding the temporal dimension, Norman states that the visceral and behavioral levels are about 'now', whereas the reflective level extends much longer.

> *"Reflective design, therefore, is about long-term relations, about the feeling of satisfaction produced by owning, displaying, and using a product. A person's self-identity is located within the reflective level, and here is where the interaction between the product and your identity is important as demonstrated in pride (or shame) of ownership or use."* (Norman, 2004, p. 38)

Norman's three levels suggest that emotional attachment is influenced by the visceral and behavioral level but is located primarily within the reflective level. This will help us to describe the temporal nature of mobile attachment in Chapter 3.3.

2.4.3 UX Models

Aside from the previously described attributes of user experience, plenty of UX models have been proposed. These research approaches can be classified in 4 areas: phenomenological approaches, design-oriented approaches, emotion-focused approaches, and quality-focused approaches (Mahlke, 2007).

Phenomenological approaches argue for a holistic and qualitative study of UX and resist to reduce UX into a number of factors or processes (Mahlke, 2007). Forlizzi and Ford (2000), for instance, point out that we can only design situations but not predicted

outcomes. According to the authors, influencing factors on UX are the user, the product, and the context of use surrounding the user and the product. The context of use is, in turn, shaped by social, cultural and organizational behavior patterns. Furthermore, the authors distinguish between *experience*, *an experience* and *experience as story*.

Based on Carlson's (1997) theory of cognition, Forlizzi and Ford (2000) define experience as "the constant stream that happens during moments of consciousness". An experience is characterized by having a beginning and an end and simultaneously changing the user. Experience as story refers to stories as vehicles that we use to condense, remember, and to communicate experiences to audience. Sanders (2001) argue that experience is a subjective event that lasts only for a moment. Experiences in the past are *memories*, whereas experiences not jet lived, but imagined Sanders calls *dreams*. Based on Battarbee's (2003) work, Forlizzi and Battarbee (2004) added the notion of *co-experience* as "user experience in social contexts [...] taking place as experiences are created together, or shared with others".

Design-oriented approaches aim to support designers (Mahlke, 2007). These approaches are mainly conceptual, taking into account all relevant aspects of UX. Jääskö and Mattelmäki (2003), for example, presented seven UX qualities which have an affect on the human-product relationship divided into two groups: directly product related qualities and different contextual qualities. The first group (directly product related qualities) consist of the following qualities:

➤ appearance (e.g., aesthetics, physical ergonomics)

➤ user interface qualities of the product (e.g., cognitive ergonomics)

The second group (different contextual qualities) includes the following human-product relationship qualities:

➤ user personality qualities (e.g., self-image, attitudes, values, lifestyle, previous experience) within the socio-cultural context

➤ product meaning qualities (e.g., attachment, stories, memories, product penetration and root) within the temporal context

➤ environmental qualities (e.g., physical and aesthetic environment, atmosphere) within the physical context

➤ interaction qualities (e.g., tasks, actions, situations) within the particular context of use

➤ product novelty qualities (e.g., comparison to other products, relation to trends, product generalization) within the market context

Arhippainen and Tähti (2003) classified factors relevant for UX into five groups:

➣ the user (e.g., values, emotions, expectations, prior experiences, physical characteristics, motor functions, personality, motivation, skills, age)

➣ the product (e.g., usability, functions, size, weight, language, symbols, aesthetic characteristics, usefulness, reputation, adaptivity, mobility)

➣ social factors (e.g., time pressure, pressure of success and fail, explicit and implicit requirements)

➣ cultural factors (e.g., sex, fashion, habits, norms, language, symbols, religion)

➣ context of use (e.g., time, place, accompanying persons, temperature)

Emotion-focused approaches deal with specific emotions or generally take the role of emotions in relation to UX into account, like, for instance. pleasure, fun, and flow. (Mahlke, 2007). Zimmermann (2008) states that emotions can be seen as an antecedent influencing the quality of interaction. Affect again is seen as a consequence of interaction. The users emotions is changed through interaction with a product. Jordan (2000) provides a hierarchical organization of user needs. Functionality is the basis, followed by usability as higher level and pleasure as highest and most important level. Furthermore, he classifies pleasure into 4 aspects: *Physio-pleasure* (the user's sensual experience of product use), *psycho-pleasure* (the experienced usability and emotions that arise), *socio-pleasure* (emotions that arise based on the relationships with others), and *ideo-pleasure* (values including tastes, moral values, or personal aspirations). Rafaeli and Vilnai-Yavetz (2004) proposed a model of the relationship between physical artifacts and emotions that are elicited by these artifacts. These artifacts are conceptualized on three levels: instrumentality, aesthetics and symbolism. Based on the perception of each of these three quality dimensions, different kinds of emotions arise.

Quality-focused approaches deal with specific non-instrumental quality aspects, often focusing on selected aspects of aesthetic and symbolic quality (Mahlke, 2007). The concept of *hedonic quality*, which deals with symbolic aspects of users' quality perceptions, is often used in HCI. Hassenzahl et al. (2000) states that hedonic quality comprises quality dimensions such as novelty, originality, innovativeness, and beauty. Hassenzahl et al. (2000) argue that subjectively perceived ergonomic quality (e.g., simplicity, controllability) and hedonic quality contribute equally to the appeal of a system.

A more comprehensive framework for UX was proposed by Mahlke and Thüring (2007). They base their model (see Figure 2.6 on the facing page) on the assumption

that UX takes place in and during the interaction with the system. Furthermore, the human-technology interaction is shaped by the influencing factors (characteristics of the user, the usage situation, and the system), including all aspects that have an impact on the interaction. The interaction is experienced by the user, where various components of UX play a role. Instrumental and non-instrumental qualities are perceived independently, and emotional user reactions are determined by instrumental and non-instrumental quality perceptions. The perception of these qualities finally determines the consequences of UX (e.g., acceptance of the system, usage behavior). Following these arguments, attachment is not a UX component itself but a consequence of user experience.
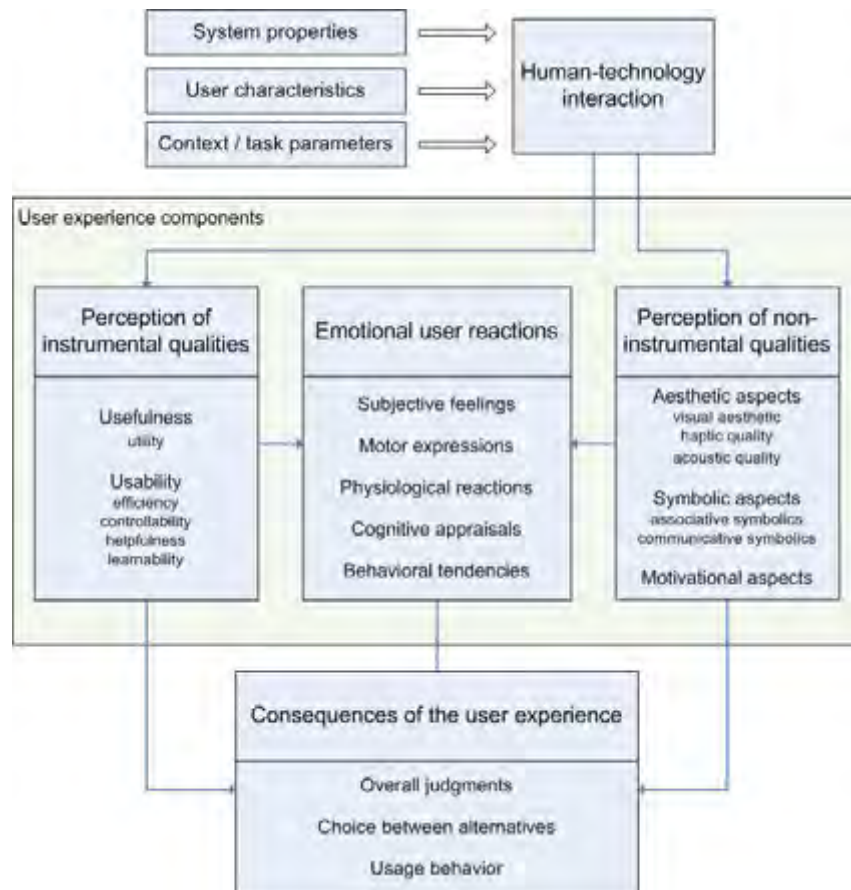

Figure 2.6: UX research framework suggested by Mahlke and Thüring (2007)

2.4.4 Temporality of UX

Another aspect addressed by UX researchers is the temporal dimension of user experience (i.e. how the quality of UX develops over time). This aspect has been rather neglected so far in HCI research (Karapanos et al., 2009). Since emotional attachment is dynamic and evolves over time, research on the dynamics of UX have to be taken into account for a comprehensive understanding of mobile attachment. Additionally, the following approaches will be helpful in the development of the temporal mobile attachment model presented in Chapter 3.3.

Roto (2007) states that user experience can be divided into three phases: *expected UX*, *UX during interaction*, and *overall UX* (see Figure 2.7). The expected UX takes place before the interaction happens. It is influenced by previous knowledge about the interaction, brand image of the artifact with which the interaction takes place, and on hearsay prior to the interaction. These factors influence the actual user experience during interaction, which again has an effect on the overall user experience. Additionally, the overall UX is influenced by factors, such as advertisements outside the interaction. In return, it influences the expected UX before the next potential interaction.
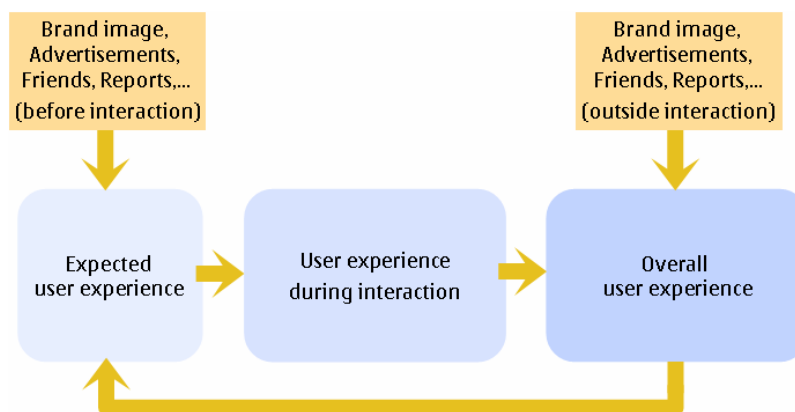
Figure 2.7: User Experience Phases (Roto, 2007)

Another framework was presented by Karapanos et al. (2009). They identified three phases in the adoption of the product based on a five-week field study that followed 6 individuals during an actual purchase of the Apple iPhone: *orientation*, *incorporation*, and *identification*. Prior to these phases, *anticipation* (i.e. the act of anticipating an experience resulting in the formation of expectations) takes place. Initial experiences including feelings of excitement and frustration occur within the orientation phase. In this phase the user gets familiar with the device. Thus, learnability and stimulation are important factors. Incorporation refers to the emergence of meaning-

fulness of the device in everyday life. A functional dependency can be observed and long-term usability and usefulness become relevant. Finally, during the identification phase, emotional attachment emerges. The device is assumed to participate in social interactions, reflects the user's self-identity, and creates a sense of community. Figure 2.8 illustrates this framework. Based on their findings, Karapanos et al. (2009) promote designing for meaningful mediation, designing for daily rituals, and designing for the self as three directions for future HCI practice.
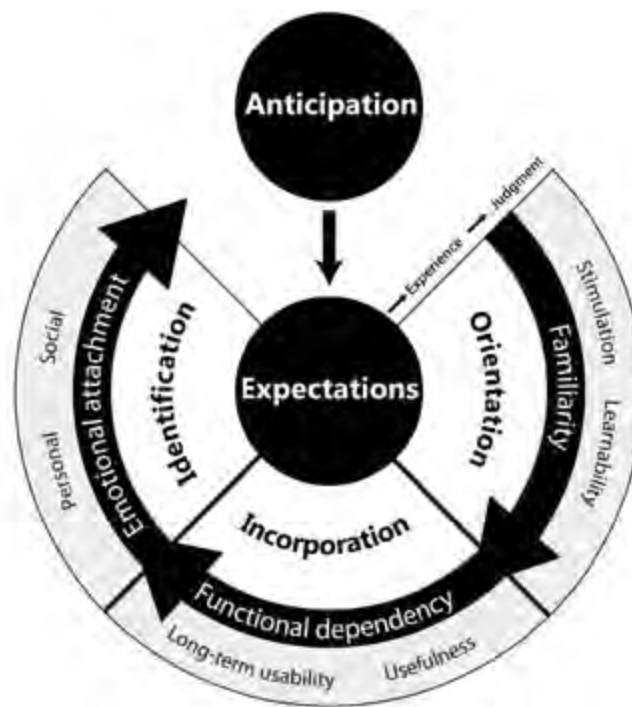
Figure 2.8: Karapanos et al.'s temporal model of experience, consisting of three main forces, an increasing familiarity, functional dependency and emotional attachment (Karapanos et al., 2009)

In addition to the presented frameworks, HCI has witnessed a few studies which explored UX over time. von Wilamowitz-Moellendorff et al. (2006) report on the dynamics of UX with mobile phones. Based on the "CORPUS" (Change Oriented analysis of the Relationship between Product and USer) interview technique, they interviewed eight individuals, who owned their mobile phone for at least one year. Their results show that pragmatic perceptions remained rather stable (utility) or even improved (usability), whereas hedonic perceptions (stimulation, beauty, communicate identity) declined. Karapanos et al. (2008) performed an exploratory study on UX with Interactive TV set-top boxes over time. Their findings show that the goodness of the interface was largely formed on the basis of pragmatic aspects (i.e. utility and

usability) during the first experiences. Identification (i.e. what the products expresses about its owner) became more dominant after four weeks of use. Beauty judgments were affected by stimulation (e.g., novelty) during the first experiences, which lost its power over time (Karapanos et al., 2008).

Chapter Summary

This chapter has revealed important aspects for mobile attachment. Attachment theory suggests that attachment has strength and evolves over time. Studies with infants have shown that it is possible to deduce different attachment types merely from the behavior of an individual. Infants, who are attached maintain proximity to their care giver, feel distressed when separated from the attachment figure and see the attachment figure as a save haven and secure base (Bowlby, 1969).

Objects may be perceived as an extension of the self by their owners, when they support the process of identity construction. This is achieved, when the object enhances personal power, provides a sense of identity by serving as a reminder of the past, and serves as a symbol of who the user is or to which group the user belongs to (Belk, 1988). Consumer research suggests that material possession attachment is a multifaceted property of the relationship between an individual and a specific material and personalized object which is dynamic, evolves over time, and has strength (Kleine and Baker, 2004). The concept of brand attachment contributes to the understanding of mobile attachment in different ways. It provides a definition (the strength of the cognitive and affective bond connecting the brand with the self) as well as a conceptual model of brand attachment. According to this a person is attached to a brand when the brand is able to gratify, enable, and enrich the self (Park et al., 2006).

From a design perspective, a shift from usable products to emotional and pleasurable designs have been promoted. Research on product attachment has revealed that different product meanings (enjoyment, individual autonomy, group affiliation, and life vision) emerge from different facets of the self (diffuse, private, public, and collective self) (Schifferstein et al., 2003). A similar approach states that at least four product meanings may be regarded as possible determinants of product attachment to ordinary products (self-expression, group affiliation, memories, pleasure) (Mugge, 2008). Other concepts like product love (Russo et al., 2011) and designing for the self (Zimmerman, 2009) have been introduced. Additionally, various product attachment studies have been presented.

Attachment related research in HCI has investigated human's attachment to virtual artifacts or robots – pets as well as humanoid robots. Additionally, concepts like the self, enchantment, love, and place attachment have been investigated. The topic of (mobile) personalization has been addressed intensely. The possibility of personalization is regarded as one important aspect of product attachment (Mugge, 2008).

The literature review on mobile attachment has revealed a lot of studies investigating mobile attachment to different user groups (above all teenager) have been carried out. Nevertheless, a solid conceptional model of mobile attachment is missing. Vincent (2005) claims that people are emotionally attached to their mobile phones when they acts as icons for the user both by reflecting the user's life and holding memories, as well as by representing the social group with whom the user communicates. Wehmeyer (2008) proposes three dimensions of mobile attachment: symbolism, aesthetics, and perceived necessity.

Finally, since UX and emotional attachment are related concepts in HCI, definitions, characteristics, and UX models have been presented. Above all, the temporal UX model by Karapanos et al. (2009) including emotional attachment at the third stage is relevant for the mobile attachment models, which will be presented in the following chapter.

Understanding Mobile Attachment

As stated in the Introduction, this thesis' overall research goal is to expand the understanding of mobile attachment from an HCI perspective. This includes the formulation and discussion of a definition of mobile attachment (RG1), the identification of causes and consequences of mobile attachment (RG2), as well as a characterization of the development of mobile attachment over time (RG3). These three aspects correspond to the first three research goals formulated in Chapter 1.2. This chapter addresses these three research goals and provides adequate solutions.

Up to now neither a concrete definition of mobile attachment, nor well elaborated models which interpret the nature of mobile attachment, are available. So far, the existence of emotional attachment to mobile phones has been described rather implicitly and consequences for individuals and the society have been researched. A thorough conceptional understanding of mobile attachment is, however, missing. As presented in Chapter 2, various disciplines have researched emotional attachment from different perspectives. On the basis of attachment theory in psychology and the concept of the extended self, consumer research and the design community have developed definitions and models for brand and product attachment in general. First steps to identify different dimensions of mobile attachment have been provided by Wehmeyer (2008). In HCI, the UX community has explored emotional attachment as part of the overall UX. For the development of a definition as well as a conceptual and temporal model of mobile attachment I have made an extended literature review. In doing so, different definitions and conceptual models from brand and product attachment research have been adapted. Additionally, findings from the three empirical studies presented in Chapter 5, 6 and 7 have contributed to the development of these models.

In this chapter, the definition of mobile attachment (RG1), the conceptual mobile attachment model (RG2), as well as the temporal mobile attachment model (RG3) are presented. It starts with a section on defining mobile attachment, which includes a detailed motivation on the terminology of mobile attachment, a discussion on the hierarchy of mobile attachment, and finally the definition itself. The next sections introduce the conceptual mobile attachment mode as well as the temporal mobile attachment model. In the last section of this chapter, mobile attachment is compared with user experience and other related concepts like love and commitment.

3.1 Defining Mobile Attachment

This section starts with the motivation on the usage of the term "mobile attachment" to describe the users' emotional attachment to mobile devices and services, and provides a discussion on its terminology. It outlines different levels of mobile attachment and discusses this hierarchy in detail. Finally, a definition of mobile attachment is provided including its implications.

3.1.1 Mobile Attachment Terminology and Scope

As outlined in Chapter 1.2, I refer to the emotional attachment to mobile devices and services as "mobile attachment". This section shows what motivate the usage of this terminology. Although the bonding between humans and their mobile phones have been researched before (see Chapter 2.3), the term "mobile attachment" has not been used to entitle this phenomenon. In scientific literature, a variety of denotation to express a close user-mobile device relationship has been used. Most researchers described this special relationship either implicit (e.g., Townsend, 2002; Katz and Sugiyama, 2005), in terms like "emotional attachment to mobile phones" (e.g., Vincent, 2005; Yamashita et al., 2007) or simply as "attachment to (cell) phones" (e.g., McCarthy et al., 2006; Palen and Hughes, 2007).

Wehmeyer (2008) has coined the term "user-device attachment" for describing the relationship between users and their mobile devices. Since the term "user-device" is rather generic and may include stationary devices as well, it is not suitable. Nevertheless, as exemplified throughout Chapter 2, the form of the term (i.e. the word "attachment" preceded by a noun to which the attachment is targeted on) is mainly used in literature to describe an emotional attachment to an attachment object. For instance, "brand attachment" refers to the research field investigating the emotional attachment

to a specific brand (Park et al., 2006a), "product attachment" investigates the emotional tie between users and everyday products Mugge (2008), and "place attachment" describes the bonding between a person and a cherished location.

Following this pattern, I suggest to use the term "mobile attachment" to label the emotional attachment to mobile devices and services. In doing so, the word "mobile" refers to mobile devices, including the services these mobile devices provide. As mentioned in Chapter 1.2, "mobile devices" comprises any kind of personal mobile ICTs including portable computers like notebooks, netbooks, tablet computers (e.g., Apple's iPad), and PDAs as well as portable music players like MP3 players (e.g., Apple's iPod) or Sony's Walkman. Although most of the findings presented here are applicable to the above described devices, "mobile attachment" as used in this thesis refers above all to the special relationship of users with mobile phones and smartphones including the particular properties of these kind of mobile devices. These properties include general capabilities of mobile phones for different kinds of communication (e.g., phone, messenger, text messages, email) and information storage and retrieval (e.g., address book, calendar, music player, web browser), as well as other characteristics like the high mobility of mobile phones contingent on their small size or the fact that mobile phones are most times switched on. Since the boarder between different kinds of mobile ICTs seems to blur with each integration of new services into new tools, an exact differentiation of mobile ICTs is not part of this thesis.

3.1.2 Hierarchy of Mobile Attachment

As explained in Chapter 2.1 and 2.2, people may experience attachments to a variety of entities. Some of the entities are living like parents (Bowlby, 1969), other adults (Hesse, 1999), celebrities (Thomson, 2006), or pets (Holbrook and Woodside, 2008). Others are inanimate mimicking living beings like humanoid robots (Levy, 2007), avatars (Wolfendale, 2007), and artificial pets (Friedman et al., 2003); while still others are more abstract like brands (Fournier, 1998), places (Farnham et al., 2009), or experiences (Kleine and Baker, 2004). The attachment to mobile devices fall into another category namely (consumer-)product attachment (Schifferstein et al., 2003) or (material) possession attachment (Kleine and Baker, 2004). In this category not only mobile phones are subsumed but also other objects like cars, watches, jewelry, etc.

According to Mugge (2008) product attachment may be experienced at five different levels of abstraction. On one level, people maybe attached to a specific product specimen which is in principle irreplaceable for the owner. On another level, people

Object	Construct	Examples
Mobile device specimen	Mobile attachment - irreplaceability	My wife's white iPhone 3G
Mobile device variant - level 1: *twin*	Mobile attachment	A white iPhone 3G
Mobile device variant - level 2: *brother*	Mobile attachment	An iPhone
Mobile device variant - level 3: *cousin*	Mobile attachment	An iPhone substitute
Brand	Brand attachment	Apple
Product category	Enduring involvement	Mobile phones
Products in general	Materialism	All possessions: mobile phones, cars, jewelry etc.

Table 3.1: Levels of mobile attachment elaborated on the basis of Mugge's (2008) product attachment hierarchy; white rows illustrate different levels of mobile attachment. The strongest form of attachment can be observed, when the mobile device specimen is irreplaceable for the owner. Mobile attachment to device variants may be structured into three levels: twins (level 1), brothers (level 2), and cousins (level 3). The grey rows illustrates higher order attachment constructs. These levels are not part of the mobile attachment hierarchy.

may be attached to a product variant, which implies on the one hand that the object has a special meaning for the owner and on the other hand that the object is replaceable by other products of the same types. The other levels are brand attachment, the enduring involvement in a product category, and finally the bond to products in general (materialism). In general these levels may be also applied to the attachment to mobile devices and services. Nevertheless, I suggest that particularly the attachment to mobile device variants may be categorized more granular. Table 3.1 illustrates the elaboration of different levels of mobile attachment based on Mugge's (2008, p. 12) "hierarchy of types of attachment to products". In the next sections, these levels are discussed in detail.

Attachment to Mobile Device Specimens and Variants

On a rather concrete level stands the attachment to a specific mobile device, or following Mugge's (2008) wording a mobile device specimen. Being attached to a unique mobile device implies that no other mobile device can completely substitute this partic-

ular one. The mobile device itself becomes irreplaceable comprising a strong symbolic meaning to its owner that is not present in other products, even when they are physically identical (Schifferstein and Zwartkruis-Pelgrim, 2008). This special meaning is deeply anchored in that particular object, and the product and its meaning become indispensable (Mugge, 2008). For example, the damaged iPhone 3G of my wife reported in Chapter 1 could not be replaced by any other iPhone 3GS. This might be the case when the mobile device holds specific memories. For example, in my wife's case the mobile device was a Mother's Day gift. Another reason for this kind of attachment could be that a replacement is actually impossible. This might be the case when pictures are only stored on the mobile device or received SMS are lost. Moreover the device could have been individually decorated (see the discussion in Chapter 2.2.3 on Deco-Den) or has inimitable signs of usage (e.g., stains, scratches) carrying a special meaning for the owner. All these reasons could lead to an increased attachment to the particular mobile device implying its irreplaceability.

Since mobile ICT and moreover the mobile phone market develops rapidly (Moore's law[1] is true for these kind of products as well), mobile phones become outdated rather quickly. The features of today's premium mobile phone model may be integrated in lower price models in less than a year and the successor of the premium model offers new possibilities. Being emotionally attached to an irreplaceable mobile device specimen means that the owner of the mobile device is resistant to the temptations presented through advertisement of newer and better mobile devices every day. Since this is seldom the case it seems reasonable to extend the notion of mobile attachment from mobile device specimens to mobile device variants.

Being attached to a mobile device variant means that this specific type of mobile device has a special meaning to the owner (Mugge, 2008). Therefore, the mobile device itself is replaceable for the owner by any other physically identical or similar mobile device. It is not the particular object itself to which the person is attached, but rather the mobile device type, its pleasing appearance, or its symbolic function for the owner. The special meaning a particular mobile device elicits in the owner is present in any other mobile device of the same type. Mugge (2008) entitles this kind of attachment to products in general as "product attachment" with "product variants" as attachment objects.

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[1]Moore's law originally describes that the number of transistors that can be placed inexpensively on an integrated circuit doubles approximately every 18 months (Moore, 1965). Linked to Moore's law is the assumption, that different capabilities of ICTs (e.g., processing speed, memory capacity) are improving at exponential rates as well (Hutcheson, 2005).

In addition to this, at least three different levels of attachment to mobile device variants can be identified. On one level, the mobile device might be replaceable for the owner only by an exact replica of the mobile device including all characteristics such as model, color, capacity. For example, my wife's white iPhone 3G with 16 GB storage capacity could only be replaced by another white iPhone 3G with 16 GB storage capacity, because she is attached to the form and color of her iPhone and wants to upload the same music and ringtones again. I refer to this type of attachment as "mobile attachment to a mobile device variant level 1" or "twin", since only a rather exact replica may replace the original. On another level, the substitute need not to be physically identical in every single detail. This ranges from a different color (e.g., instead of the white iPhone a black one) and quality characteristics (e.g., instead of the iPhone with 16GB the model with 32 GB) to another model of the same series (e.g., instead of the iPhone 3G, the succeeding model 3GS, or the brand new model iPhone 4). In the latter case the owner is not attached to a particular iPhone but iPhones in general. I refer to this kind of bond as "mobile attachment to a mobile device variant level 2" or "brother", since the attachment object may be replaced by another device from the same product family. On yet another level, the replacement phone may not even be an iPhone, but an adequate substitute. Driven by the enormous success of the iPhone other communication companies have released iPhone alternatives offering similar experiences and services (e.g., multi touch screen, app store). This kind of mobile attachment is referred to as "mobile attachment to a mobile device variant level 3" or "cousin", since the original may be replaced by a (remote) relative, which shares certain characteristics but does not necessarily belong to the same family.

From a consumer research point of view, the second level of mobile attachment (brother) seems to be mainly welcomed by communication corporations. Companies like Nokia, Samsung, LG Electronics, Motorola , Sony-Ericsson, Research In Motion, Apple, HTC Corporation and all other mobile phone manufacturers, desire a balance in the strength of mobile attachment. On one hand, they try to produce covetable mobile phones to which people can easily build a strong emotional attachment to sell as many mobile devices as possible. On the other hand, if the strength of mobile attachment is too high then people are less willing to buy another mobile phone. In order to increase sales, volume mobile phone manufactures try to strengthen mobile attachment to mobile device series. Whenever a new device of the same series is published, the consumer should substitute the old mobile device with a new one from the same type. Apple is a good example for this. Apple has introduced the original iPhone in 2007. In 2008, the successor models iPhone 3G and iPhone 3GS were

presented and in 2010 the iPhone 4 was launched. From a company perspective, it would have been most profitable if people had bought the original iPhone in 2007, replaced it in 2008 by the iPhone 3G or 3GS and again replace this model with the new iPhone 4 in 2010. Each new model was advertised as better than the old one and has offered the customer new possibilities. The first generation iPhone was replaced by the iPhone 3G with a slightly different appearance, GPS and triband connectivity. The 3GS model includes a faster processor, more storage capacity, HSDPA and a digital compass. The fourth generation iPhone 4 again looks different than the older models and was made from other materials. It includes a higher megapixel camera, HD video, improved performance, a gyroscopic sensor, a higher display resolution to mention only a few.

The research on mobile attachment in teenagers presented in Chapter 2.3.2 may be characterized both as attachment to mobile device specimens and mobile device variants. On one hand, it was reported that teenagers are attached to mobile phone specimens, which are irreplaceable for them. Examples are Kasesniemi and Rautiainen's (2002) and Taylor and Harper's (2002) depiction of teenagers being attached to their mobile phones, because they serve as a container for messages in their original form, and Ling and Yttri's (2002) report on the big role of mobile phones for teenagers as an expression of their personality. On the other hand, it was revealed that mobile phones in general provide symbolic functions. Examples are Vincent's (2004) report on the special meaning of mobile phones for 11 to 16 year olds as a symbol for 'coming of age' and Palen and Hughes's (2007) description of parents who use mobile phones to maintain an emotional connection with their children. In these cases, the attachment object itself is relatively easy to be replaced as long as the service it provides remain the same. People who feel attached to mobile phones in this way generally state that they cannot live without a mobile phone anymore regardless of a particular mobile phone as long as a substitute with the same features is available. This kind of attachment is often dependent on the specific services the mobile device provides (e.g., telephone, SMS) fulfilling desires (e.g., feeling of independence, social bond).

Attachment to Brands

A different form of attachment, which is even more welcomed by corporations, is reached when people do not experience a bond with a particular mobile device (e.g., a friend's Nokia E90 Communicator) or mobile device series (e.g., Nokia Communicators) but to the brand itself (e.g., Nokia). As discussed in Chapter 2.1.3, brand

attachment refers to the strength of the connection formed between the customer and the brand toward a prediction of relationship stability over time (Fournier, 1998). A person who is attached to a specific brand is likely to purchase another mobile phone from this brand in case of a replacement of the old one (Park et al., 2006). Although mobile devices and brands are mainly closely connected to each other (e.g., through a corporate identity or a logo) this person does not necessarily feel an attachment to his or her particular mobile device or even to the according mobile device series.

In reality, mobile attachment and brand attachment show parallels and often influence each other. Each interaction with a specific mobile device affects the perception of the brand and vice versa; the relationship with a brand has an influence on mobile attachment. The attachment to the mobile device may be even transfered to the brand and in return the brand attachment may be assigned to the mobile device (Mugge, 2008). Nevertheless, it is imaginable that a person, for whom Apple has no special meaning, may experience an attachment to an iPhone. On the other hand, somebody who is attached to Apple (e.g., likes the Apple lifestyle and loves to work on an Apple MacBookPro) may be not attached to an iPhone but rather likes mobile devices with a real keyboard.

Attachment to Product Categories and Products In General

Another form of relationship is when a person feels no bond with a particular mobile device or a mobile device series but is generally attached to mobile devices independent from brand or type. Mobile phone collectors may fall in this category. Regarding products in general, Mugge (2008) suggest to use a different construct than attachment for this kind of relationship, namely "enduring involvement". She argues that experiencing "enduring involvement" toward a specific product category (e.g., jewelry) implies that this product category in general is important for this person. This leads to a desire to be kept informed about the product category by reading magazines, or visiting related websites and stores. Furthermore, Mugge (2008) reasons that a person who is enduringly involved with a certain product category is probably attached to his or her own products belonging to this category. On the other hand, the attachment to a specific product does not require enduring involvement with the respective product category. For mobile devices, this means that a person may not be enduringly involved in mobile phones in general, but may feel deeply attached to his or her mobile phone.

The most abstract level of person-object relationship is reached when a person is connected not only to single product categories but products in general. This kind of

relationship can be described as materialism, which is defined as "the importance a person attaches to worldly possessions" (Belk, 1985). Mugge (2008) argues that materialism and product attachment are not directly related, since the former is unconnected to any possessions in particular and the latter is targeted at specific objects. Nevertheless, mobile attachment might be related to attitudes towards materialism (e.g., materialism skeptics might refuse a new mobile device being attached to their old mobile phone).

3.1.3 Mobile Attachment Definition

As exemplified in Chapter 2.1, the definition of different attachment constructs is dependent on the attachment object (e.g., person, brand, product) and the scientific community (e.g, psychology, consumer research, design) in which the definition is situated. A single agreed on definition is not available. Bowlby (1979) has defined attachment as "an emotion-laden target-specific bond between two persons". Park et al. (2006) applies this definition to brands and defines brand attachment as "the strength of the cognitive and emotional bond connecting the brand with the self". Schifferstein et al. (2003) defines the degree of consumer-product attachment as "the strength of the emotional bond a consumer experiences with a product". Based on these definitions it can be concluded that that attachment is both an emotional and cognitive bond between a person and an attachment object. Consequently, "mobile attachment" can be defined as follows:

Mobile attachment is a cognitive and emotional target-specific bond connecting a person's self and a mobile device that varies in strength.

Thus, attachment denotes a psychological state of mind in which a strong cognitive and affective bond connects the mobile device with an individual in such a way that the mobile device is assumed to be an extension of the self and, therefore, becomes part of the self-concept (see Park et al., 2006a). The definition itself has a few implications, which will be discussed in the following. First of all, as described in Chapter 3.1.1, the definition includes not only mobile phones and smartphones but is applicable for any personal mobile ICT. The attachment object (mobile device) includes the device itself (hardware), the operating software and the applications that run on the mobile device (software), the services that are provided by hard- and software, and the content that is stored within the mobile device. It forms with specific mobile devices, not with brands or product categories.

Second, the definition implies the existence of a connectedness between the individual's self on one hand and the mobile device on the other. This relationship reflects the extend to which the mobile device is linked to the self. Kleine and Baker (2004) argue that self-extension is a property of possession and for Ball and Tasaki (1992) attachment is even identical to self-extension. Schifferstein and Zwartkruis-Pelgrim (2008) state that attachment and self-extension are related to each other but are not the same. They argue that emotional attachment is not a necessary prerequisite for self-extension. In the case of brand attachment, Park et al. (2006) suggest that individuals develop attachments to brands, which fulfill needs to gratify the self through experiential consumption, to enable the self through functional consumption, and to enrich the self through symbolic consumption. These strategies for brand-self associations may also be applied to mobile attachment.

Third, the definition suggests that the mobile device triggers both cognitive and emotional responses within the user. Positive thoughts and feelings are emerging automatically within the user. Schultz et al. (1989) enumerate a wide range of mainly positive feelings people experience with products to which they are strongly attached (e.g., happiness, love, memories, warmth, pride, security, comfort, excitement, joy) and negative feelings or no feelings at all with, what they called "weak attached objects" (e.g., boredom, frustration, work, disgust). Interestingly "sadness" was mentioned in both categories (i.e. people experience sadness with products to which they strongly and attached as well as with weak attached objects) implying that strong attached objects not only elicit positive emotions. Concerning mobile devices, a lot of researchers report on emotional and cognitive responses from users (see Chapter 2.3). For example, Vincent and Harper (2003) mention panic, strangeness, 'being cool', irrational behavior, thrill, and anxiety as emotional responses from users concerning mobile phones. On a cognitive level, a stronger mobile attachment arises when the mobile device provides the owner with something exceptional above its utilitarian meaning (e.g., autobiographical memories).

Fourth, mobile attachment is not a binary property (i.e. either one is attached or is not attached) but has strength. It might range from the absence of mobile attachment to a very strong attachment like the feeling of loving the mobile device. This assumption is supported by Park et al. (2007) who argue that brand attachment varies in strength and Mugge (2008) who claims that "experiencing attachment to products is a matter of degree". If a user experiences a strong mobile attachment, the particular mobile device becomes irreplaceable. The weaker it gets the easier it is for the user to replace it. The strength of the attachment is dependent on the degree of the mobile-self connectedness.

In its strongest form, the mobile device may be experienced as an extension of the self. The user is willing to invest time and money (e.g., for the purpose of personalization) in the mobile device and participates in communities related to the mobile device on this level. In its weakest form, the mobile device is merely seen as tool which can be replaced by any other mobile device that provides the same basic functionality. In this case, the user is rather attached to the provided service than the mobile device itself. Some authors (e.g., Schifferstein and Zwartkruis-Pelgrim, 2008; Mugge, 2008) argue that solely utilitarian reasons are not sufficient for the emergence of product attachment. These products are easily replaced and, therefore, a strong attachment would not occur. In the case of mobile devices, the functionality of the mobile device may lead to mobile attachment. The desire of being always connected to ones family, friends and colleagues may lead to an attachment to the tool, which enables the user to be always connected. Many people even state that they are dependent on their mobile phones.

Finally, mobile attachment evolves over time and is dynamic in nature. The development of attachment results from repeated interactions between the individual and the attachment object over time (Kleine and Baker, 2004). These interactions start when the user becomes aware of the mobile device for the fist time (e.g., through advertisement), take place when the user handles the mobile device for the fist time (e.g., when unpacking the mobile device) and proceed through possession rituals like using, displaying, cleaning, discussing, and personalizing (McCracken, 1990). These personal experiences may create autobiographical memories, meanings and trust (Park et al., 2006) resulting in the perception of the mobile device as an extension of the self.

Nevertheless, the strength of mobile attachment does not necessarily have to increase with each interaction but has a dynamic nature (Kleine and Baker, 2004). For example, malfunctions normally do not advocate mobile attachment. The stronger the mobile attachment is, the easier it is for the owner to excuse such malfunctions. Sometimes the owner even ascribes humanoid mannerisms to their mobile device when they behave in an unexpected way and concede an independent existence to them. Another reason for the dynamic nature of mobile attachment, is the fact that both the owner's self and the symbolic meaning of the mobile device changes over time. Mobile devices that supports one's personality today may not express the same tomorrow since the owner himself or herself may have changed (e.g., life situation or world view) and the mobile device itself may not represent the same anymore (e.g., an initially modern device has turned into an old-fashioned one). As described in Chapter 3.1.2, mobile devices usually become outdated rather fast and continually newer and – if advertise-

ments are to be believed – better mobile devices are available. This is true within a model series (e.g., the previously described evolution of iPhones) or for different types of mobile devices. Therefore, the mobile attachment to a specific device may decrease and end rather abruptly, being replaced by a mobile attachment to another device.

Generally, it can be stated that most of the discussed implications are related to Kleine and Baker's (2004) nine characteristics of material possession attachment presented in Chapter 2.1.3. Mobile attachment forms with specific material objects (1), forms with psychologically appropriated material objects (2), serves as a type of self-extension (3), forms to decommodified, singularized, and personalized particular material objects symbolizing autobiographical meanings (4), evolves over time when a personal history between the user and the mobile device develops (5), has strength (6), is multifaceted (7), emotionally complex (8), and dynamic in nature (9). With these characteristics as a basis and the previously formulated implications from the mobile attachment definition the conceptual and temporal mobile attachment models will be set up in the next section. Here it is important to mention that the focus of these models lie on mobile attachment as a characteristic of a particular relationship between a user and his or her mobile device as opposed to a model of different attachment patterns (e.g, secure, avoidant, resistant) into which individuals may be categorized as it is the focus of Bowlby's (1969) attachment theory (see Chapter 2.1.1).

Mobile Attachment Models

So far, this section has provided answers to RG1, which aims at providing a definition and discussion of mobile attachment. An extended discussion on mobile attachment, including its differentiation to UX, will be part of Chapter 3.4. RG2 refers to the identification of causes and consequences of mobile attachment and RG3 aims at characterizing the development of mobile attachment over time. The next paragraphs will address these research goals. As defined mobile attachment is a cognitive and emotional target-specific bond connecting a person's self and a mobile device that varies in strength. This definition describes the essence of mobile attachment, but it does not provide answers to questions like:

➢ What are the reasons for the emergence of mobile attachment?

➢ Which factors influences mobile attachment?

➢ To which consequences does mobile attachment lead for the user?

➢ How does mobile attachment develop over time?

To answer these questions, two mobile attachment models which comprise conceptual properties of mobile attachment, antecedent drivers, behavioral user responses, as well as temporal dimensions are presented. The conceptual model describes causes, influencing factors, and consequences for mobile attachment. The temporal model illustrates the mobile attachment lifetime cycle. The proposed definition has a substantial influence on these models and both models are connected with each other. The next two sections will describe the conceptual mobile attachment model and the temporal mobile attachment model in detail.

3.2 Conceptual Mobile Attachment Model

The conceptual mobile attachment model specifies possible reasons for the emergence of mobile attachment, factors that influence this attachment, and resulting behavioral consequences for the individual who is attached to his or her mobile device. In case of brand attachment, Park et al. (2006a) already proposed a model consisting of *causes* and *consequences* of brand attachment. The conceptual model presented here takes this model as a starting point, adapts its considerations to mobile attachment, includes related work on attachment theory (e.g., Bowlby, 1969), possession attachment (e.g., Belk, 1988) and product attachment (e.g., Schifferstein et al., 2003), and adds *influencing factors* as a separate part of the model. It is also related to Mahlke and Thüring's (2007) UX research framework (see Figure 2.6 on page 49). Thus, the conceptual model consists of three parts:

1. Mobile attachment causes

2. General influencing factors

3. Mobile attachment consequences

Mobile attachment causes describe different possibilities why a person is emotionally attached to his or her mobile device. General influencing factors are properties of the user, the device, or the environment which have an impact on mobile attachment. Mobile attachment consequences are behavioral or emotional aftereffects, which emerge as a possible result of the existence of mobile attachment. Figure 3.1 on the following page illustrates the basic elements of the conceptual mobile attachment model.
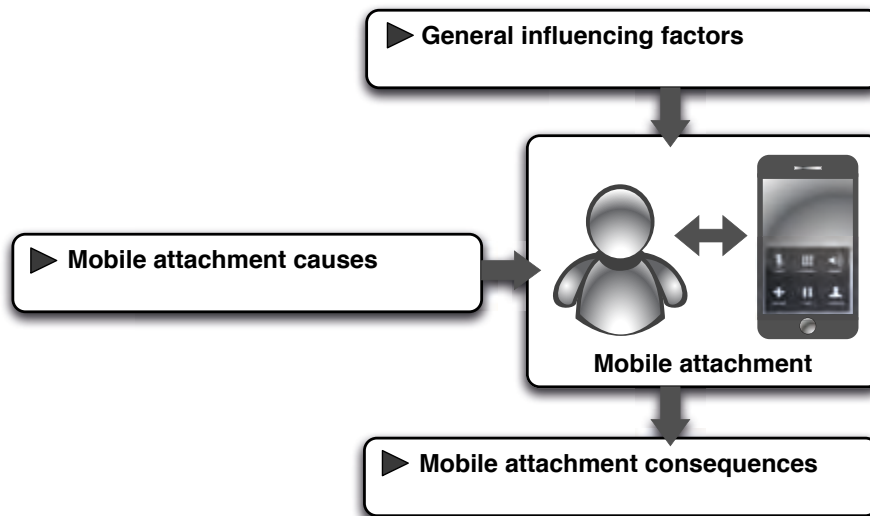
Figure 3.1: Conceptual mobile attachment model

Causes

Following the above elaborated definition, mobile attachment emerges when the mobile device is capable of providing a contribution to the owner's self concept (see Belk, 1988 and Park et al., 2006). Based on diverse forms of how the mobile device may support the self concept, different meanings of the mobile device for the owner can be identified. These meanings may be assumed as possible determinants of mobile attachment (Mugge, 2008). The different forms of how the mobile device is able to support the owner's self concept and based on these forms elaborated determinants build one part of the conceptual mobile attachment model. This part of the model is mainly based on Park et al.'s 2006 contribution on brand attachment as well as on Schifferstein and Zwartkruis-Pelgrim's 2008 and Mugge's 2008 work on product attachment.

Influencing Factors

Another part of the conceptual model of mobile attachment is the identification of various factors which influence mobile attachment. These factors include characteristics of the user (e.g., personality of the user) and the device itself (e.g., design), as well as environmental aspects (e.g., advertisements). Although these factors are in principle independent characteristics of the user, the device, and the context, they may influence the emergence of mobile attachment and correlate with mobile attachment causes. This part of the model is influenced by related work on UX (see Chapter 2.4) and context research in HCI.

Consequences

Finally, the conceptual model comprises behavioral and emotional consequences resulting from mobile attachment, such as the intention to maintain proximity with the device, the investment of money and time, or a recommendation of the mobile device. These potential consequences may provide valuable information on how to measure mobile attachment. Again, Park et al.'s 2006 work on brand attachment served as a basis for this part of the model. Additional related work on attachment theory (see Chapter 2.1.1) as well as HCI related research (see Chapter 2.2) and research on human-mobile relationships (see Chapter 2.3) were considered.

In the following sections, the different aspects of the conceptual mobile attachment model will be discussed in detail. First, mobile attachment causes will be described (see Chapter 3.2.1). Second, general influencing factors will be discussed (see Chapter 3.2.2). And finally, possible consequences of mobile attachment will be considered (see Chapter 3.2.3).

3.2.1 Mobile Attachment Causes

As discussed previously, mobile attachment implicates a kind of mobile-self connectedness. Similar to infants who develop an emotional bond with their caregivers in order to fulfill basic needs (e.g., security, protection, warmth, nutrition) individuals may develop an emotional relationship with their mobile devices that can be counted on to achieve certain goals. Although adult needs might be substantially more complex than those of infants, the basic process by which attachment develops is similar (Park et al., 2006). As pointed out in Chapter 2.1.3, in consumer behavior literature, it is claimed that people use objects to define the self, to serve as a reminder of the self, and to protect the self concept. Mobile attachment may emerge when the user appreciates his or her mobile device and the role it plays in achieving certain goals. The device becomes meaningful, significant, and serves as an object to fulfill the needs of its owner to support his or her self image. To identify causes of mobile attachment and propose possible mobile attachment determinants already conceptualized attachment constructs from psychology, consumer-research and design may be consulted. In the following, related approaches and their relevance for mobile attachment are presented.

Related Approaches

Similar to Park et al.'s (2006) causes for brand attachment, I argue that mobile devices may be counted on to fulfill needs in at least three different ways. First, the mobile device may become linked to the self by offering utilitarian meaning, "enabling a sense of self-efficacy by providing the possibility to achieve mastery goals" (Park et al., 2006). Second, the mobile device may offer a symbolic meaning, enriching the self by representing one's past, present and future self. Third, the mobile device may be connected to the self by providing hedonic meaning and, thereby, gratifying the self by offering aesthetic pleasure.

Kleine and Baker (2004) describe various benefits an attachment possession may provide for the owner. Their work is based on an extensive review of literature about the value of material possession attachment. They categorize overlapping benefits of attachments into two meta-themes: self-definitional value and self-continuity/change value. Self-definitional values include autobiographical values (e.g., to mark life events), story-telling values (e.g., stories of search, self-discovery, growth, and achievement), contemplation values (e.g., using objects for achievement of selfhood based on conscious reflection), action values (e.g., the development of self-control through unique acts), self-boundary regulations (corporal and temporal), self-cultivation and self-development (e.g., memorabilia, growth and development), and affiliation values (e.g., relationships). Self-continuity and self-change values refer to the projection of ourselves into the future. They include adaptive values (e.g., to aid life transitions) and self-preservation values (e.g., after death).

Drawing on Belk's (1988, pp. 145–150) notion of the extended self , the mobile device can provide at least three functions for the owner. In a symbolic way, it may support the desired identity by serving as a symbol of whom one is or to which group one belongs. In an autobiographical way, mobile devices may link the self to the past by providing memories. Finally, mobile devices may literally extend the self as an enhancement of personal power by providing necessary functions to live a modern life.

From a design perspective, Schifferstein and Zwartkruis-Pelgrim (2008) followed a different approach to develop possible determinants for product attachment. They state that people become attached to objects when they support different facets of the self-schema. These were introduced by Greenwald (1988): the diffuse self, the private self, the public self, and the collective self. Schifferstein and Zwartkruis-Pelgrim (2008) claim that the diffuse self's aim is to provide hedonic satisfaction and, therefore, en-

joyment is a driver of attachment. The private self aspires for individual achievements and tries to reach internal personal standards. Products to which we become attached should reflect our identity and express individual autonomy. The public self looks for approval of others (e.g., family members, friends, social groups) resulting in a group affiliation meaning of the product. Finally, the collective self searches for approval from a reference group (e.g., religious community, subculture, ethnic minority) symbolizing an idea or life vision rather than individuals within the reference group.

Schifferstein and Zwartkruis-Pelgrim (2008) argues that these four facets are related to Jordan's (2000) four aspects of pleasure: physio-pleasure, psycho-pleasure, socio-pleasure , and ideo-pleasure as well as to Norman's (2004) three levels of design: visceral, behavioral, and reflective design. Physio-pleasure refers to the user's sensual experience while using a product. Psycho-pleasure includes emotions based on the experienced usability. Socio-pleasure refers to emotions that arise based on the relationships with others. Within ideo-pleasure, values like tastes, moral values, or personal aspirations are included. Visceral design has to do with the appearance of a product, behavioral design concerns the pleasure and effectiveness of use, and reflective design considers the realization and intellectualization of a product.

Another approach to identify determinants of of product attachment was presented by Mugge (2008), as described in Chapter 2.1.4. She proposed four product meanings (self-expression, group affiliation, memories, and pleasure) as possible determinants of product attachment. The determinant self-expression originates in an individual's desire to differentiate from others as an expression of the own identity. The determinant group affiliation stems from people's need to be connected to others, whereas the determinant memories serve as reminder of one's past, which is assumed to be essential to define and maintain one's identity. The last determinant pleasure refers to the aesthetic pleasure and superior functionality of the product.

Finally, Wehmeyer (2008) proposes three dimensions of user-device attachment: symbolism, aesthetics, and perceived necessity (see Chapter 2.3.1). The dimension symbolism includes the group membership and social status. The dimension aesthetics relates to behavior like personalization of mobile phones and is reflected in perception of its beauty and aesthetics. The third dimension perceived necessity covers the level of a close integration of the device in everyday acts of communicating and socializing.

Device-Self Linkage Routes and Design Space Determinants

Based on these approaches, mobile attachment causes including different device-self linkage routes and resulting design space determinants may be derived. Generally, it can be concluded that a mobile device becomes connected to the self when it is perceived as part of the user's self concept. This linkage between the device and the user's self may be fostered via different routes. Each of these routes again may be seen as a different determinant within the mobile device design space. Figure 3.2 illustrates the different causes for mobile attachment including determinants.
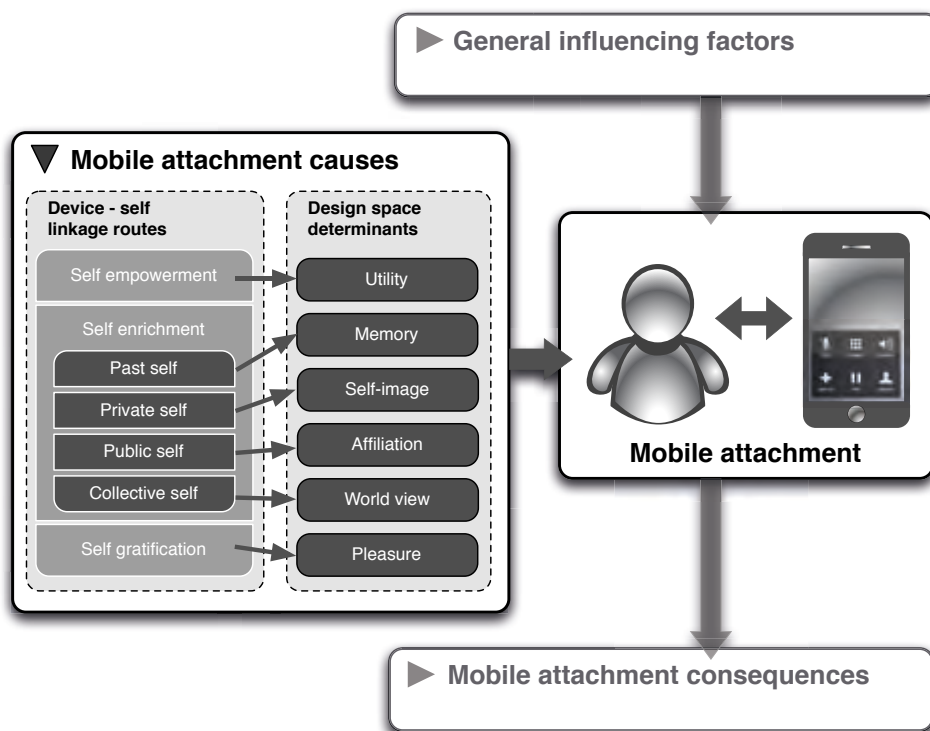
Figure 3.2: Possible causes for the emergence of mobile attachment including different device-self linkage routes and elaborated design space determinants

Analogous to Park et al. (2006), mobile devices may contribute to the self-concept when they have the capability for *empowerment*, *enrichment* and *gratification* of the self. This classification provides a useful high-level structure of device-self associations:

➢ The empowerment of the self refers to the utilitarian meaning of the mobile device.

➢ The enrichment of the self is provided by the symbolic meaning of the mobile device.

➤ The gratification of the self is achieved through hedonic qualities of the mobile device.

The enrichment of the self again has different dimensions. Temporally, a distinction between the past self, the present and future self is suggested (see Park et al., 2006). The mobile device may enrich the past self by providing memories. It may enrich the present and future self by protecting and enhancing the user's self concept. In addition to that, a distinction between the private, the public and the collective self is suggested (see Greenwald, 1988). The private self reflects the self-image a person conceives, the public self reflects the affiliation of the self with a group or the differentiation from others, and the collective self symbolizes a rather abstract idea or world view.

In reality the mentioned reasons are not mutually exclusive; meaning that any or all combinations of causes may foster strong mobile attachment. The more links a mobile device provides to the self and the more intense these links are, the stronger the mobile attachment becomes. Table 3.2 on the following page subsumes the proposed device-self connectedness dimensions and mobile attachment determinants together with the above mentioned factors and determinants from literature. In the following, the different device-self connectedness dimensions and resulting determinants will be discussed in detail.

Self Empowerment → Utility

Strong mobile attachments can occur when a mobile device creates an efficacious and capable self, empowering owners to achieve mastery goals. If a mobile device enables the user to exert control over his or her environment in order to reach desired goals and avoid undesired ones, it may be regarded as part of the self and, therefore, mobile attachment may emerge (see the notion of "enabling the self" by Park et al., 2006). In its strongest form, mobile devices may be seen as an extension of the self. Since the mobile device in this case provides mainly utilitarian functions, the resulting design space determinant is labeled "utility".

The utilitarian meaning of a product serving as a necessary condition for emotional attachment is a matter of discussion in scientific literature. For example, Schifferstein and Zwartkruis-Pelgrim (2008) claim that product utility is not a necessary condition for consumer product attachment. They argue that people may hang on to products to which they are attached even when these products are broken or do not work properly. In their opinion, the fact that a product fulfills its primary utilitarian function (e.g., a clock shows the correct time) does not contribute to the degree of product attachment.

Device-self linkage routes	Design space determinants	Related work
Self empowerment	Utility	Enable the self[a], Action value[b], Enhancement of personal power[c], Behavioral design[d], Perceived necessity[e]
Past self enrichment	Memory	Enrich the self[a], Autobiographical value[b], Story-telling value[b], Link to past[c], Private self[f], Individual autonomy[g], Psycho-pleasure[h], Reflective design[d], Memories[i], Symbol[e]
Private self enrichment	Self-image	Enrich the self[a], Contemplation value[b], Self-boundary regulation[b], Self-cultivation[b], Symbolic[c], Private self[f], Individual autonomy[g], Psycho-pleasure[h], Reflective design[d], Self-expression[i], Symbol[e]
Public self enrichment	Affiliation	Enrich the self[a], Affiliation value[b], Symbolic[c], Public self[f], Group affiliation[g,i], Socio-pleasure[h], Reflective design[d], Symbol[e]
Collective self enrichment	World view	Enrich the self[a], Self-development[b], Symbolic[c], Collective self[f], Life vision[g], Ideo-pleasure[h], Reflective design[d], Self-expression[i], Symbol[e]
Self gratification	Pleasure	Gratify the self[a], Diffuse self[f], Enjoyment[g], Physio-pleasure[h], Visceral design[d], Pleasure[i], Aesthetics[e]

Table 3.2: Proposed device-self connectedness dimensions and mobile attachment determinants together with factors and determinants described in the literature

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[a]Park et al. (2006)

[b]Kleine and Baker (2004)

[c]Belk (1988)

[d]Norman (2004)

[e]Wehmeyer (2008)

[f]Schifferstein and Zwartkruis-Pelgrim (2008) based on Greenwald (1988)

[g]Schifferstein and Zwartkruis-Pelgrim (2008)

[h]Jordan (2000)

[i]Mugge (2008)

Nevertheless, they admit that in cases where a product performs better than the average (e.g., is extremely easy to use) may foster attachment. In case of mobile attachment, it is very unlikely that a person still experiences a strong attachment to his or her mobile device when it no longer works properly. Additionally, it can be argued that, above all, mobile phones offer possibilities without which many people could not imagine a fulfilled life.

In a similar way Mugge (2008) argues that product attachment and self-extension are different constructs. She acknowledges that products may become self-extensions due to their utilitarian meaning, but in her opinion this is insufficient to become attached to them. To elicit product attachment in addition to the utilitarian function, the attachment object has to provide a special meaning to the owner (e.g., objects which can be regarded as an utilitarian extension of the self but do not fall into the category of product attachment). Mugge (2008) mentions computers that extend a person's memory and calculation capacity.

Due to the role of mobile devices in modern society, the situation for these kind of objects is slightly different. Even if people do not feel attached to a specific mobile device specimen, they often experience a special relation to services provided by their mobile phones which, again, enables the owner to live a modern life. It is a fact that mobile phones have become an important part of many peoples lives. People who do not own a mobile phone and, therefore, are not expected to be reachable anytime and anywhere are the exception, primarily in western society. Following these arguments it can be assumed that even people who do not feel a special bond to their own mobile device, but agree that they need a mobile phone to live a fulfilled life, experience a (weak) form of mobile attachment. In this case people feel attached to the services and possibilities the mobile device provides, rather than to the mobile device specimen itself. Nevertheless, the specific mobile device is the carrier of the desired functionalities. A loss of the mobile phone may lead to distress until a new mobile phone substitutes the old one. In general, a life without mobile phones is not imaginable.

This point of view is supported by Belk (1988) in his concept of the extended self. It suggest that material possessions can help us to define ourselves, when they serve as an enhancement of personal power, allowing us to do things of which we would otherwise be incapable. Based on this assumption, Ball and Tasaki (1992) and Kleine and Baker (2004) suggest that people become attached to such material possessions and, therefore, the concepts of the extended self and material possession attachment are closely related. Kleine and Baker (2004) use the term "action value" to describe the

benefit a material possession may have for the owner. Csikszentmihalyi and Rochberg-Halton (1981) argue that special possessions involve the development of self-control through unique acts. In the special case of mobile phones, Wehmeyer (2008) includes the dimension perceived necessity in his user-device attachment construct. He argues that the ubiquity of the mobile communication device develops into a necessity for users both in business and private spheres.

If mobile devices can be regarded as part of the user's extended self by providing services without which the user cannot live a fulfilled life, then they can be seen as attachment objects, even though the mobile device itself is replaceable by any other similar mobile device. This view is also reflected in the ways mobile phones are called in various languages. For example, the Finnish term for mobile devices is *kännykkä*, which literally means an extension of the hand. In German mobile phones are labeled *Handy*[2], which characterize the mobile device as something that can be carried by hand.

Summarizing, it can be argued that a mobile device may be regarded as part of the self-concept by empowering the self through its utilitarian functions and, therefore, utility may serve as a determinant for mobile attachment. Utility alone may not be sufficient enough to foster strong mobile attachment, but it may increase the degree of mobile attachment.

Self Enrichment

The strongest contributor to a strong mobile attachment may be when the mobile device enriches the self by providing symbolic functions. The important role of symbolism for attachment is reflected in various literature. Park et al. (2006) argue that brands may offer symbolic meaning, enriching the self by representing one's past, present, and future self. Belk (1988) states that an object may support the desired identity, symbolizing who one is or to which group one belongs, as well as by providing an autobiographical function. Schifferstein and Zwartkruis-Pelgrim (2008) argue that the feelings of irreplaceability form the most important component of attachment, "because they are based on the personal, idiosyncratic relationship with the product". Regarding symbolism, Schifferstein and Zwartkruis-Pelgrim (2008) state that people become attached to objects, when they support the private self, the public, and the collective self. Mugge (2008) proposed self-expression, group affiliation, and memories as symbolic determinants of product attachment. Wehmeyer (2008) includes addi-

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[2]The German word for hand is *Hand*.

tional facets (e.g., group membership and social status) in his user-device attachment
determinant symbolism.

In general, two perspectives on the symbolic function of the attachment object can
be identified. Park et al. (2006) distinguish especially between temporal aspects (i.e.,
past self, present self, and future self), whereas Schifferstein and Zwartkruis-Pelgrim
(2008) distinguish between different self concepts (i.e., diffuse self, private self, public
self, and collective self). For the conceptual model of mobile attachment, both tempo-
ral dimensions as well as the distinction between different self concepts may be used
to describe different aspects of how a mobile device can enrich the self through its
symbolic function. I argue that the following four symbolic functions are important
routes to how mobile devices can enrich the self:

1. The *past self* may be enriched by the mobile device, when it serves as a *reminder*
   of one's identity.

2. The *private self* may be enriched by means of a mobile device, when it helps
   creating a person's identity by reflecting a *self-image*.

3. The *public self* may be enriched when the mobile device represents a group
   affiliation and serves as a status symbol.

4. The *collective self* may enriched, when the mobile device symbolizes a *world
   view*.

In the following section self supporting symbolic function and resulting determinants
will be described in detail.

> ***Past Self* Enrichment → Memory** First, mobile devices can enrich the
> self by symbolically representing one's past self (see Park et al., 2006). The
> mobile device may provide an autobiographical meaning by evoking memories
> of the past and by linking the present self to the past. For example, the mobile
> device could serve as a reminder of the pleasant feeling of unpacking it for the
> first time. Another example is, when the mobile device was a present from
> a cherished person or was obtained in a special context (e.g., on a trip). The
> resulting design space determinant is labeled "memory".
>
> In literature, past self enrichment through objects that remind oneself of the
> past are proposed by various authors as possible causes for emotional attach-
> ment. Mugge (2008) introduced memories as one possible determinant for prod-
> uct attachment. She argues that products may remind a person of people, events,
> or places that are important to him or her and, therefore, help to maintain a sense

of the past, which is assumed to be essential to define one's identity. Belk (1988) argues that possessions may provide a link to an individual's past and, therefore, gained a symbolic meaning. Kleine and Baker (2004) names autobiographical values and story-telling values as possible causes of possession attachment. The former marking life events and, therefore, contributing to define the self, the latter helping to tell personal stories of self-discovery, growth, and achievement.

If a mobile device acts as a reminder of one's past, the owner is not necessarily emotionally attached to the mobile device. If this would be the case, people would be attached to all their products, since all products elicit memories in some way or other. Nevertheless, if the mobile device acts as a reminder in a way that it symbolically represents one's past self and is highly significant to the owner, it may encourage the strengthening of mobile attachment. This can be the case when it holds very specific memories of the past, or memories are stored on the mobile device.

***Private Self* Enrichment → Self-image** Second, mobile devices can take on symbolic meaning representing one's private self (see Schifferstein and Zwartkruis-Pelgrim, 2008). In this case the mobile device has a self-definitional purpose. It serves as an expression of one's identity and represents how the owner sees himself or herself. The mobile device is interpreted as suiting himself or herself. It may also embody how the owner wants to be. For example, an individual, who rates himself or herself as a modern person may favor a modern mobile device. People who see themselves as fashion-conscious prefer a fashionable mobile device emphasizing their appearance. Other people may define themselves as environmental friendly and choose mobile devices which are assumed to be produced in a sustainable way. Such mobile devices provide a link to individual's ideal selves by representing their values and beliefs. Additionally, mobile devices may serve as symbols for personal achievements. For example, the mobile device may be seen as an award for special accomplishments. Finally, inimitable mobile devices may also serve as a symbol of uniqueness and individuality. This could be achieved through personalization (see Chapter 2.2.3). Since the mobile device in this case symbolizes the image of oneself it the resulting design space determinant is "self-image".

Related research has highlighted the importance of the self defining purpose of products for the emergence of emotional attachment. Mugge (2008) used the term self-expression to entitle the related determinant for product at-

tachment. According to her, self-expression originates in the person's desire to differentiate oneself from others and to express his or her identity. This could be achieved by acquiring, displaying and using products. Schifferstein and Zwartkruis-Pelgrim (2008) suggest the determinant individual autonomy as a driver of attachment. They argue that products to which we become attached should reflect our identity and express individual autonomy supporting the private self. Kleine and Baker (2004) enumerates three kinds of values (contemplation, self-boundary, and self-cultivation) as possible reasons of possession attachment. Contemplation value refers to the question of "Who am I?". Therefore, objects may be used for achievement of selfhood based on conscious reflection (Csikszentmihalyi and Rochberg-Halton, 1981). Moreover, material possessions considered "me" or "not me" may designate self-boundaries (Belk, 1988). Finally, emotionally significant possessions may reflect and influence a person's growth (Csikszentmihalyi and Rochberg-Halton, 1981).

***Public Self* Enrichment → Affiliation** Third, the mobile device may serve as a status symbol underlining that the owner is part or not part of a specific group and, therefore, enriching the public self. This determinant stems from the people's need to be connected, associated, and involved with others (Mugge, 2008). For example, the newest BlackBerry mobile devices may be only allocated to managers within a company, whereas other employees 'only' get 'normal' mobile phones. These circumstances may trigger mobile attachment within those who are equipped with BlackBerry devices. People who are not in this group may feel the desire also to be rewarded with a BlackBerry. In case of teenagers the particular brand, color, size, logo and ring tone of the mobile device may define to what group an individual belongs. In these cases the mobile device itself symbolizes important persons or a whole group, because they enhance that part of the self that needs to feel connected (see Ball and Tasaki, 1992; Schultz et al., 1989). The resulting design space determinant is labeled as "affiliation".

In literature the affiliation value of cherished objects have been recognized broadly. Mugge (2008) and Schifferstein and Zwartkruis-Pelgrim (2008) included group affiliation into their determinant set for product attachment. Mugge (2008) argues that products that support group affiliation define to which group a person belongs and, therefore, symbolize desirable connections to family members, friends or social groups. Schifferstein and Zwartkruis-Pelgrim

(2008) claim that the public self 's aim is to look for approval of others resulting in a group affiliation meaning of the product. Additionally, it is related to Jordan's (2000) socio-pleasure notion, which involves emotions that arise based on the relationships with others. Kleine and Baker (2004) name affiliation value as a possible facilitator for possession attachment.

Mugge (2008) mentions that, although the determinant group affiliation (i.e. affiliation) seems to oppose the determinant self-expression (i.e. self-image), they can actually co-exist. On one hand, people are seeking for autonomy trying to establish and maintain a unique identity. On the other hand, they are seeking for affiliation to maintain interpersonal connections that also define the self. Recapitulatory mobile devices that enrich the self in a form of creating an identity and support an actual or desired self-image may foster mobile attachment. In addition, mobile devices, which serve as a status symbol to signalize the affiliation to a group and thus enriching the collective-self, may raise the strength of mobile attachment as well.

***Collective Self* Enrichment → World View**   Fourth, mobile devices may enrich the self by symbolically representing one's collective self. Schifferstein and Zwartkruis-Pelgrim (2008) state that "the collective self searches for approval from a reference group. After internalizing the norms of a reference group, people strive to conform to these norms.". They name the inhabitants of a country, a subculture, or an ethnic minority as examples. The objects do not refer to specific people within the reference group, but symbolize an idea or a philosophy of life. In case of mobile attachment the mobile device may symbolize a specific world view. For example, people who disagree with Apple's restrictive policy (e.g., Apps on iPhones are only available via the Apple's App Store) may refuse buy an Apple product due to this policy. They might strive for an alternative mobile device (e.g., an iPhone like, open-source based smartphone such as an Android mobile phone) in order to have the same functionality without Apple's restrictions. Further on, this mobile device might represent one's collective self by symbolizing the open-source philosophy. In this case the mobile device symbolizes a general attitude towards life the corresponding design space determinant is labeled "world view".

In literature Schifferstein and Zwartkruis-Pelgrim (2008) primarily utilize the collective self to derive the determinant life vision for consumer-product attachment. They additionally argue that the collective self and Jordan's (2000) ideo-

pleasure, which include values like tastes, moral values, or personal aspirations are related.

The enrichment of the collective self bears some similarities to both private self enrichment and public self enrichment. Compared to the former, the enrichment of the collective self does not necessarily represent oneself (e.g., how somebody perceives oneself) but a philosophy. Compared to the latter, the collective self does not symbolize the relationship to individuals (e.g., members of a peer group) but rather an idea. Nevertheless, in reality, mobile devices can enrich the self through any or all three routes.

Self Gratification → Pleasure

Finally, a mobile device may be emotionally important for the owner when it provides gratification through its hedonic properties (Park et al., 2006). In this case, it supports the diffuse self (Schifferstein and Zwartkruis-Pelgrim, 2008). It might please the owner through any combination of sensorial pleasures experienced during interaction. The mobile device's overall visual appearance (e.g., form, color, background image) may please the owner whenever he or she looks at it. Its tactile characteristics (e.g., material, surface texture, temperature) may gratify the owner whenever he or she touches the mobile device. Its auditory properties (e.g, ringtones, alarm sound, stored music) may delight the owner whenever he or she listens to it. The familiarity of interacting with a well-known mobile device may enjoy the user. Mobile devices with such qualities may elicit positive emotions within the owner making him or her a happier person. Strong mobile attachment, thus, evolves through aesthetic and hedonic characteristics of a mobile device that evoke sensory gratification for the self (Park et al., 2006). The derived design space determinant is called "pleasure".

Aside from Park et al. (2006) various authors propose self gratification through pleasure as a determinant for attachment. Mugge (2008) recommends pleasure as a possible determinant for product attachment.Schifferstein and Zwartkruis-Pelgrim (2008) propose enjoyment as a determinant of consumer-product attachment. Following their argumentation, the diffuse self, physio-pleasure, and visceral design share the involvement of sensory gratification. Wehmeyer (2008) names aesthetics as a determinant for user-device attachment.

Summary Mobile Attachment Causes

As described in Chapter 3.2 the conceptional mobile attachment model consist of the three parts mobile attachment causes, general influencing factors, and mobile attachment consequences. So far, mobile attachment causes have been presented. Mobile attachment may emerge, when the mobile device supports the user's self-concept. This could be achieved when the mobile device empowers the self of the user by providing important and personal utility to the user. Another way to foster mobile attachment is when the mobile device enriches the self through its symbolic functions for the user. It might serve as a memory of the past self; it might reflect the actual or desired self-image of the user enriching the private self; it might serve as an affiliation symbol adding to the public self; and it might represent a kind of world view supporting the collective self. A third reason why mobile attachment evolves is given, when the mobile device gratifies the self of the user by providing pleasure. In the next sections, the remaining two parts of the conceptual mobile attachment model (general influencing factors and mobile attachment consequences) will be presented.

3.2.2 Mobile Attachment Influencing Factors

The second part of the conceptual model are various factors which may influence the emergence of mobile attachment. In the first instance these *general influencing factors* are characteristics which exist independently of the existence of mobile attachment. Nevertheless, they may influence the emergence of mobile attachment in one or another way. In HCI literature, such influencing factors are often referred to as 'contextual factors' or more generally 'context'.

Among HCI researchers, many discussions have taken place around the factors comprising a specific context. Several researchers have identified context factors and created context frameworks and models for different application areas. Karapanos et al. (2008) state that UX qualities vary with several contextual factors. These factors include individual differences (e.g., human values), the type of the product and the situation in which the interaction takes place. Abowd et al. (1999) propose location, identity, activity and time as different main categories of context from which subcategories can be conveyed. Regarding mobile context, Rodden et al. (1998) categorize context as infrastructure context, application context, system context, location context, and physical context. Chen and Kotz (2000) distinguish between four context-aware mobile computing categories: computing context (e.g., communication costs

and nearby resources), user context (e.g., the user's profile and location), physical context (e.g., lighting and noise levels), and time context (e.g., time of a day and season of the year). Huuskonen (2005) classifies context dimensions for mobile phone applications according to three primary categories and several subcategories. First, the environment includes the geographical environment, other things around (e.g., people, devices), other phones in the pocket, the physical environment, time and date, and other available services in the environment. Second, the phone and services include sensors, network services, current application, and the user interface (e.g., the use of headphones, screen size). Third, the user includes the user's profile, the social context, the mental context, and the physical context of the user, as well as the user's activity. In addition, we have to be aware of the fact that the context, in particular for mobile devices, is constantly changing. In the pilot mobile attachment study described in Chapter 5, this categorization has been used to build an evaluation framework for different context dimensions.

Based on these context models and findings from the pilot mobile attachment study (see Chapter 5) the general influencing factors for mobile attachment may be structured in three areas:

1. The user

2. The environment

3. The mobile device

These areas are not mutually independent from each other but overlap in certain areas. In the following, examples for each area are provided. An exhaustive list of general influencing factors is not the focus of this thesis but left for future work. Figure 3.3 on the next page illustrates the different areas, including examples for each area.

User

The first area which may have an impact on the emergence of mobile attachment is the user himself or herself. Personality related, cultural or demographical aspects may have an influence on mobile attachment. Personality related aspects may include the tendency of a person being a rather extraverted or introverted, sensing or intuitive, thinking or feeling person (see Jung, 1971). Some people may admit the existence of an emotional bond between them and their mobile devices, whereas others may categorical refuse having any kind of emotions to inanimate objects, let alone everyday objects like mobile devices. For instance, during the pilot mobile attachment study (see
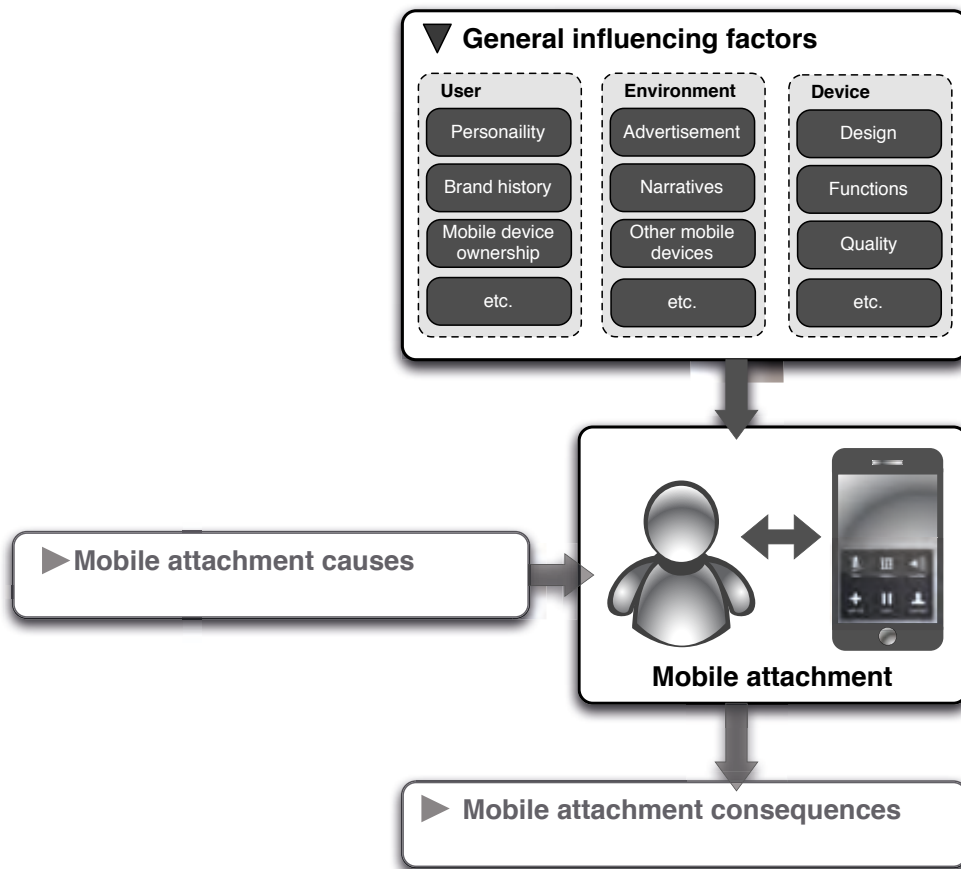
Figure 3.3: General factors which may influence the emergence of mobile attachment structured in three areas: the user, the environment, and the device; for each area example factors are provided

Chapter 5) and the BlackBerry attachment study (see Chapter 6) some participants stated that they love their mobile device amongst many other objects, whereas others refused the existence of an emotional bond to inanimate objects at all.

Additionally, different types of purchase behavior may influence mobile attachment. For example, people who see themselves as early adopters may develop mobile attachment easier than late followers, since they often seek individuality. Regarding the influence of cultural aspects, related research suggest that in Asia the relationship with mobile phones is a very intimate. As described in Chapter 2.2.3 mobile phones in Asia may be seen as spiritual devices (Katz and Suygiyama, 2005). Concerning demographical aspects, mainly age seems to be an influencing factor for mobile attachment. As outlined in Chapter 2.3.2 various studies highlight the importance of mobile devices in life of teenagers indicating that particularly in young people mobile attachment arises. Taking gender into account, Geser (2006) reports that "more women than men have

assimilated the mobile phone as a central component of their personal existence: by integrating it into their lifestyle or by becoming so dependent on it that life without it has become unimaginable."

Other factors which might influence mobile attachment, are the user's brand history (i.e. the user's experiences with a specific brand) or the user's mobile device ownership (i.e. the user's experiences with other mobile devices over time). For instance, Khong and Song (2003) have proposed that computer experience and capability are two antecedent variables of users' emotional response to IT products usage. The pilot mobile attachment study (see Chapter 5) has revealed that users who are satisfied with a specific brand are likely to stick with this brand since they are used to a specific way of interacting with their mobile device (e.g., information and interaction architecture, shortcuts). On the other hand, participants reported that they would never buy a mobile device from a specific brand again, since they were extremely disappointed with the usability and user experience of owning a mobile device from this brand in the past. Other participants stated that they are emotionally connected to specific characteristics of mobile devices (e.g., clamshell phones) suggesting that both the user's perception of the brand as well as the user's experiences with former mobile devices influence mobile attachment.

Environment

Another area possibly influencing mobile attachment is the environment in which the user is perceiving the mobile device. In this context, the environment includes all factors which are not directly related to the user or the mobile device. As an example, it includes mobile device advertisements, which often do not only promote the outstanding performance and usability of a product but also sell a life style. They draw a picture that owning the praised mobile device brings pleasure and status and, therefore, influences the public opinion of a mobile device. The public opinion again is important for the mobile device to serve as a status symbol. Advertisements for the iPhone or the iPad, for example, contribute a lot to the success of these products. Another influencing factor for mobile attachment are narratives or recommendation of colleagues, friends, or family members. For example, if all members of a clique own a certain type of mobile device it is more likely to become part of the group when one also own the same type of mobile device. This is especially true if the mobile phone offers services only available on this type of mobile device. As an example, Apple's FaceTime video telephony application works only on iPhones. Thus, mobile attachment to this specific

type of mobile device may be fostered. Other mobile devices on the market may also influence mobile attachment. Since almost everyday newer and 'better' mobile phones are presented a once stylish mobile device might be outdated rather soon and mobile attachment might decrease.

Device

Finally, the characteristics of the mobile device itself influence mobile attachment. This includes the design of the mobile device, the provided functions and applications, as well as the quality of used materials and supplied services. From a hardware perspective the visual, the tactile, and the acoustical properties of the device influence mobile attachment. This includes qualities like the device's dimension (big to provide a large display and a powerful battery vs. small to be highly mobile), its geometry (e.g., shape, size of buttons and screens), its texture (smooth vs. rough), used materials (e.g., metal, glass, plastic) and colors (e.g., white, black, colored), input modalities (keypad vs. keyboard vs. touchscreen), layout and position of various elements (e.g., buttons, signal lights, plug-in connectors), sensors (e.g., accelerometer, proximity sensor, light sensors), additional features (e.g., camera, flash light), speech quality, battery life time, storage size, and possibilities to personalize the mobile device (e.g., cover, memory card). From a software perspective, the visual design as well as the interaction design may foster mobile attachment. This again includes size, shape and colors of elements, the underlying operating system, the possibility to install third party apps, the possibility to personalize visual and acoustical elements (e.g., background image, themes, ringtones). Also, the provided services may influence mobile attachment as the success of short message services (SMS) has shown.

In general all possible design decisions may influence mobile attachment. The more these design decisions support the design space determinants proposed above, the more likely mobile attachment emerges. An analysis of design implications will be presented in Chapter 8.

Summary Mobile Attachment Influencing Factors

Aside form causes the conceptional mobile attachment model consist of general influencing factors for mobile attachment. These influencing factors are characteristics of the user, the environment or the device which exist independently of the existence of mobile attachment. Nevertheless they might have a big impact on mobile attachment. Influence factors regarding the user includes, for example, personality related, cultural

or demographical aspects. In addition to that the user's brand and mobile device history influence mobile attachment. Regarding the environment advertisements, other mobile devices and recommendation ay have an influence. Concerning the mobile device its characteristics (e.g., size, materials, color, features, quality) influence mobile attachment. In the next section, mobile attachment consequences will be presented.
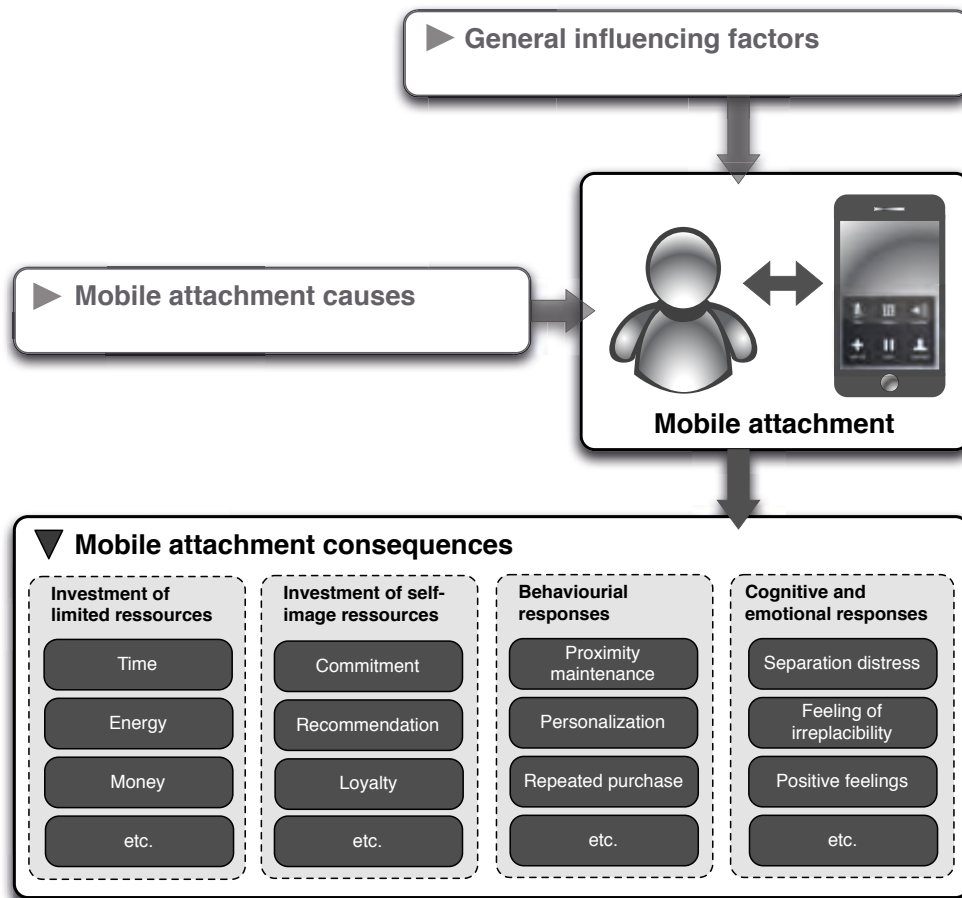
3.2.3 Mobile Attachment Consequences

The third part of the conceptual model are possible *mobile attachment consequences*. If a person is emotionally attached to his or her mobile device, a variety of behavioral and emotional consequences can be observed. When mobile attachment is strong the device typically means a lot to the owner and consequently the person will experience emotional loss if that device is lost (Schifferstein and Zwartkruis-Pelgrim, 2008). Therefore, these consequences might serve as an indicator for the degree of mobile attachment. The studies presented in Chapter 5 and 6 have shown evidence that people, if directly asked whether they feel a kind of emotional attachment to their mobile devices or not, neglect this. On the other side, the same people have personalized and decorated their mobile devices and even felt some kind of separation distress.

Similar to the last section on influencing factors for mobile attachment, a completed list of consequences is not the focus of this thesis. Based on related work of attachment theory, consumer research and product attachment, four conceptually different but yet related areas of possible mobile attachment consequences are introduced: the investment of limited resources, the investment of self-image resources, behavioral responses, as well as cognitive and emotional responses. Again, these areas are not mutually independent from each other but may influence each other. The following sections provide examples for each area. Figure 3.4 on the following page illustrates mobile attachment consequence areas including examples for each area.

Investment of Limited Resources

Regarding brand attachment, Park et al. (2006) argues that the strength of the emotional bond connecting the brand and the self engenders the effect that the brand become self-relevant, impacting one's readiness to allocate discrete and self-image resources to the brand. Discrete resources include time, energy and money. In the case of mobile devices, this means that a strong mobile attachment leads to behaviors like the personalization of the mobile device. This includes investing time and money to alter the appearance and functionality of the mobile device to better fit one's personality. Exam-

Figure 3.4: Possible consequences of mobile attachment depicting four different areas including examples

ples are the decoration of the mobile device, changing background images, installing preferred interaction themes, assigning shortcuts, uploading selected applications, entering personal information, adding various contact information to the address book (e.g., telephone number, address, birthday, picture), assigning different ringtones to different contacts, and involvement in mobile device communities (e.g., participating in blogs).

Investment of Self-image Resources

The investment of self-image resources refer to psychological resources for the sake of the mobile device including self-pride and self-esteem (see Park et al., 2006). By publicly displaying, defending, advocating, or promoting the mobile device, the owner is willing to face the risk of social rejection. The more resources the individual is willing to risk, the stronger the mobile attachment is likely to be. If the mobile device

is seen as an extension of the self, attacks or criticism against the mobile device are interpreted as personally threatening (Park et al., 2006). A person who is attached to his or her mobile device is likely to demonstrate commitment to the cherished mobile phone, recommend this device to friends and show loyalty in a way that if somebody speaks badly of the mobile device he or she would publicly defend it.

Behavioral Responses

As outlined in Chapter 2.1.1, previous research on mother-child attachment has identified different indicators of attachment (Ainsworth et al., 1978). Regarding behavioral responses, mainly proximity maintenance seems to be a consequence of mobile attachment. People who take their mobile device with them wherever they go (e.g., holiday, bed) are more likely emotionally attached than those people who do not seek constant proximity to their mobile devices. Another behavioral response of people who are attached to their mobile devices is the level of mobile device personalization. The more the user personalizes his or her mobile device to fit his or her personal needs, the stronger mobile attachment is. Additional evidence for the existence of mobile attachment is when the user repeatedly purchases the same mobile device. This might be the case when the mobile device is irretrievably lost or damaged beyond repair. A strongly attached person would purchase an exact replica mobile device and personalize it in a way that it exactly matches the lost one.

Cognitive and Emotional Responses

Park et al. (2006) argue that an emotional attachment to brands automatically elicits cognitive and affective responses within the customer. Such emotional responses are also an indicator for the existence of mobile attachment. Again, we can consult Ainsworth et al.'s (1978) indicators of attachment in the realm of mother-child attachment. Among the other indicators, separation distress seems to be the main indicator for mobile attachment. This point of view is supported by the fact that it is a kind of punishment to withdraw mobile devices from pupils for a certain time in schools, when the student has not switched off the mobile device during lessons. Since the mobile device itself is regarded as a special object belonging to the private sphere of pupils, recently the mobile device itself is not confiscated but the SIM card. At the end of the school day the SIM card is returned to the pupil.

As pointed out in Chapter 2.3.1, Vincent and Harper (2003) have shown that people felt strong negative and positive emotions to their mobile phones. On the one hand,

they reported that people felt panic when being separated from the mobile device. On the other hand, people felt thrill about the novelty of a new mobile phone. Such thrills may be regarded as emotional responses of mobile attachment. Finally, Schifferstein and Zwartkruis-Pelgrim (2008) propose a close relationship between irreplaceability and product attachment. Therefore, a feeling of irreplaceability may be regarded as direct consequences of mobile attachment.

Summary Mobile Attachment Consequences

By describing possible consequences of mobile attachment the conceptional mobile attachment model has been completed. Consequences include the investment of limited resources (e.g., time, energy, money) as well as the investment of self-image resources (e.g., commitment, recommendation, loyalty). Attached users might also show behavioral responses, such as, proximity maintenance or the personalization of the device. Additionally, cognitive and emotional responses might occur (e.g., separation distress, positive feelings).

3.2.4 Aggregated Conceptual Model

Figure 3.5 on the next page illustrates the aggregated conceptual mobile attachment model in detail. Mobile attachment is fostered by various causes. These causes provide a linkage between the mobile device and the self via different routes. Based on these device-self linkage routes design space determinants have been elaborated. A possible mobile attachment is influenced by a variety of factors. These factors may be regarded as user, device or environment related. Finally, the existence of mobile attachment leads to different mobile attachment consequences. These consequences may be the deliberate investment of limited or self-image resources. Simultaneously, a variety of other behavioral and emotional responses may occur. The observable consequences may be used to measure mobile attachment.

The conceptual mobile attachment model gives answers to the second research goal (RG2), which targets at developing a conceptual model of mobile attachment including determinants influencing the strength of mobile attachment. The next section will address the third research goal (RG3) and present a temporal mobile attachment model.
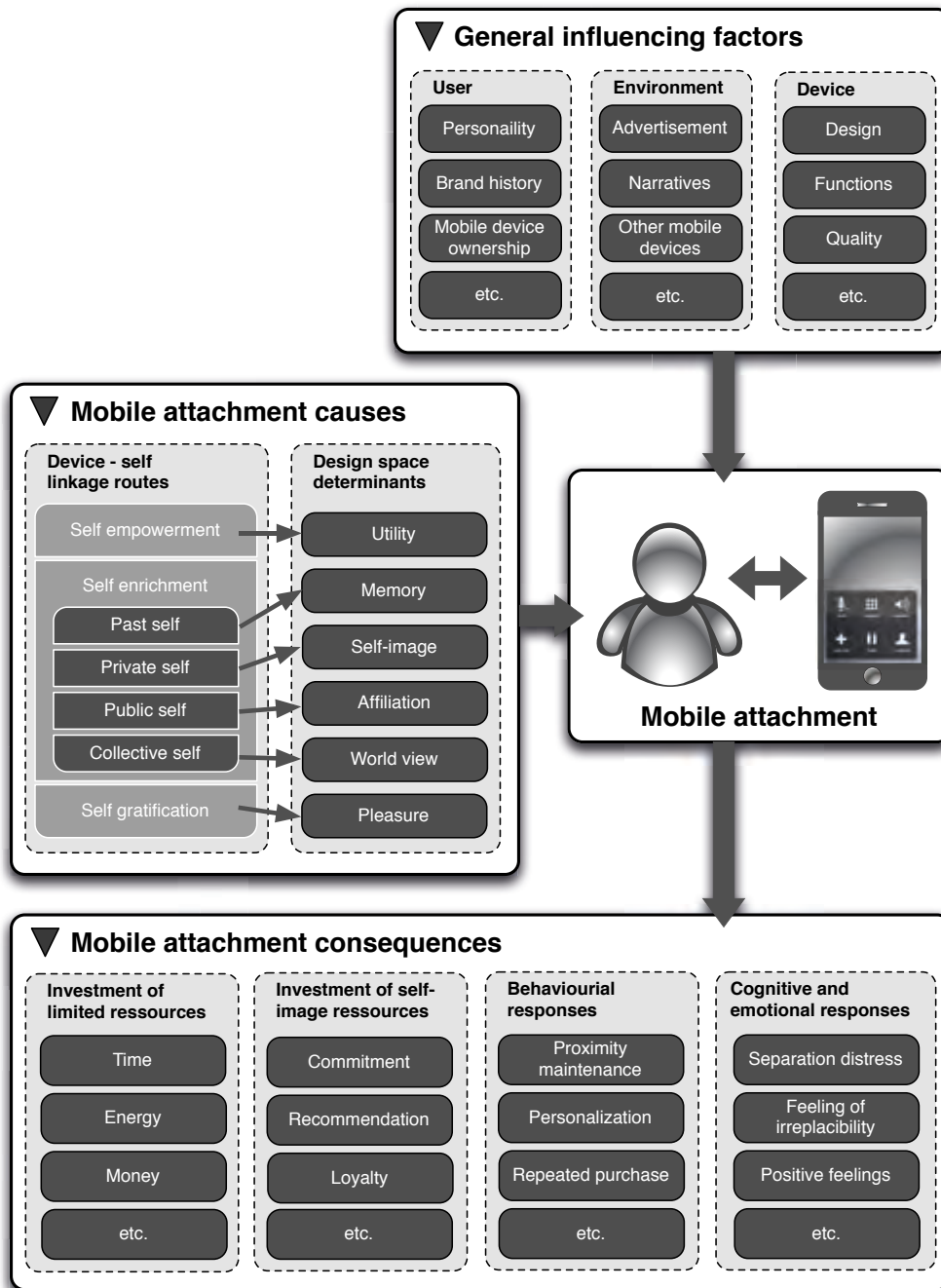
Figure 3.5: Aggregated conceptual mobile attachment model
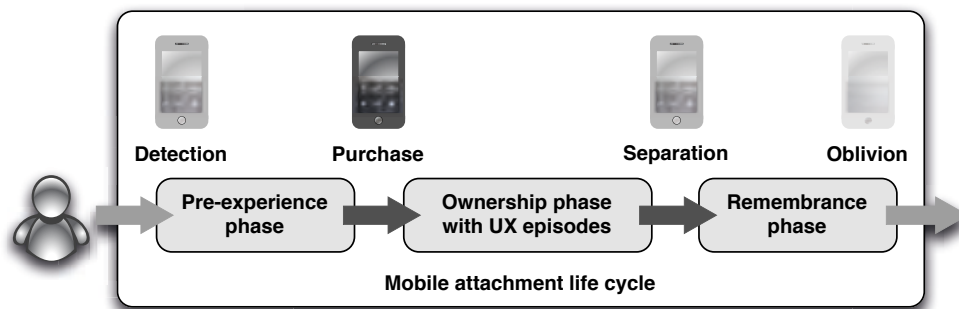
3.3 Temporal Mobile Attachment Model

In the last section, the conceptual model describing causes, influencing factors, and consequences for mobile attachment were presented. This chapter presents a temporal model of mobile attachment illustrating the mobile attachment lifetime cycle (RG3). Similar to other attachment constructs mobile attachment develops over time and is dynamic as described in Chapter 3.1.3. It evolves when the mobile device becomes irreplaceable through possession rituals such as using and personalizing the mobile device or showing and discussing it with other people. These rituals both extract meaning from it and give meaning to it (Kleine and Baker, 2004).

Contrary to interpersonal attachment or the attachment to most other objects (e.g., jewelry, cars), mobile attachment seems to have a shorter life-cycle due to the fact that mobile devices often become outdated very quickly when new mobile device types are introduced. This has important consequences. Since people are aware of the fact that their own mobile device will be outdated and possibly replaced in the near future, mobile attachment to a mobile device specimen does not evolve easily. If attachment to a mobile device specimen evolves, this specimen has to be exceptional to the owner (e.g., the mobile device was a gift, has unique characteristics, or is an individual item). The pilot mobile attachment study and the BlackBerry attachment study (see Chapter 5 and 6) revealed that participants were not attached to their mobile device specimen but rather to specific characteristics or services provided by their mobile phone. Their current mobile device was perceived as a kind of manifestation of specific desired characteristics and services. Therefore, mobile attachment was targeted at a mobile device variant rather than the device specimen. Again, attachment to mobile device specimens and variants do not exclude each other but rather overlap.

In the following, a mobile attachment life-cycle with a mobile device specimen as a target object is presented. Figure 3.6 on the facing page illustrates the different phases of mobile attachment. It is based on Roto's (2007) user experience phases (see Figure 2.7 on page 50), Karapanos et al.'s (2009) temporal model of experience (see Figure 2.8 on page 51), and Levinger's (1976) Relationship Stage Theory. Levinger (1976) identified five phases how partners interact over time which overlap each other: attraction, building, continuation, deterioration and ending.

Logically, a user can only be attached to a mobile device in the time between the first recognition of the mobile device until he or she forgets it again. Thus, these two point build a temporal frame for the possible existence of mobile attachment. The mo-

bile attachment life cycle is segmented into three phases. The pre-experience phase starts with the initial detection of the mobile device by the user. This phase conforms Levinger's (1976) attraction phase and Karapanos et al.'s (2009) anticipation phase. After the purchase of the mobile device, a variety of user experience episodes take place when the user is interacting with the mobile device. This phase conforms Levinger building and continuation phases. The ownership phase is segmented by Karapanos et al. (2009) into the orientation, incorporation and identification stages. The authors claim that emotional attachment emerges only during the last stage – the identification stage. Contrary to this assumption, I argue that the basis for the emergence of mobile attachment is already laid during the pre-experience phase (see next section). After the separation, the user might remember some experiences and perceives mobile attachment on a reflective level until the mobile device falls into oblivion. This phase conforms Levinger's deterioration and ending phases.

Figure 3.6: Temporal model of mobile attachment segmented into three phases: pre-experience phase, ownership phase with user experience episodes, and remembrance phase; the grey arrow before the pre-experience phase indicates that experiences made prior may influence mobile attachment; the grey arrow after the remembrance phase indicate that this mobile attachment life cycle has influence on future mobile attachment life cycles

3.3.1 Pre-experience Phase

As stated previously, a possible mobile attachment can only occur after the user has detected the existence of the mobile device. Nevertheless, the user might have other experiences prior to this moment, which influence the potentially forthcoming mobile attachment. This includes, for example, experiences with other mobile devices, experiences with different brands, and experiences with other ICTs. Even if a user has never owned a mobile device before, he or she has had some experiences with mobile devices. Infants for instance experience the use of mobile phones, when watching their parents or other people use these devices. Once the user has detected the mobile device

for the first time (e.g., through advertisements, narrations), expectations and attitudes towards the it arise within the user. With each new perceived advertisement, narration, hands-on experience, report etc., the expectations and attitudes may change. Even without any effective interaction with the device itself, a kind of mobile attachment (to a mobile device variant) may arise.

When the iPhone 4 was released in June 2010, people all over the world camped in front of Apple stores to be the first to buy an iPhone 4. Apple stores opened to long waiting queues (see Figure 3.7). These people are most likely to form a strong mobile attachment with their iPhone. Once the user has decided to buy a specific mobile device and actually receives it, the next phase in the mobile attachment life cycle is reached.

Figure 3.7: Customer waiting in front of an Apple store in San Diego to buy the new iPhone 4 on June 24, 2010; customers who reserved an iPhone 4 in advance wait in the left lane, the others wait in the right line (Picture taken by Joe Wilcox received via Flickr)

3.3.2 Ownership Phase

The ownership phase is characterized by various interactions of the user with the mobile device. These user experience episodes begin with an initial impression of the object, continue through actual experiences utilizing it, and culminate with degrees of emotional attachment to it (Cupchik, 1999). It can be assumed, that the more often a person relates positive emotions to a product or service, the higher the mobile attachment will be, and vice versa. The more often a person relates negative emotions to

a product or service, the weaker the mobile attachment will be. Nevertheless, a high mobile attachment forgives even malfunctions.

Among various user experience episodes, the out-of-the-box experience seems to be of especial importance for mobile attachment. This is the first time, when the user opens the box in which the brand new mobile device is placed. For the first time expectations are met or belied. Often, the first personalization processes take place (e.g., PIN change, storage of important telephone numbers, selection of ringtones) and the user literally comprehends the device for the first time. Norman (2004) calls this phase the visceral level (see Chapter 2.4.2). It is based on the initial appearance of the object and is an instinctive response to the physical form.

After the first impression, people begin to use and experience the mobile device. Chapman (2005) suggests to describe the passionate early stages of attachment as "honeymoon period". In this period everything is new and exciting. Since the honeymoon phase is not everlasting a saturation of exciting user experience episodes occurs. These different user experience episodes can be distinguished between the behavioral and the reflective level (Norman, 2004). Pleasure happens at the behavioral level. Whereas on the reflective level consciousness takes part in the process. Reflective emotional reactions are assumed to be holistic. They reflect the overall design experience and incorporate the meaning of the object within society (Norman, 2004). Within the reflective level mobile attachment can be located. Norman (2004, p. 39) argues that self-image, personal satisfaction, and memories are located within the reflective level. When the user interacts with the mobile device again, a recursive process takes place and people are influenced on the behavioral level, which in return influences the emotional attachment on the reflective level. Figure 3.8 on the following page illustrates the interplay between the behavioral and reflective level. Each interaction with the mobile device has an influence on the reflective level and may, therefore, strengthen or weaken mobile attachment. Feelings and thoughts within the reflective level again influences how the user is interacting with the device on the behavioral level. A user with a high mobile attachment will probably treat the mobile device with special care.

As stated previously, Karapanos et al. (2009) have proposed an interesting model of UX over time during the ownership phase by classifying UX into the orientation, incorporation and identification stages. During a five-week field study, they investigated six individuals before and during the first weeks of iPhone ownership. Their results show that participants were excited by the iPhone's "visual aesthetics [. . .] and the aesthetics in interaction" as well as positive surprised by its simplicity during the orientation
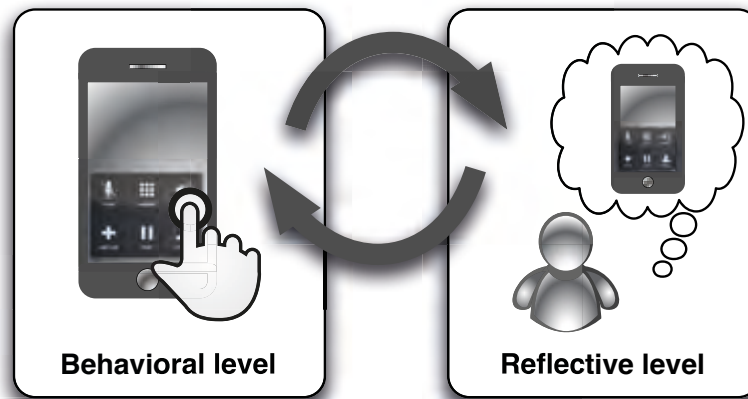
Figure 3.8: Repeated interplay between behavioral and reflective level has constant influence on mobile attachment; arrows indicate that interactions on the behavioral level influences thoughts and feelings on the reflective level and vice versa

stage. Within the incorporation stage the iPhone became more and more meaningful for participants, enhancing their efficiency over time. Finally, during the identification stage it was observed that "participants formed a personal relationship with the product as it was increasingly incorporated in their daily routines and interactions.", finally "resulting in an increasing emotional attachment to the product." (Karapanos et al., 2009). Interestingly, user experiences related to "self-expression" subsided with time, whereas affiliation feelings (i.e. being part of the community) increased.

Overall, during the ownership phase a variety of mobile attachment consequences can be observed (see Chapter 3.2.3). The user might invest time, money and energy to personalize the mobile device. He or she might recommend the device to friends and defend it if somebody criticizes it. He or she might keep the mobile device always with him or her and feel distress if the mobile device is lost or somewhere forgotten. Nevertheless, mobile attachment might also be weakened or even terminated during the ownership phase. The next section discusses factors, which may lead to a weakening or even termination of mobile attachment.

Mobile Attachment Weakening and Termination

Since mobile attachment is dependent on the mobile device-self relationship, the primary reason for a weakening of this bond is when the mobile device loses its capability of empowering, gratifying, and enriching the self.

When a mobile device does not empower the self anymore, it loses its utilitarian ability. This might be the case when the device becomes error-prone (e.g., the number of malfunctions increases) or the performance declines (e.g., the device reacts slower, the battery loses power). A person who is strongly attached to his or her mobile device would try to restore the device (e.g., by exchanging the battery, or updating the system). If this is not possible, mobile attachment would decline. Another reason could be when other mobile devices provides new functionalities, which have become necessary for the owner to enable the self. For instance, new devices could offer new services like video conferencing or the possibility to install apps, whereas the actual device does not offer these possibilities.

When a mobile device does not gratify the self anymore, it loses its pleasure providing power. This could come to pass when either the device changes its appearance (e.g., through unwanted signs of usage) or the owner changes his or her taste (e.g., does not like the color of the mobile device anymore). Interestingly, traces of usage may both foster and reduce mobile attachment. On one hand, they may serve as a symbol for uniqueness. While on the other hand, they may decrease the hedonic qualities of the mobile device.

When a mobile device does not enrich the self anymore, it loses its symbolic power as well. Reasons for this might be when the owner does not want to be reminded by the device of certain memories (e.g., the device was a gift, but the giver is not a loved person anymore), or when the device does not symbolize the private, public or collective self anymore. This could be the case when a formerly modern device gets outdated, when the device does not symbolize a peer group membership anymore, or when the user himself or herself has changed.

3.3.3 Remembrance Phase

After the emotionally attached mobile device has been discarded, the remembrance phase takes place. The user might regret the loss of the attached mobile device and praise its superior qualities, depending on the circumstances of the separation (e.g., lost, broken, outdated). The stronger the mobile attachment was, the more likely it is that a person is replacing the old, or lost, or broken mobile device with a similar mobile device (e.g., twin, brother, cousin – see Chapter 3.1.2). If the new mobile device is an adequate replacement for the formerly attached mobile device (e.g., offers the same or better services and shares the same or better qualities), mobile attachment for the new device might emerge more easily. Nevertheless, the user might still feel attached to

the previous mobile device and experience pleasant associations with it. It might serve as a reference mobile phone and the user might have the feeling that this was the best mobile device he or she has ever owned and still remember it after many years. Both the pilot mobile attachment study (see Chapter 5) and the BlackBerry attachment study (see Chapter 6) showed evidence for such behavior. Finally, the mobile attachment life cycle ultimately ends with the oblivion of the mobile device.

3.3.4 Aggregated Temporal Model
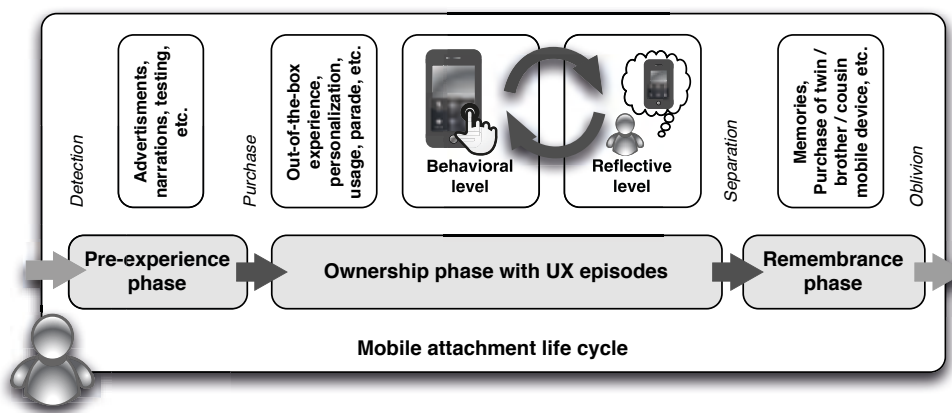
Figure 3.9: Aggregated temporal mobile attachment model

Figure 3.9 illustrates the complete temporal mobile attachment model in detail. After the first detection of the mobile device the pre-experience phase is characterized by advertisements, narrations, and testing. The ownership phase starts with the purchase of the mobile device and has its first highlight in the out-of-the-box experience. During this phase, a variety of different UX episodes take place. This includes, but is not limited to, the simple usage of the mobile device, its personalization, or showing the device to other people. Finally, the device is discarded and most often replaced by another mobile device (e.g., twin, brother, cousin). Within the remembrance phase the user has pleasant associations with the emotionally attached mobile device. The mobile attachment life cycle ends with the oblivion of the mobile device.

The temporal mobile attachment model describes how mobile attachment develops over time. Thus, it provides answers to the third research goal (RG3), which targets at developing a temporal model of mobile attachment in order to understand the mobile attachment life cycle. The next section provides further inputs to RG1 by differentiating mobile attachment to other constructs.

3.4 Differentiating Mobile Attachment

In Chapter 3.1, we have addressed RG1, which aims at providing a definition of mobile attachment along with a discussion from an HCI perspective, by discussing the mobile attachment terminology (see Chapter 3.1.1), introducing a hierarchy of mobile attachment (see Chapter 3.1.2), and establishing a mobile attachment definition (see Chapter 3.1.3). To completely answer RG1, a comparison of mobile attachment and other concepts in HCI is necessary. This section contrasts mobile attachment with related concepts like user experiences, love, and brand attachment. In addition the proposed mobile attachment models are compared with technology adoption models. On one hand, these concepts share some common characteristics with mobile attachment. On the other hand, they are conceptually different. A comparison between these concepts and attachment will provide valuable insights to the overall research goal of a comprehensive understanding of mobile attachment.

3.4.1 Mobile Attachment and User Experience

The close relationship between attachment and user experience (UX) has already been elaborated in Chapter 2.4.2. This section sharpens the differences between these two concepts and correlate them with each other. It describes where attachment and UX are equal and where they differ from each other. As already reported in Chapter 2.4, the COST294-MAUSE initiative conducted a survey on UX related issues and asked UX researcher and practitioners if they agree that UX is equal to emotional attachment (COST294-MAUSE, 2010). Law et al. (2009) reports on the results of this survey. First of all, among 23 statements which could be rated on the survey on a five-point Likert scale ("strongly disagree", "disagree", "neutral", "agree", "strongly agree"), the statement "UX is equal to emotional attachment" obtain the second lowest approval of all statements sorted by mean agreement (n=261, mean=2.27, SD=0.06), followed only by "UX is best viewed in terms of marketing". It was derived that respondents (mildly) disagreed with the statement that UX and emotional attachment are the same. Interestingly, a difference between respondent from Finland and the USA could be observed. The Finnish participants supported the statement that UX equals emotional attachment most (mean=2.64, SD=1.13), whereas their counterparts from the USA agreed the least (mean=1.93, SD=0.69) (Law et al., 2009). This might be attributable to language or research community related aspects. Overall, these results indicate that most UX experts dissent that UX and emotional attachment are identical.

Based on the definitions and models of UX presented in Chapter 2.4.1 and 2.4.3, the following differences between UX and (mobile) attachment can be identified:

➢ First. UX is something, which happens to be whenever a user is interacting with a product regardless how long or how often this interactions happens. Whereas, (product) attachment most often evolves over time. A single withdrawal of money at an ATM engenders a certain experience within the user. It can hardly be argued that an emotional attachment targeted at the ATM within the user evolves. Therefore, emotional attachment can be assumed to be a subset of UX sharing similarities with – what Roto calls – the "overall UX" (Roto, 2007).

➢ Second. People have user experience with a multitude of systems – some may argue with all systems the user interacts, whereas they usually experience strong attachment only with a few objects, if at all. Regarding mobile attachment people have user experiences with all mobile phones they ever interacted, but emotional attachment evolves only with a subset.

➢ Third. Although UX is said to be subjectively dealing with hedonic qualities and particularly the positive outcomes of technology use (Hassenzahl, Lai-Chong Law, and Hvannberg, 2006), it also covers non emotional interactions, as well as emotionally negative experiences. Emotional attachment elicits mainly positive feelings and thoughts and is always accompanied by emotions (Park et al., 2006). If a user interacts with a system which elicits no emotions at all, a certain UX will always arise, but it is unlikely that attachment to the system will emerge. If a system mainly evokes negative emotions, the user will have user experiences but probably no emotional attachment to the system. Again, emotional attachment is a special case of a general UX.

➢ Fourth. Norman (2004) argues that emotional attachment with objects is always rewarding. Similar people describe the love to a product as being very rewarding (Russo, 2010). This is not necessarily the case with UX. UX happens when people are interacting with a system even though this experience is not rewarding.

➢ Fifth. UX is often said to be environment dependent (e.g., Hassenzahl and Tractinsky, 2006). Both, the pilot mobile attachment study (see Chapter 5) and the BlackBerry attachment study (see Chapter 6) indicated that mobile attachment is stable across various contexts. Once a person is attached to his or her mobile device, attachment does not necessarily change when the person is on holiday or at work. As outlined in the temporal attachment model, the emergence of mobile attachment is influenced by the environment and various UX

episodes. These are influenced by the context in which they happen, but the resulting emotional attachment is independent of the respective context in which single UX episodes happen.

➢ Sixth. By taking the proposed definition of mobile attachment as a basis, strong attachment requires the existence of a connectedness between the individual's self and the attachment object. This bond does not necessarily have to exist when we talk about UX.

I claim that UX with a mobile device and mobile attachment are similar but not necessarily equal. On one hand, mobile attachment is influenced and shaped by UX episodes. Each new UX episode, when reflected, contributes something to the relationship between the user and the mobile device. Thus, the emotional bonding to a mobile device can be seen as an emotion-laden container of user experiences. With this in mind, it can be argued that UX is a factor of mobile attachment. Furthermore, emotional attachment may equal "the overall UX" (see Roto, 2007) with a product if the user feels an emotional bond with this product.

On the other hand, the feeling of being attached to a mobile device is a characteristic of the user who is interacting with the mobile device. Since the context including the user himself or herself (see Abowd et al., 1999) is influencing every single UX episode, mobile attachment can be regarded as a UX factor. When a person is emotionally attached to his or her mobile device, this feeling may influence the UX of each interaction. It alters the way in which a person interacts with the device and thus alters every singe UX episode. As an example, the user experience could either be improved when the device meets expectations (e.g., gratifies, enables, or empowers the user), or the UX could be worsened when the cherished device disappoints the user's expectations.

3.4.2 Mobile Attachment and Other Constructs

Aside from UX, emotional attachment and mobile attachment bears some similarities with other constructs. Mobile attachment is briefly compared to constructs like love, brand attachment, attitude, satisfaction, involvement, and commitment below.

Love

Attachment bears some similarities to the construct of love but does not seem to be quite the same. In the consumer research realm, Park et al. (2006) states that love is an

emotion that characterizes the attachment bond, not the attachment bond itself. What speaks against this view, is that emotions are said to be existing only for a short period of time (Ekman, 1994). Love rather seems to be a container for emotions and not an emotion itself (Russo, 2010). From a design perspective, Russo (2010) (see also Chapter 2.1.4) built a model of product love using Sternberg's Triangulation Theory of Love (1988). This theory states that love has three components: (1) intimacy, which is a long-term experience including a feeling of connectedness, (2) passion, which leads to romance, physical attraction and sexual consummation, and (3) commitment, which describes the commitment to built and maintain a relationship. A mathematical combination of these components leads to eight, what Sternberg calls "kinds of love". They range from the absence of love, when none of the component applies, to the presence of consummate love, comprising all three components. In Beatriz Russo's view[3], the bond of attachment refers in a love relationship solely to the commitment component of love, and, therefore, love and attachment are not the same phenomena. Nevertheless, her studies on product love revealed similarities between love and attachment. Russo (2010) reported that "participants described love [to products] as a very rewarding, long-term, and dynamic experience that contains other affective experiences and arises from meaningful relationships with special products they own and use." From my point of view, the borders between emotional attachment and love are overlapping and mobile attachment could be regarded as a component of mobile love.

Brand Attachment

As outlined in Chapter 2.1.3, brand attachment and mobile attachment are closely related. Since mobile devices are usually labeled with a special brand, the name of the brand and the device are highly connected. Sometimes mobile devices are called by the name of their brand (e.g., "I like my BlackBerry", "I like my Motorola."); then again, mobile devices are called by the name of the type or series (e.g., "I like my iPhone.", "I like my Communicator."). Thus, mobile attachment and brand attachment often come together and attachment to a brand may transfer to the mobile device and vice versa (Mugge, 2008).

Nevertheless, brand attachment and mobile attachment are conceptually different (Fournier, 1998). The former builds with brands (e.g., Apple, Nokia, BlackBerry), the latter with specific mobile devices (e.g., my white iPhone, my black Nokia communicator, my red BlackBerry Pearl). Brand attachment differs from product attachment

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[3]Beatriz Russo stated this in a personal email to me on September 15th 2010.

with respect to irreplaceability (Kleine and Baker, 2004). This has been depicted in the mobile attachment hierarchy discussion (see Table 3.1 on page 58). If someone is strongly emotionally attached to his mobile device specimen, it is irreplaceable for him (e.g., because it was a gift). It could not be replaced by another mobile device – even it is of the same brand. If somebody is attached to a device variant level 1 (twin) or level 2 (brother) the brand might play an important role. If somebody is emotionally attached to a mobile device variant level 3 (cousin), the brand plays a minor role.

Attitude, Satisfaction, Involvement, Commitment

Although mobile attachment is often accompanied by a positive *attitude* towards the mobile device, it is a different concept. Similar to attachment, attitude captures the extend to which one likes or dislikes an object but it does not necessarily link the object to the self. As discussed previously, emotional attachment is suggested to have strong behavioral impacts (e.g., proximity maintenance, separation distress), whereas a positive attitude towards a mobile device does not necessarily imply such behavioral manifestations (Park et al., 2006a).

Satisfaction, again, is an evaluative judgement of a products performance that develops as a result of cognitive evaluations and affective reactions (Mugge, 2008). Thus, a mobile device, which merely performs according to its expectations, may be regarded as satisfying, but does not necessarily elicits an emotional attachment.

Schifferstein and Zwartkruis-Pelgrim (2008) argue that product *involvement* addresses a person's feelings towards an entire product category and not a product specimen, which makes it conceptually distinct to mobile attachment. Referring to Park et al. (2006), the concept of involvement may be subsumed within attachment. On one hand, people who are attached to an object are also likely to be involved with it. On the other hand, emotional attachment is neither necessary nor sufficient for involvement. People can be involved with objects for which they develop little or no attachment.

Finally, mobile attachment reflects a psychological state of mind, whereas *commitment* reflects intentions to engage in behaviors that maintain a user-mobile device relationship and may be regarded as an outcome of attachment (Park et al., 2006).

3.4.3 Mobile Attachment and Technology Adoption Models

Aside from concepts such as UX, brand attachment and love a reflection on technology adoption models is valuable to further improve the knowledge of mobile attachment.

This section contrasts the proposed conceptual and temporal mobile attachment models with technology and mobile phone adoption models. Technology adoption has has been researched from different perspectives in various disciplines (e.g., psychology, sociology, consumer research, HCI) and a multitude of theoretical models has been proposed over the last decades. In the following sections different adoption models are described and their similarities and differences to mobile attachment models are discussed.

Diffusions of Innovations

Rogers (1995) proposed in his diffusion of innovations model how an innovation diffuses through a society. He defines innovation as "an idea, a practice, or object that is perceived as new by an individual" and diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". Thereby, he differentiates between five different user groups divided into time of adoption of an innovation. Innovators make up approximately 2.5% of the population[4] and pursue a new technology as soon as it appears. They are experimenters and have a high status. Early adopters (ca. 13.5%) are the second fastest people who adopt an innovation. Typically, they are young and have a high education. The early majority (ca. 34%) are the pragmatists who are slower in the adoption process than the previous two categories. The late majority (ca. 34%) are skeptics who adopt an innovation after the average. Finally, laggards (ca. 16%) might not adapt to an innovation at all. They are less educated and older. Regarding mobile attachment these different user groups are likely to differ in the mobile attachment style as well. Innovators and early adopters might experience a strong mobile attachment in the beginning but as soon as another invention is on the market they replace the mobile specimen and emotional attachment vanishes. The early and late majority might not be enthusiastic with a new mobile device but when they have adopted it mobile attachment may stay stable over a longer time period. In laggards again mobile attachment might not emerge at all. Studying these assumptions might be a worthwhile endeavor for future research.

Another part of the diffusion of innovations model are five intrinsic characteristics of innovations influence an individual's decision to adopt an innovation (Rogers, 1995). First, relative advantage refers to the degree to which the innovation is better than the currently used technology. Second, compatibility refers to the consistency of the new technology with the individual's requirements and values. Third, complexity is the

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[4]Percentages were retrieved from van Biljon and Kotzé (2007).

degree of perceived difficulty using the innovation. Fourth, trialability is the degree of ability to experiment with the innovation prior to commitment. Finally, observability refers to the degree to which interacting with the innovation is observable to others. Compared to the conceptual mobile attachment model the following considerations can be made. Relative advantage is related to the proposed general influencing factor mobile device ownership as well as all three device-self linkage routes. If the new mobile device is capable of empowering enriching, and gratifying the self more than the old device, the strength of mobile attachment for the new device will be stronger. Compatibility is linked to the enrichment of the private self. If the new device is compatible with the self perception of the individual mobile attachment might emerge. The absence of complexity (i.e. ease-of-use) refers to utilitarian feature of the mobile device. Trialability is not reflected in the conceptual mobile attachment model but might be important in a pre-experience phase of the temporal mobile attachment model. For innovators trialability might be not an important factor whereas other user groups might want to be able to have a hands-on experience before adopting a new mobile device. Observability refers to the general influencing factors advertisements and narratives in the environment dimension.

The diffusion of innovations model was extended by various researchers. Moore and Benbasat (1991) added voluntariness of use ("the degree to which use of the innovation is perceived as being voluntary or free will") and image ("the degree to which use of an innovation is perceived to enhance one's image or status in one's social system"). The former construct is not reflected in the mobile attachment models since the force of adoption of a new mobile device is not likely to be a cause of mobile attachment. The latter is related to the enrichment of the public self dimension in the conceptual mobile attachment model.

Theory of Reasoned Action and Theory of Planned Behavior

The Theory of Reasoned Action (TRA) stems from social psychology and was developed by Fishbein and Ajzen (1975). It is regarded as one of the most fundamental and influential theories of human behavior (Venkatesh et al., 2003). TRA explains individual's behavior by using two primary constructs. The first construct is the person's attitude towards the behavior ("an individual's positive or negative feelings (evaluative affect) about performing a target behavior", Fishbein and Ajzen, 1975, p. 216). The second construct is the subjective norm within the individual's social milieu ("the person's perception that most people who are important to him think he should or should

not perform the behavior in question", Fishbein and Ajzen, 1975, p. 302). These two factors determine an individual's intention to behave in a certain way, which again leads to an actual behavior. Within the conceptual mobile attachment model the former construct is reflected in the gratification of the self, the latter in the enrichment of the public self.

Ajzen (1985) extended the TRA and developed the Theory of Planned Behavior (TPB). TPB adds perceived behavior control as a new component to TRA. Perceived behavioral control originates from self-efficacy theory and incorporates an individual's perceived ease or difficulty when performing a particular behavior.

Technology Acceptance Model

One of the most prominent models in HCI is the Technology Acceptance Model (TAM) proposed by Davis (1989). TAM is based on the TRA for modeling technology acceptance within organizations. TAM suggests that a behavioral intention to use is determined by perceived usefulness ("the degree to which a person believes that using a particular system would enhance his or her job performance", Davis, 1989, p. 320) and perceived ease of use ("the degree to which a person believes that using a particular system would be free of effort", Davis, 1989, p. 320). Behavioral intention to use, again, predicts actual usage. Venkatesh and Davis (2000) have proposed TAM2 which is a theoretical extension of TAM that explains perceived usefulness and behavioral intention to use in terms of social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use). A third TAM model addresses the question how managers can foster greater acceptance and effective utilization of IT (Venkatesh and Bala, 2008).

Since TAM primarily targets at predicting the adoption of an innovation in the working context it is related to the utilitarian meaning of a product, and is, consequently, related to empowerment of the self dimension of mobile attachment causes. Despite its success TAM has faced a criticism in the last years (e.g., Benbasat and Barki, 2007; Legris et al., 2003). While TAM is appropriate in the working context it is often difficult to apply to other domains. Moreover, TAM is a binary property ignoring context and contingency (Hedman and Gimpel, 2010). In comparison to TAM the conceptual mobile attachment model is focus on hedonic and symbolic dimensions of mobile attachment.

Unified Theory of Acceptance and Use of Technology

On the basis of the diffusion of innovations theory, TRA, TPB, TAM and other models Venkatesh et al. (2003) have developed the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT suggests that three key constructs determine behavioral intention to use a system and consequently actual usage behavior. These key determinants are performance expectancy ("the degree to which an individual believes that using the system will help him or her to attain gains in job performance", Venkatesh et al., 2003, p. 447), effort expectancy ("the degree of ease associated with the use of the system", Venkatesh et al., 2003, p. 450), social influence ("the degree to which an individual perceives that important others believe he or she should use the new system", Venkatesh et al., 2003, p. 451). Another key determinant which directly affects usage behavior are facilitating conditions ("the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system", Venkatesh et al., 2003, p. 453). The individual's age, gender, experience and voluntariness of use are assumed to be mediating factors of behavioral intention and use behavior.

In comparison to the conceptual mobile attachment model performance expectancy and effort expectancy are reflected in empowerment of the self, social influence refers enriching the public self. For facilitating conditions no equivalent can be found in the conceptual mobile attachment model. The differentiation of UTAUT in determining factors and mediating factors are also a key aspect in the conceptual mobile attachment model which distinguishes between mobile attachment causes and general influencing factors.

MOPTAM

The so far mentioned theories and models deal with technology adoption in general. van Biljon and Kotzé (2007) have proposed the Mobile Phone Technology Adoption model (MOPTAM) which is based on diffusions of innovations, TAM, UTAUT and additional literature sources. Similar to UTAUT MOPTAM distinguishes between mediating and determining factors. Mediating factors include demographics (e.g., age, gender, education, technological advancement), socio-economic factors (e.g., job status, occupation, income), and personal factors (e.g., relative advantage, compatibility, complexity, trialability, observability, image, trust) (van Biljon and Kotzé, 2007, p. 157). Determining factors include social influence (subjective norm encompassing social pressure), perceived usefulness, perceived ease of use, and facilitating conditions

which refer to the mobile phone infrastructure such as service quality and costs (van Biljon and Kotzé, 2007, p. 156–157). These factors determine behavioral intention and as a result actual system use. In a refined version of MOPTAM van Biljon and Kotzé (2008) include human nature influence (motivational human needs) and cultural influence as factors for social influence.

Mediating factors in MOPTAM correlates with general influencing factors in the conceptual mobile attachment model. For a future refinement the differentiation between demographics, socio-economic and personal factors should be taken into account. Contrary to the suggestions to propose social influence as a determining factor in MOPTAM cultural and human nature aspects are seen as general influencing factors in the conceptual mobile attachment model (see Chapter 3.2.2). Since the other factors are borrowed from the above mentioned models reflections on the conceptual mobile attachment model and these determinants outlined as before are the same.

Applied Theories

Barnes and Huff (2003) have applied adoption theories to understand the success of iMode in Japan at the beginning of the 21st century. The iMode service which was launched by Japan's leading mobile phone operator NTT DoCoMo combined information, interaction and the user by offering continuous and always-on Internet access. Therefore, a general model of technology acceptance which includes behavioral beliefs (determining attitude toward using the new technology) and normative beliefs (resulting in subjective norms toward using the new technology) about adopting the mobile technology. Attitude and subjective norm, again, determine behavioral intention to use and subsequently actual use of technology. Based on an extended version of the diffusion of innovations model (Rogers, 1995) behavioral beliefs include relative advantage, compatibility, complexity, trialability, observability, image and trust. With TRA as a basis (Fishbein and Ajzen, 1975), normative beliefs comprise the opinion of friends, family, colleagues, and other opinion leaders.

Based on this model Barnes and Huff (2003) provide a reasoned explanation of the iMode success. The relative advantage of iMode was its effective and reasonably priced Internet access channel. In terms of complexity iMode provided a simple and intuitive interface including a micro-browser. Compatibility with people's previous experience was provided by familiar mobile handsets reflecting Japanese cultural values. Trialability was achieved through low initial costs of the imode service. Observability was enhanced through the possibility to witness others and instant responses of

the iMode services. Image and trust was provided through the well known brand of the owner (NTT DoCoMo). Subjective norms were reached by mass adoption of the service and Japanese culture tendency towards group conformity (Barnes and Huff, 2003). Despite the fact that the authors researched adoption of a mobile service and not mobile attachment to the device their findings support that a tie between an individual and his or her mobile device is dependent on a multitude of factors including symbolic values on an individual as well as on a societal level. Their findings also show that utility (including ease of use) is of high importance of a mobile service to be successful.

Adoption Model for Hyped Technologies

From an information technology management perspective Hedman and Gimpel (2010) have recently proposed an adoption model of hyped technology. Their model is based on the theory of consumption values as well as an iPhone user study. In the focus of their research lies the adoption of hyped technologies, which are often "surrounded by extravagant publicity" and where the distinction between the actual capability of the device and the imagination what the technology might be able to do blurs.

The theory of consumption values (TCV) stems from consumer research and was developed by Sheth et al. (1991). It aims at understanding and predicting consumer behavior by identifying five consumption values influencing consumer choices. Thereby, consumption values address intrinsic and extrinsic motives whether to buy or not to buy a specific consumer good. The proposed consumption values are as follows. First, functional value is "the perceived utility acquired from an alternative's capacity for functional, utilitarian, or physical performance". Traditionally, this value was assumed to be the primary driver of consumer choice. In the mobile attachment model this value refers to the utility determinant. Second, social value is "the perceived utility acquired from an alternative's association with one or more social groups". This value refers to the public and collective self of the conceptual mobile attachment model. Third, emotional value is "the perceived utility acquired from an alternative's capacity to arouse feelings or affective states". This value corresponds to pleasure determinant in the conceptual mobile attachment model. Fourth, epistemic value is "the perceived utility acquired from an alternative's capacity to arouse curiosity, provide novelty, and/or satisfy a desire for knowledge". For this value the conceptual mobile attachment model provides no equivalent. Finally, conditional value is 'the perceived utility acquired by an alternative as the result of the specific situation or set of circumstances facing the

choice maker". This value refers to the utilitarian as well as symbolic meaning of the mobile device in the conceptual mobile attachment model. According to TCV, these values contribute in different ways with distinct emphasis to the adoption process.

Hedman and Gimpel (2010) utilized this model in the construction of their adoption model of hyped technology. For a six-month user study they equipped 16 participants with 3G iPhones. Similar to the BlackBerry mobile attachment study (see Chapter 6) participants answered surveys, participated in focus groups, provided interviews and had to return the mobile device after the study. Their results suggest that emotional, epistemic, and social values influence the adoption of hyped technologies, whereas the functional value had little impact on the adoption of new technologies. These results contradicts the findings in our BlackBerry study where the utilitarian function of the mobile device was perceived as most important. Reasons for these differences could be the type and image of the mobile device (iPhone vs. BlackBerry). The iPhone is often associated with emotional values, whereas the BlackBerry is assumed to be foremost a business tool. Another explanation can be found when looking into the data. Hedman and Gimpel (2010) report that participants focused on perceived drawbacks of the iPhone in comparison to their current phones. For example, heavy SMS users familiar with the T9 keypad complained that they were not able to write text messages while walking. Others complained about poor Internet performance because 3G coverage was poor, or the 3G iphone could not be used as a video camera. Nevertheless, both basic features like the phone and additional features like the MP3 player were perceived as valuable. This suggests that the authors focused on usability issues as well as add-on features of the iPhone when evaluating functional values. When interpreting the results of the pilot and BlackBerry mobile attachment study we focused on primary services a mobile phone should provide (e.g., telephone, SMS) and their individual implications (e.g., being reachable, being able to reach others). These features were rated as most important for participants and highly valuable. Recapitulatory, it could be argued that the utilitarian benefits might not be as important as emotions, social prestige or curiosity when adopting hyped mobile devices but essential features have to be provided properly.

Chapter Summary

In this chapter, we have reached the first three research goals. Regarding RG1, we have provided a definition of mobile attachment and discussed different aspects of it. A key aspect of this definition is that it connects mobile attachment and the concept

of the self. A hierarchy of mobile attachment has been presented with respect to the degree of mobile attachment. At the end of this chapter we have elaborated differences and similarities between mobile attachment and UX.

Concerning RG2, a conceptual model of mobile attachment has been laid out. Mobile attachment emerges, when the self is empowered through exceptional functions of the mobile device, when the self is enriched by the symbolic value the mobile device for his owner, and when the self is gratified through pleasures provided by the mobile device. We have identified various general influencing factors of mobile attachment and categorized it in user, environment, and device related factors. Finally, we have elaborated different behavioral and emotional consequences of mobile attachment.

RG3 has been addressed by providing a temporal mobile attachment model. This model distinguishes mobile attachment into three phases: pre-experience, ownership, and remembrance phase. Within the ownership phase usually a number of UX episodes on a behavioral and reflective level influence mobile attachment.

Measuring Mobile Attachment

In the last chapter, it has been concluded that mobile attachment is a multifaceted construct, which could be conceptually understood by combining causes, consequences and influencing factors. It has been elaborated that mobile attachment evolves and changes over time through a variety of UX episodes. For a comprehensive understanding of mobile attachment, its measurement and evaluation are of equal importance.

Thus, this chapter focuses on the measurement of user's emotional attachment to their mobile devices. research goals four and five are addressed (see Chapter 1.2) and appropriate answers are provided. RG4 aims at the construction and validation of a mobile attachment measurement instrument. RG5 addresses the development and implementation of an in-situ method to assess the development of mobile attachment over time. In this chapter these two research goals are addressed and solutions are provided.

Scales to measure emotional attachment to products in general have been presented by different researcher (e.g., Ball and Tasaki, 1992; Sivadas and Venkatesh, 1995; Schifferstein and Zwartkruis-Pelgrim, 2008). These researchers assess emotional attachment as a single dimensional construct and do not consider special characteristics of mobile devices. Wehmeyer (2008) has developed an initial mobile attachment questionnaire including the dimensions symbolism, aesthetics, and perceived necessity, which does not sufficiently include emotional and behavioral consequences (e.g., personalization). With these scales as a starting point a multidimensional mobile attachment questionnaire labeled "FeatMo" has been developed[1]. This chapter presents

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[1]The development and validation of the FeatMo questionnaire was supported by a colleague of mine within the RIM project (see Meschtscherjakov, Scherndl, Losbichler, and Tscheligi, 2009).

the different phases in developing FeatMo, the final FeatMo questionnaire itself, as well as an outlook on potential improvements of this scale.

Regarding methods to assess the development of mobile attachment over time, so far no particular methods have been proposed. Since the emergence of mobile attachment is affected by user experience episodes, methods to evaluate UX over time seem to be a good approach to evaluate mobile attachment as well. Interviews, ethnographic studies and self reporting methods like the Daily Reconstruction Method (DRM) (Kahneman et al., 2004) or the Experience Sampling Method (ESM) (Larson and Csikszentmihalyi, 1983) have been utilized, among others, to evaluate UX over time. DRM, for instance, has been used to evaluate the development of UX of new iPhone owners (Karapanos et al., 2009). Karapanos et al. (2010) have recently presented a survey tool (iScale) that elicits UX narratives retrospectively. The approach presented in this thesis is to use an enhanced version of the experience sampling method. Based on ESM the "Maestro" concept, which allows user behavior driven and context triggered experience sampling has been developed and implemented[2]. Both, the FeatMo questionnaire and the Maestro concept have already been successfully applied in the user studies presented in Chapter 6 and 7.

In the next section, a quick glance at mobile user experience evaluation techniques and measurements with a special focus on mobile attachment is provided. Thereafter the FeatMo questionnaire is introduced. Finally, the Maestro concept and its technical implementation on BlackBerry devices are presented.

4.1 Mobile User Experience Evaluation

Challenges of mobile UX research have been in the focus of different academic approaches (e.g., Nakhimovsky et al., 2009; Roto and Kaasinen, 2008) and a variety of frameworks have been proposed for mobile evaluation (e.g., Heo et al., 2009; Sá and Carriço, 2009). Therefore, different quantitative as well as qualitative evaluation methods have been suggested. These methods have been categorized in various ways. For instance, Bernhaupt et al. (2008) provide a framework for usability evaluation methods for mobile applications, including methods going beyond traditional usability methods. Their classification includes four main categories. The first category includes user testing methods like thinking aloud protocols, log file analysis, and user observation either in the laboratory or in the field. The second category contains in-

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[2]The Maestro concept and implementation was developed by colleagues of mine and myself within the RIM project (see Meschtscherjakov, Reitberger, and Tscheligi, 2010).

spection oriented expert methods like heuristic evaluation and cognitive walkthrough. The third category comprises self-reporting and inquiry-oriented methods like diary studies, ethnographic studies, observations, contextual inquiries, interviews, questionnaires and probe studies. Finally, the fourth category consists of analytical modeling like task model analysis and performance models. Each approach has its own focus, advantages and disadvantages. The selection of the appropriate method is always dependent on the research question.

For the measurement of mobile attachment self-reporting and inquiry-oriented methods seem to be particularly appropriate. Surveys could measure the momentary degree of mobile attachment. However, long term contextual field studies could evaluate the temporal aspects of mobile attachment. Above all, the evaluation of UX over time could help us to understand how the interactions between a user and his or her mobile device influence the experience of emotional attachment and how this bond changes over time. As Russo et al. (2011) point it out in the realm of product love: "This could help designers 'see' the story [. . .] over time and possibly be of help to them in seeking to foster rewarding and long term person-product relationships." On the whole, a combination of investigating UX in a particular point in time as well as the identification of UX and mobile attachment over time is valuable, due to the temporary nature of feelings and meanings (Law et al., 2009).

In Chapter 3.3, it has been outlined that the mobile attachment life cycle could be separated into three phases: the pre-experience phase, the ownership phase, and the remembrance phase. The focus for this thesis lies in the ownership phase. As described in Chapter 3.3.2, this phase is characterized by different UX episodes happening on the visceral, behavioral and reflective level. To capture the UX and, thus, mobile attachment over time, each level can be evaluated separately using different methods and combinations of methods (Obrist et al., 2009).

The visceral level may be inspected by observing users while experiencing the mobile device or service for the first time. Observational techniques combined with thinking aloud techniques are appropriate to capture users emotions when passing through the "out of the box" experience. In addition, focus groups or workshop settings are applicable in order to capture UX at this level (Obrist et al., 2009).

The behavioral level is the most challenging to evaluate. This is the level where experience happens. Assessing UX while interacting with something is considered as necessary, since it is the current internal state of a user and the context of use which influences the UX (Law et al., 2009). To get a comprehensive understanding of the

UX and its influence on mobile attachment, the usage of mobile devices and services have to be captured over a longer period. This could be achieved through observational methods like ethnography or contextual inquiry, which in turn are rather obtrusive and time consuming. Another approach for this, is the combination of logging data (e.g., usage behavior) together with multimodal measurements to measure emotions (e.g., EEG), which is again rather obtrusive and expensive and probably not suitable for a large number of participants.

The reflective level where users tell about their experiences with the mobile device, again is best evaluated using questionnaires and interviews (Obrist et al., 2009). As previously discussed, the behavioral and reflective level are in constant and repeated interplay with each other. It seems to be efficient to evaluate these levels together. Other research methods have to be considered since it is impossible to observe users in many different mobile contexts with limited resources and a limited time span for research. A promising approach for this is the combination of logging data together with in-situ self-reporting methods like the Experience Sample Method (ESM) (Larson and Csikszentmihalyi, 1983). ESM is a powerful method for understanding a range of psychological phenomena as they occur in the daily lives of individuals. It overcomes the constraints of other methods by combining the ecological validity of field methods with a multitude of measurement techniques (Kubey et al., 1996). Our approach, which will be present in detail in Chapter 4.3, constitutes a variation of ESM by combining user behavior and context sensing with a set of short in-situ questions over an extended period of time.

4.2 FeatMo: A Mobile Attachment Scale

In this section, an instrument for measuring mobile attachment is introduced: the FeatMo questionnaire. It consists of 29 items, which are derived from exploratory research and theoretical considerations. Single items stem either from literature on already existing scales (e.g., Wehmeyer, 2007) or were developed based on the results of the pilot mobile attachment study (see Chapter 5). A more detailed description of the development of FeatMo can be reviewed in Meschtscherjakov, Scherndl, Losbichler, and Tscheligi (2009).

Since the conceptual mobile attachment model was developed chronologically after the FeatMo questionnaire, the factors proposed in the FeatMo questionnaire and mobile attachment causes (see Chapter 3.2.1) and consequences (see Chapter 3.2.3) do

not necessarily match each other. At the end of this section I provide a set of items, which could serve as a basis for an iteration of the FeatMo questionnaire – FeatMo2.

In the next section, related work on various attachment scales is presented. Thereafter, the development process of FeatMo is explained. Finally, an outlook on FeatMo2 will be given.

4.2.1 Related Work

Although a variety of studies report on the existence of attachment to mobile phones (see Chapter 2.3.1) and above all on the relationship between teenagers (see Chapter 2.3.2) and their mobile devices, validated instruments to measure mobile attachment are hard to find. These studies often report on how people talk about their mobile phones in emotional terms (e.g., Vincent, 2005) or how they treat their mobile devices in special ways (e.g., Taylor and Harper, 2002). Based on interviews and ethnographic studies, the existence of mobile attachment is often derived.

Similar practices were used in the realm of possession and product attachment. People had to indicate products to which they feel very attached or not attached at all and then provide an explanation why they were attached or not attached (Csikszentmihalyi and Rochberg-Halton, 1981). Additionally, a variety of measurement scales have been presented. Most of these scales aim at measuring attachment as a unidimensional construct (Kleine and Baker, 2004).

In consumer research, Ball and Tasaki (1992) proposed a nine-item *possession attachment scale* including items capturing the public self (e.g., "If someone ridiculed my . . . , I would feel irritated.") as well the private self (e.g., "My . . . reminds me of who I am."). Additionally, they provide a three-item *emotional significance scale* capturing the degree of emotional significance a product has with items like, "If I lost my . . . , another one like it wouldn't be as meaningful." and "My . . . reminds me of important people in my life." (see Table A.1 in Appendix A). Sivadas and Venkatesh (1995) present a rather straight forward four-item *possession attachment measurement scale* with items such as "I am emotionally attached to my . . . ." and "I am sentimental about my . . . .". They also provide a five-item *scale for incorporation into the extended self*. This scale includes items like "My . . . helps me achieve the identity I want to have.", and "My . . . is part of who I am." (see Table A.2).

As discussed in Chapter 2.1.3, Park et al. (2006, p. 25) suggest to measure brand attachment with two factors: the degree of brand-self connectedness and the automaticity of thoughts and feelings about the brand. It is suggested that the former may be

measured including statements like "emotional bonding", "connection", "part of me", or "an extension of the self". The latter factor may be evaluated by using agreement scales including items such as "positive thoughts and feelings of (the brand) come to me automatically and naturally" or "positive thoughts toward (the brand) are elicited automatically and unconditionally whenever I am exposed to it".

Within the design community, Schifferstein and Zwartkruis-Pelgrim (2008) have examined the interrelationship between product attachment, irreplaceability, self-extension, and indispensability. Additionally, they presented scales to measure these four concepts and performed a confirmatory factor analysis (see Table A.3). Five attachment items are listed in the final scale. Example items are "I feel emotionally connected to this product." and "I have a bond with this product.". Examples for the other scales are as follows: "Even a completely identical specimen cannot replace this specimen for me." (irreplaceability scale), "This product is necessary for me." (indispensability scale), and "This product reminds me of who I am." (self-extension scale). Mugge (2008) has used similar scales to measure product attachment, self-expression, group affiliation, memories, disposal tendencies, product care, and irreplaceability. A drawback of these measurements is that they were often utilized with products to which people already expressed a kind of attachment.

Regarding mobile attachment, Wehmeyer (2008) proposes a three dimensional mobile attachment scale. He argues that user-device attachment (i.e. mobile attachment) is represented by three dimensions: symbolism, aesthetics, and perceived necessity. For each dimension, Wehmeyer formulated statements to be rated on a five-point Likert scale (see Table A.4). Items addressing the symbolic meaning of a mobile device refer to the perceived importance of owning an up-to-date model, fitting the user's personality and signaling lifestyle and self-image. Statements assessing the perceived importance of others' judgements are also included. The aesthetic dimension is addressed by items regarding the visual appearance and audio characteristics of the mobile device. Finally, perceived necessity is reflected by items like "I always have my mobile device with me." and "I feel more self-confident when I have my mobile device with me.". All scales presented in this section are listed in Appendix A.

4.2.2 FeatMo Scale Development

In this section, the iterative development of the FeatMo questionnaire is presented. FeatMo is a multidimensional measurement instrument to assess an individual's emotional attachment to a mobile device. The term "FeatMo" is an acronym for "*F*orm

for the evaluation of *e*motional *at*tachment to *mo*bile devices". Originally developed in German it was first used in the BlackBerry mobile attachment study.

As described previous, most attachment scales proposed to date measure product attachment with an unidimensional scale. This fact was already criticized by Kleine and Baker (2004), who state that mobile attachment is a multidimensional property. They argue that "the contrast between multifaceted conceptualizations and unidimensional measurement scales [...] reflects the challenge of capturing rich concept such as attachment in measurement scale format.". I propose that mobile attachment is a multidimensional property, which is best assessed through a multidimensional scale. Different measurement dimensions may address different dimensions of mobile attachment, thus providing a deeper insight into the nature of mobile attachment. This approach follows Wehmeyer's (2008) example, who proposes a three dimensional scale to quantify user-device attachment. Wehmeyer (2008) describes his work as a basis for future discussions and construct development efforts regarding user-device attachment. Furthermore, he states that "[His] conceptualization [...] should be seen as a first proposition that could still be subject to refinement and change in hypothesized dimensions and meaning". Thus, his three dimensional user-device attachment scale has been taken as a basis for our approach to develop a measurement instrument aiming to assess mobile attachment.

To develop the FeatMo questionnaire, we followed an iterative design process, comprising the construction and evaluation of different versions of the FeatMo scale including several pretests. The development of the FeatMo scale is presented In the following section.

Measurement Item Development

Similar to Wehmeyer (2008), an initial set of measurement items were derived from theoretical considerations and exploratory research. Items were either adopted from the above mentioned scales, stemmed from additional literature research, or were developed from academic discussions based on relevant topics from literature (Lewis et al., 2005). Single items were either literally taken (1), complemented with the term "mobile device" (2), reformulated to be suitable for mobile devices (3), or were developed as a result of relevant literature review[3] (see Table 4.1 on the next page for examples.) The comprehensibility of single items were evaluated individually by two fellow HCI researchers.

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[3]These statements were formulated in German and afterwards translated into English.

Item	Source
(1) My mobile device is beautiful.	⇐ My mobile device is beautiful. (Wehmeyer, 2008)
(2) My mobile device reminds me of who I am.	⇐ My ...reminds me of who I am. (Ball and Tasaki, 1992)
(3) My mobile device has no special meaning for me.	⇐ This product has no special meaning for me. (Schifferstein and Zwartkruis-Pelgrim, 2008)
(4) My mobile device is more precious than only money.	⇐ Literature on endowment effect (Reb and Connolly, 2007)

Table 4.1: Examples how items for the FeatMo questionnaires were developed

Exploratory Factor Analysis

The result of this process was a set of 33 mobile attachment scale items formulated as statements to be rated on a five-point Likert scale (strongly agree, rather agree, neutral, rather disagree, strongly disagree). With this initial set of items, an explorative analysis was conducted in paper-pencil style. A questionnaire containing the 33 items and an additional 34th item asking directly about mobile attachment was printed out together with some demographic questions (e.g., age, gender) and distributed among students, employees and visitors of the University of Salzburg (see Figures A.1–A.2 in Appendix A). Participants were randomly chosen and asked to fill out the questionnaire in the presence of a researcher. If they did not understand a question, they could consult a researcher for explanation. The researcher recorded every time this occurred. Additionally, notes were taken whenever a participant commented on the questionnaire. These notes were later discussed and single items were rephrased for a better comprehensibility. Overall, 104 responses (66 female, 38 male) were retrieved and coded for analysis in SPSS 16[4]. Respondents were between 15 and 48 years old (mean=20.6, SD=6.90).

In order to determine reliability and construct validity, an Explorative Data Analysis with the use of SPSS 16 was conducted. We considered different factor solutions and applied them in order to fit the obtained data. Specifically, we utilized exploratory factor analyses using principal component analysis with direct oblimin rotation in order to obtain latent factors underlying the questions. The initial solution comprised eight factors with eigenvalues above 1, which consequently constitutes the maximum number of possible factors. However, an 8-factor solution was not interpretable. Instead, 3-factor, 4-factor and 5-factor solutions were examined and compared in terms

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[4]SPSS for Windows, Rel. 16.0.2., IBM SPSS Statistics, SPSS Inc.

of a minimum of cross-loadings of the included items and comprehensibility of the obtained factor solution. Items with serious factor loadings on more than one factor (difference of factor loadings smaller than .20 and loadings higher than .40) were eliminated as well as items which did not load on any of the given factors (factor loadings <.40). This procedure was repeated iteratively for each of the different factor solutions (3-factor, 4-factor and 5-factor) in order to obtain a factor solution which comprises only items which have substantial loading on only one factor.

With regard to contents, neither the 3-factor, nor the 4-factor solution seem to be homogenous. On account of this, the 5-factor solution was favored, which consists of 28 items. It provided both, good statistical parameters (see Table 4.2 on the following page for factor loadings) and well-grounded interpretability. The five factors were labeled as: (1) *importance*, (2) *symbolism*, (3) *personalization*, (4) *likeability*, and (5) *emotional valence* and explained 68.72% of variance in the data. The factors also showed good internal consistencies (all α>.80). Following Amelang and Schmidt-Atzert (2006) content validity was appraised through expert consensus.

Confirmatory Analysis

In order to verify prior results, a confirmatory study with this set of 28 items was conducted. A questionnaire containing the above mentioned 28 items, an additional item covering the direct question, as well as demographic questions was printed out and distributed among colleagues and fellow students at the University of Salzburg. 31 responses (23 female, 8 male; mean age=26.52 years, SD=5.60) were coded and analyzed using SPSS 16. It should be mentioned that due to the smaller sample size, results of the conducted factor analysis do not seem very stable. Instead, reliability analysis was conducted in order to assess the internal consistency of each scale. It was found that the scales likeability and importance yielded satisfactory levels of internal consistency (α>.65) and the scales personalization, symbolism and emotional valence good internal consistency (α>.75). The somewhat smaller alphas are partly due to the fact that the sample size is smaller, as referred to earlier.

Item	Factors [a]				
	I	S	P	L	EV
everyday life possible without it (R)[b]	.790				
it is not important (R)	.775				
cannot imagine life without it	.749				
it is always with me	.715				
without it something is missing	.553				
it is important part of me	.406				
it is a status symbol		.794			
it has no special meaning (R)		.693			
its appearance not important (R)		.658			
it is more than a technical device		.627			
up-to-date model is important		.582			
it is more precious than only money		.430			
invest time and energy to make it unique			.821		
keep informed to use possibilities			.762		
it fits personality			.584		
personal note			.583		
individual ring tone			.412		
like it				.868	
recommend it to friends.				.818	
it is beautiful.				.789	
fun using it				.752	
like background image				.462	
like ringtones				.451	
sad if lost					.762
panic if undiscoverable					.650
uneasy feeling if somebody else uses it					.504
like to remember first usage					.485
it elicits positive emotions and thoughts					.402

Table 4.2: Factor loadings of the 5-factor solution (N=104). I: importance; S: symbolism; P: personalization; L: likeability; EV: emotional valence

[a]All loadings < .40 are repressed
[b]Indicates reversed scored items

FeatMo Scale

The final FeatMo questionnaire consists of 29 items of which 28 belongs to five factors and one item directly asking for the existing of mobile attachment:

➢ Likeability (6 items)

➢ Importance (6 items)

➢ Symbolism (6 items)

➢ Personalization (5 items)

➢ Emotional valence (5 items)

➢ Direct question (1 item)

The FeatMo instrument has been shown to have adequate construct validity (using factor analyses) and face validity (through expert discussions). Furthermore, we found moderate correlations of the factors to the direct question measuring emotional attachment (see Table 4.3). All in all, it can be concluded that the given questionnaire is an apt instrument to measure the given facets of emotional attachment.

	DQ	L	I	S	P	EV
DQ	1					
Likeability	.287	1				
Importance	.526**	.445*	1			
Symbolism	.412*	.612**	.476**	1		
Personalization	.329	.614**	.493**	.520**	1	
Emotional valence	.453*	.350	.527**	.413*	.457**	1

Table 4.3: Intercorrelations of the factors and their correlations with the direct emotional attachment question (DQ)

Table 4.4 on the following page lists the final set of items and their corresponding dimension (see Appendix A for the original questionnaire in German). The FeatMo questionnaire was used in the BlackBerry attachment study (Chapter 6) and the MP3 player attachment study (Chapter 7). For both studies, items were renamed regarding the specific target object (e.g., for the BlackBerry attachment study the term "mobile device" was replaced by "BlackBerry"; for the MP3 player attachment study the term "mobile device" was replaced by "MP3 player"). Items were ordered randomly and had to be rated on a five-point Likert scale (strongly agree, rather agree, neutral, rather disagree, strongly disagree). See Figure D.7 on page 294 for the BlackBerry FeatMo and Table E.1 on page 296 for the MP3 player FeatMo (both in German).

Direct question
I am emotionally attached to my mobile device.

Emotional valence
I have an uneasy feeling if somebody else uses my mobile device.
I like to remember the moment, when I used my mobile device for the first time.
If I lost my mobile device I would be sad.
My mobile device elicits positive emotions and thoughts in me.
I feel panic if I cannot find my mobile device.

Importance
My mobile device is not important for me. (reversed score)
My mobile device is an important part of me.
I have my mobile device always with me.
Without my mobile device, I feel like something is missing.
My everyday life would be possible without my mobile device. (reversed score)
I cannot imagine a life without my mobile device.

Likeability
My mobile phone is beautiful.
I like the ringtones on my mobile device.
I like the background image / theme on my mobile device.
It is fun using my mobile device.
I like my mobile device.
I am willing to recommend my mobile device to my friends.

Personalization
I invest much time and energy to make my mobile device unique.
I keep informed to be able to use the possibilities of my mobile device.
My mobile phone fits my personality.
I have given my mobile device a personal note.
I have equipped my mobile device with a individual ring tone.

Symbolism
My mobile device is more precious than only money.
The appearance of my mobile device is not important for me. (reversed score)
My mobile device has no special meaning to me. (reversed score)
My mobile device is a status symbol for me.
My mobile device is more than a technical device.
An up-to-date model is important for me.

Table 4.4: 29 items and five dimensions of the FeatMo questionnaire to measure the emotional attachment to a mobile device; originally statements were formulated in German and afterwards translated into English

4.2.3 Outlook on FeatMo2

As stated previously, the FeatMo scale was developed prior to the conceptual mobile attachment model. Thus, neither the selection of items, nor FeatMo dimensions reflect the structure of the conceptual mobile attachment including causes and consequences. As stated above an exhaustive initial set of items were derived from other scales and developed from literature serving as a basis for the FeatMo scale. This initial set of items could serve as a good starting point for the development of an iterated version of the FeatMo scale (FeatMo2). Clustered items which reflect the structure of mobile attachment causes and the different device-self linkage routes as well as mobile attachment consequences are presented below. Neither the list of items nor the categorization claims to be comprehensive. Single items may fit into various categories. Additionally, sources for items are provided. So far this set of initial items of FeatMo2 have not been used in any study. They primarily serve as a basis for FeatMo2 (see also Chapter 10.2).

Self empowerment to achieve mastery goals
My everyday life would be possible without my mobile device. (reversed score)
My mobile device enables me to lead a social life.
My mobile device makes me independent.
My mobile phone satisfies my needs.
Through my mobile device I can do things, which I could not do without it.
I use my mobile device to keep in touch to my loved ones.
I feel more self-confident when my mobile device is with me.[a]

Table 4.5: The mobile device empowers the self by facilitating to achieve mastery goals and enabling a sense of self-efficacy,

[a]Wehmeyer (2008)

Past self enrichment by serving as a memory
I like to remember the moment, when I used my mobile device for the first time.
My mobile device holds memories of my past.
My mobile device reminds me of important people in my life.[a]
My mobile device reminds me of important things I've done or places I have been.[a]
My mobile device reminds me of memories and experiences.[b]

Table 4.6: The mobile device enriches the past self by serving as a memory of cherished people or past experiences.

[a]Ball and Tasaki (1992)
[b]Sivadas and Venkatesh (1995)

Private self enrichment by strengthening identity
My mobile device fits my personality.[a]
My mobile device is an expression of my personality.[a]
My mobile device is central to my identity.[b]
My mobile device is part of who I am.[b]
My mobile device is a part of me.[c]
My mobile device belongs to me.[a]
My mobile device reminds me of who I am.[d]
My mobile device says nothing about me as an individual. (reversed score)
If I were describing myself, my mobile device would likely be something I would mention.[d]
If I didn't have my mobile device, I would feel a little bit less like myself.[d]
My mobile device helps me achieve the identity I want to have.[b]
My mobile device helps me narrow the gap between what I am and what I try to be.[b]
My mobile device is like I want to be.
If someone ridiculed my mobile device, I would feel irritated.[d]
If somebody praised my mobile device, I would feel somewhat praised myself.[d]
Probably, people who know me might sometimes think of my mobile device when they think of me.[d]
Other people can tell by my mobile device what kind of person I am.

Table 4.7: The mobile device enriches the private self by representing the self-image or strengthening one's identity.

[a]Wehmeyer (2008)
[b]Sivadas and Venkatesh (1995)
[c]Park et al. (2006)
[d]Ball and Tasaki (1992)

Public self enrichment by symbolizing affiliation
Through my mobile device I feel comfortable in my peer-group.
I know my friends' device types.[a]
My friends' judgment on my device is important for me.[a]

Table 4.8: The mobile device enriches the public self by symbolizing the affiliation to a peer group.

[a]Wehmeyer (2008)

Collective self enrichment by symbolizing status or a world view
My mobile device is a status symbol.
My mobile device is an icon for me.
My mobile device is a fashion statement.
My mobile device suits me.
My mobile device has a symbolic meaning for me.
My mobile device is an expression of my world view.
An up-to-date model is important for me.[a]
I would rather not use an outdated type.[a]
Modern persons should use up-to-date devices.[a]
The appearance of my mobile device is important for me.[a]

Table 4.9: The mobile device enriches the collective self by symbolizing status or a specific world view.

[a]Wehmeyer (2008)

Self gratification through hedonic pleasures
It is fun using my mobile device.[a]
My mobile phone is beautiful.[a]
I like the overall appearance of my mobile device.
The design of my mobile device is artistic.[a]
The shape and color of my mobile device are appealing.[a]
The ring tone of my mobile device makes me smile.
I like my mobile device.
I like the ringtones on my mobile device.
I like the background image or theme on my mobile device.

Table 4.10: The mobile device gratifies the self through hedonic pleasures (e.g., through its appearance or behavior).

[a]Wehmeyer (2008)

Investment of limited resources
I invest much time and energy to make my mobile device unique.
I do invest time in my mobile device.
I do invest effort in my mobile device.
I do invest money in my mobile device.
I keep informed to be able to use the possibilities of my mobile device.
I seek for communities who have the same mobile device like me.
I participate in blogs related to the same model as my mobile device.
I have devoted much time to altering the appearance of my mobile device.
I have spent a lot of energy on changing the appearance of my mobile device.
I have equipped my mobile device with an individual ring tone.

Table 4.11: The Mobile device becomes self-relevant impacting one's readiness to invest limited resources (e.g., time, energy, money).

Investment of self-image resources
My mobile device is not important for me. (reversed score)
My mobile device is more precious than only money.
My mobile device is more than a technical device.
I am willing to recommend my mobile device to my friends.
I will not sell my mobile device even if there is a better product.
When I could get a new mobile device for free, I would not change my mobile device through the new one. I feel loyal to the mobile device.

Table 4.12: The mobile device becomes self-relevant impacting one's readiness to invest self-image resources (e.g., commitment, recommendation, loyalty).

Behavioral responses
I have my mobile device always with me.[a]
My mobile device is integrated in my daily life.
My mobile device is part of my daily life.
I have my mobile device always near my body.
I would not give my mobile device to someone else.
I have personalized my mobile device, so it better fits to me.
I've customized my mobile device to fit my personality.
I have given my mobile device a personal note.
I have equipped my mobile device with a individual ring tone.
If I lose my mobile device, I would buy the same model again.

Table 4.13: The mobile device elicits behavioral responses (e.g., proximity maintenance, personalization, repeated purchase).

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[a]Wehmeyer (2008)

Cognitive and emotional responses
My mobile device elicits positive emotions and thoughts in me.[a]
I don't really have too many feelings about my mobile device.[b] (reversed score)
I am sentimental about my mobile device.[c]
I have no feelings for my mobile device.[c] (reversed score)
My mobile device has no special meaning to me.[d] (reversed score)
My mobile device is very dear to me.[d]
Without my mobile device, I feel like something is missing.[e]
I have an uneasy feeling if somebody else uses my mobile device.[e]
I feel uneasy if my mobile device is not at hand.[e]
I feel lost if my mobile device is not with me.
I feel panic if I cannot find my mobile device.
If my mobile device is stolen from me I will feel as if my identity has been snatched from me.[c]
If I lost my mobile device, I would feel like I had lost a little bit of myself.[b]
If someone destroyed my mobile device, I would feel a little bit personally attacked.[b]
If I lost my mobile device, another one like it wouldn't be as meaningful.[b]
If I lost my mobile device, I would be sad.
I cannot imagine a life without my mobile device.

Table 4.14: The mobile device elicits cognitive and emotional responses (e.g., positive feelings, separation distress, feeling of irreplaceability).

[a]Park et al. (2006)
[b]Ball and Tasaki (1992)
[c]Sivadas and Venkatesh (1995)
[d]Schifferstein and Zwartkruis-Pelgrim (2008)
[e]Wehmeyer (2008)

Direct questions
I am emotionally attached to my mobile device.[a]
I have a strong bond to my mobile device.[b]

Table 4.15: Direct questions to assess mobile attachment including terms like "attached" or "bond"

[a]Sivadas and Venkatesh (1995)
[b]Schifferstein and Zwartkruis-Pelgrim (2008)

Summary FeatMo

RG4 aims at the construction and validation of a mobile attachment measurement instrument. I have introduced the FeatMo questionnaire – a multidimensional scale to assess mobile attachment. It consists of 29 items belonging to the five factors emotional valence, importance, likeability, symbolism, and personalization, as well as a direct question. Its validity has been proven by an explorative data analysis. FeatMo can be used to asses the degree of mobile attachment at one point in time. When asked in different phases of mobile device ownership, the development of mobile attachment over time may be assessed. For a thorough understanding of mobile attachment, it is not only important to research if someone is attached to his or her mobile device and the degree of mobile attachment at different points in their device ownership, but also how different UX episodes influence this attachment. To address this development, appropriate methods have to be applied. The next section deals with this subject.

4.3 Maestro: Contextual and Behavior Driven Experience Sampling

The fifth research goal (RG5) addresses the development and implementation of an in-situ method to assess the development of mobile attachment over time. This section is concerned with this research goal. It provides a methodical approach on how to evaluate mobile attachment over time. It introduces the Maestro approach, which is a concept to study behavior in realistic environments based on the experience sampling method (ESM)[5] (Larson and Csikszentmihalyi, 1983).

Maestro is a variation of ESM by providing researchers with the possibility to remotely and dynamically 'orchestrate' experience-sampling studies for evaluating user behavior in various contexts (Meschtscherjakov, Reitberger, and Tscheligi, 2010). Maestro combines the logging of user behavior and context data with experience samples (i.e. short UX questions). With Maestro researchers are capable of evaluating UX and mobile attachment in-situ over an extended period of time. The next section provides an overview on the experience sampling method in general, ESM tools, as well as related research approaches in HCI. Thereafter, the Maestro concept is presented. It includes the Maestro architecture, as well as a section on the implementation of Maestro on BlackBerry mobile devices.

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[5]In the following the term "ESM" is used synonymously for the experience sampling method as well as experience sampling in general.

4.3.1 ESM Background

ESM is an in-situ method to collect data and capture people's experiences in their everyday life (Hektner et al., 2007). This is achieved by repeatedly prompting self-reports (e.g., diary entries, predefined questions) on quality of people's experience at different point in time (Kubey et al., 1996). ESM is capable to measure the frequency and forms of daily activities, thoughts, as well as the intensity of emotional and cognitive dimensions of experience (Csikszentmihalyi and Larson, 1987). Although no single person or research program can be credited with ESM, Larson and Csikszentmihalyi's (1983) work is often mentioned as a reference (Scollon et al., 2003). A current overview of ESM can be found at Hektner et al. (2007).

One important aspect of ESM is the time and type of the trigger, which tells participants to record a self-report or answer specific questions. Wheeler and Reis (1991) distinguish between three basic methods. Within *interval-contingent* ESM, participants report on their experiences at regular, predetermined intervals (e.g., everyday at 8:00 pm, before going to bed). This method is suitable to characterize everyday experiences across a general time period. The biggest problem with this method is, that recordings tend to be removed in time from the event in question and, therefore, bears the danger of memory biases. Within *signal-contingent* ESM studies participants are instructed to describe their experience whenever signaled by a researcher (e.g., through an electronic paging device). Finally, *event-contingent* ESM requires participants to report every time an event meeting a pre-established definition has occurred. The latter two methods reduces the subject's likelihood of forgetting and might reduce the possibility of systematic bias, when selected randomly. On the other contrary, these methods might be more intrusive since they might disrupt participants in inconvenient moments (Wheeler and Reis, 1991). Intille et al. (2003) have proposed context-aware experience sampling triggering samples in particular situations that are detected by sensors connected to a mobile device.

ESM takes UX research out of the laboratory and into real-life situations, thus increasing its ecological validity (Scollon et al., 2003) and above all event-contingent ESM minimize the danger of cognitive biases (Froehlich et al., 2006). In addition to that ESM has various advantages over other methods. First, it allows researchers to empirically characterize a user's general pattern of experience or behavior by statistically aggregating cross trials (Barrett and Barrett, 2001). Thus, ESM has already been used to build predictive user models (Kapoor and Horvitz, 2008). Second, it enables researchers to observe user behaviors, UX episodes and therefore, the development

of mobile attachment over time. ESM data could be analyzed regarding idiographic (within-person) as well as nomothetic (between persons) aspects (Conner et al., 2007). Idiographic methods seek to identify behavior patterns within an individual over time and within contexts, whereas nomothetic approaches aims at gaining knowledge about people in general. Analyzing data in the first way could reveal findings on how mobile attachment develops over time within a person and how it is influenced by various UX episodes. Examining data in the second way allows to interpret how UX and contextual parameters influence mobile attachment in general. Third, ESM allows researchers to better understand the contingencies of behavior (e.g., the link between happiness and extraversion) (Scollon et al., 2003). Another advantage of ESM is that data can be accessed over and over again to test a number of hypothesis even long after the data has been collected (Kubey et al., 1996). Within the HCI community, ESM has been proposed to be a mighty tool to evaluate ubicomp applications (Consolvo et al., 2007) and mobile user behavior (Lew, 2009).

On the other side, ESM also bears a few pitfalls such as being expensive, interrupting the subject at inappropriate moments, the burden of repeatedly answering similar questions, the difficulty of entering self-report data (e.g., on mobile devices), and the need to sample more frequently when some activities take place and less frequently otherwise (Khan et al., 2009). Scollon et al. (2003) mentions three types of problems that can be associated with ESM: participant issues (e.g., self-selection bias, attrition, motivation, ethical issues), situation issues (e.g., quality of data over time, situation selection) as well as measurement and data analytic issues (e.g., reactivity[6], the limits of self-reports, the issue of scaling).

ESM Tools

Early ESM studies used paper-and-pencil methods to capture participants self-reports (e.g., diaries, small booklets of self report forms) and pagers to trigger signal-contingent ESM. With the advent of mobile devices, a shift towards more to more sophisticated computerized ESM tools could be observed. Barrett and Barrett (2001) have reflected advantages and disadvantages of computerized experience sampling. Advantages include the possibilities of a precisely controlled timing, objectively recorded compliance rates, characterizing rating behavior (e.g., to record the time it takes for a participant to respond), the reduction of human errors, and the possible en-

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[6]The potential that the study itself could have an effect on the studied phenomenon or as Scollon et al. (2003) points it out laconically: "Psychologists must contend with their own version of Heisenberg's Uncertainty Principle."

thusiasm of participants to use technology in experiments. Disadvantages include the need for programming skills, setup and maintenance issues, accidents like damage or loss, as well as participant burden and attrition.

ESM tools like ESP[7] (Experience Sampling Program) by Barrett and Barrett (2001), iESP (Intel Experience Sampling Program) by Consolvo and Walker (2003), and PMAT (Purdue Momentary Assessment Tool) by Weiss et al. (2004) utilized PDAs not only to trigger questions but also to display questions and capture user responses. Some of these tools already provided a high degree of functionality like random ordering of questions, branching, signal- and event-contingent trigger, fixed and random timed triggers, advanced time management, multiple choice questions, scaled and open-ended responses, data export functionality etc. These tools ran on Windows CE or Palm OS platforms and were programmed as stand alone applications. Neither 'on-the-fly' changes nor wireless data retrieval was possible. For a detailed comparison of these three tools refer to Le et al. (2006).

As already described previously, Intille et al. (2003) proposed *context-aware* experience sampling for the HCI community. They integrated the functionality of triggering questions based on context-sensing sensors (e.g., GPS plug-in, camera plug-in) into the Context Aware Experience Sampling Tool (CAES [8]) for PDAs running Microsoft's PocketPC operating system. Another approach is the SocioXensor software toolkit (Mulder et al., 2005), which also exploits hardware sensors and software capabilities of smartphone to capture user behavior and social context data as well as subjective UX responses. The SocioXensor architecture consists of a mobile client software, which logs mobile device usage data as well as user experience data. Additionally, a variety of context sensors (e.g., Bluetooth, audio, GPS) can be attached. Context, usage and experience data are stored in a local repository and uploaded to a central repository via appropriate media at appropriate moments. The SocioXensor research tool has already been successfully applied within an ESM study to explore which context information predicts a person's availability for a phone call (ter Hofte, 2007).

One of the most prominent and adopted ESM tools within the HCI community so far is the MyExperience[9] tool (Froehlich et al., 2007). It combines passive logging of device usage like communication (e.g., phone calls) and application usage (e.g., music), user context sensing (e.g., calendar appointments) and environmental sensor data (e.g.,

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[7]ESP is available from http://www.experience-sampling.org/ – last accessed January 3, 2011

[8]CAES is available from http://web.mit.edu/caesproject/ - last accessed January 3, 2011

[9]MyExperience is available from http://myexperience.sourceforge.net/ – last accessed January 3, 2011

Bluetooth, GSM, GPS) with active context triggered experience sampling. MyExperience runs on Windows Mobile devices and requires the installation of a Microsoft SQL database. Similar to SocioXensor, logging information and the experience sampling data are primarily stored locally on the mobile device itself with the possibility for wireless data synchronization with a networked PC (Froehlich et al., 2007). MyExperience, for example, has been used to investigate the relationship between place visit behavior and preferences (Froehlich et al., 2006), to evaluate mobile phone applications like the UbiGreen Transportation Display prototype (Froehlich et al., 2009), or to understand human recall of routine activities (Klasnja et al., 2008). All these tools lay their focus on a powerful client software installed on the mobile device itself including a local repository for data storage. As a consequence, working clients were only programmed for specific platforms (e.g., MyExperience is only available for Windows Mobile devices) and cannot be easily ported to other platforms.

Another interesting approach, which provides possibilities to conduct experience sampling studies, is Momento[10] proposed by Carter et al. (2007). Momento is a toolkit for situated and remote evaluation of ubicomp applications based on a client server-architecture. Momento consists of a set of configurable components including a client used primarily by participants to send messages and make requests, a desktop platform used by experimenters to configure and monitor studies, and a server handling the communication between clients and the desktop and providing remote access to facilities. Communication between users (clients), experimenters (desktop), and the server is done via text messaging (SMS), media messaging (MMS) or HTTP. To gain qualitative reports from the users, Momento includes a configurable mobile client (in addition to SMS/MMS) which is capable to display an information request to the user, who can respond by taking a photo, recording audio, entering a text or draw a sketch (Carter et al., 2007). Momento so far has been used to evaluate different ubicomp applications such as Scribe4Me - a mobile sound transcription tool for deaf people (Matthews et al., 2006). Recently Lee et al. (2010) have proposed an ESM system with a similar architecture to evaluate an adaptive speed-call list algorithm.

Related ESM approaches in HCI

Aside from the already mentioned tools, many other approaches have been presented to remotely capture user behavior, UX and contextual data in the field. Most of these tools regard experience sampling as an add-on functionality but focus on other as-

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[10]Momento is available from http://www.m0ment0.com/ – last accessed January 3, 2011

pects. Pocket Bee (Gerken et al., 2010), for instance, combines diary methods with ESM. It is a multimodal diary tool based on the Android smart phone platform, which uses so-called "core questions" as cognitive triggers for pre-defined events in order to motivate participants to write diary entries according to these events. Instant network synchronization allows researchers to view and analyze the data on-the-fly and react on it accordingly, for example, by sending out specific tasks or questionnaires. The Experience Sampling and Reconstruction Method (ESRM) (Khan et al., 2009) and the related Reconexp tool (Khan et al., 2008) combines aspects of the Day Reconstruction Method (DRM), which was introduced by Kahneman et al. (2004), with ESM. These tools aim to reduce data loss, improve data quality and lessen burden put upon participants by proposing a distributed application which partly runs on a mobile device (ESM) and partly on a website (DRM). On the website, participants can review the data they have provided during the day by using ESM.

EDDY again is a framework for gathering various kinds of data on mobile devices consisting of a mobile phone connected with external sensors (e.g., heart rate, GPS) and a server with an online database (Hammer et al., 2010). The EDDY approach combines ESM with cultural probes (Gaver et al., 1999) by combining the record of active data (e.g., text and audio input, pictures) and passive data (e.g., heart rate, 3D acceleration) with diary entries connected to the recorded data. Another approach was provided by de Sá et al. (2008). Their software framework supports the construction of mixed-fidelity prototypes for mobile devices including the possibility to evaluate these prototypes by gathering passive (e.g., logging) and active usage (e.g., experience sampling) information.

The HCI community has not only provided a variety of tools to implement ESM but has also suggested different methodological variations. Iachello et al. (2006) have used individuals as 'proxies' to get user feedback on ubicomp applications. Hudson et al. (2003) gave subjects an audio prompt to provide a self-report of interruptibility at random intervals. Wilson et al. (2010) used ESM trigger to prompt users to project different types of media with a mobile phone pico projector prototype onto something in their environment. In addition participants had to fill out a questionnaire regarding user experience related issues in the particular context.

Some studies used text messages to trigger the answering of ESM questions. The text message includes a URL to a web form containing a short questionnaire. For instance, Fischer and Benford (2009) investigated player engagement in pervasive gaming and Kane et al. (2009) explored web browsing activities across different computing

devices (PCs and mobile phones) by prompting user responses by the means of SMS. Recently, Fischer et al. (2010) investigated the effects of the content of interruptions and the time of interruption delivery on mobile phones. Advantages of this approach are that ESM studies are easy to set up (no client installation required) and possible with different platforms, even within a single study, as long the devices have an internal web browser. Disadvantages include neither user behavior logging nor context sensing are possible and that only signal- and interval-contingent ESM is feasible.

In the pilot mobile attachment study (see Chapter 5), a similar method was used to prompt participants. Mancini et al. (2009) followed an innovative approach to make event-contingent ESM via SMS possible. They collected Facebook status updates via a RSS feed at a sampling rate of ten per hour. Depending on the changes in the status of the Facebook user, a text message was sent to the participant containing a URL to a questionnaire.

Related to the experience sampling method, Hsieh et al. (2008) have shown that the use visual feedback to participants has increased the compliance rate of ESM studies. Cherubini and Oliver (2009) have proposed rESM (refined ESM) to reduce the burden to participants by (semi-)automatically collect data (e.g., the camera of the phone takes automatically a picture) triggered by user behavior (e.g., the user makes a phone call). A-ESM (Adaptive Experience Sampling) aims to enhance ESM by enabling researchers to detect unexpected behaviors and react to this by changing the behavior of sensors (e.g., changing thresholds and sampling frequency), define different triggers and adapt questions (Vastenburg and Herrera, 2010).

Future ESM Tools in HCI

Recently, different suggestions for future ESM tools have been proposed. Khan et al. (2009) provides a multitude of different features for the future experience sampling tool. They envision event-triggering of queries to be end-user programmable (e.g., providing a plethora of events from which the researcher could select one than programming it), easy installation procedures (e.g., client, server, database), and smart presentation of queries (e.g., queries can be prompted on multiple devices simultaneously). Additionally, they highlight the importance of the support for multimodal participant input, the support for optional user initiated input, automatic capturing of user context factors, the possibility to synchronize the data, automatic and configurable information visualization tools of the collected data, and possibilities to keep participants motivated (e.g., through email or SMS notifications). They argue for integrating

ESM tools on participant's own mobile phones for convenience as well as scaling reasons.

Fischer (2009) provided seven recommendations for the design of future ESM tools. (1) Instead of putting everything on the device, he proposes a client-server architecture utilizing mobile device data connectivity. (2) ESM tools should be designed for easy authoring. (3) People's own devices should be used for studies instead of equipping participants with extra devices. (4) ESM tools should be designed for different levels of study complexity (e.g., take advantage of built-in functionalities like SMS, email, or the device's browser). Furthermore, he suggests (5) a separation between logging and questionnaires (e.g., sophisticated triggering could be used direct on the client) and demands (6) wise client choices (e.g., current iPhone applications cannot run in the background[11]). (7) Finally, a server-based ESM tool would also allow researchers to monitor the study progress or alter both content and structure of the study. Interestingly, Fischer also uses the term "orchestration" of a study, which is the same terminology we used as a motivation for the Maestro[12] approach.

4.3.2 Maestro Concept

For the Maestro approach, we have anticipated and implemented the majority of the previously mentioned suggestions for future ESM tools. In a nutshell, Maestro is a concept to study behavior in realistic environments based on user behavior logging and experience sampling. Its main purpose is to give researchers the possibility to dynamically and remotely orchestrate ESM studies for evaluating usage behavior and user experience in various different contexts (Meschtscherjakov, Reitberger, and Tscheligi, 2010). Although Maestro's primary targets are mobile devices, the basic architecture makes it easy to adapt Maestro to other devices (e.g., personal computer, TV-boxes,). Maestro allows user behavior driven and context triggered experience sampling by utilizing a client-server architecture. This means that not only contextual information regarding the environment (e.g., location, time), the device (e.g., sensors, network services, running application), and the user (e.g., user actions, social context) may be used to trigger experience samples but the change in long-term user behavior and usage patterns can be used for shaping personalized ESM questions to different types of users. Thus, it is possible to react to long- and short-term behavior changes of users and ask different questions depending on the type and extend of behavior change.

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[11]In the meanwhile iPhone OS 4.x is capable of multitasking.

[12]The word "Maestro" is Italian meaning master or teacher often used as a title of respect given to a master musician. (http://en.wikipedia.org/wiki/Maestro – last accessed January 3, 2011)

Basically Maestro, like most other tools, serves two purposes. First, Maestro is capable of recording continuous objective context and usage information. This includes data from internal and external sensors (e.g., GPS data, light sensors, accelerators, signal strength), as well as user activities like the time and duration of outgoing and incoming phone calls including telephone numbers and information how the call was ended (e.g., participant or recipient has ended the call). Dependent on the operating system and the capabilities of the Maestro client, virtually every status information of the mobile device can be logged. Second, Maestro provides researchers with the possibility to capture input from the user's subjective experience by means of experience sampling. Sampling procedures can be basically interval-, signal-, and event-contingent (Wheeler and Reis, 1991), as well as context-aware (Intille et al., 2003). Participants could be prompted at regular, predefined intervals (e.g., everyday at eight o'clock), at random times whenever signaled by a researcher, whenever a specific event happens (e.g., the participant enters a new contact information), or when sensors detect a particular, predefined situation (e.g., an accelerometer detects a specific movement).

Nevertheless, I claim that these distinctions vanish with the advent of computerized ESM tools on mobile devices. Like other tools, Maestro is capable of merging different contingencies. In principle, almost all of todays computerized ESM studies in HCI are signal-contingent in a way that participants are prompted through a signal by a researcher either automatically or manually. If and when a signal is sent to the participant can be dependent on various factors like time and date, user activity, and sensor data or by a combination of these factors and, therefore, studies can be assumed as event-contingent or context aware.

To exemplify this the trigger setup of a Maestro study is given. In this study we investigated participants perceived work efficiency improvements of BlackBerry devices (Meschtscherjakov, Moser, and Tscheligi, 2010). Triggers based on different rules were sent to participants. Sample rules included: ask questions from Monday to Saturday, not on Sunday; ask questions only between 9:00 am and 6:00 pm; ask a maximum of three questions a day; if a question is answered the next question should be asked only after two hours. Depending on different events (e.g., SMS sent, contact added), different questions were asked. When a question for a specific event was answered, the same question was not asked again within the same week. These and other rules made a complex study setup possible. Most of the rules targeted at minimizing the burden for participants with simultaneously covering a broad range of situations. Here, I want to highlight that specific events and context factors can not only used for prompting questions but also to exclude triggers when interrupting the participant in

inappropriate situations (e.g., when the mobile device is in silent mode or while the participant is making a phone call) and postpone the prompting.

In summary, it can be said that context-aware triggers have two purposes. First, they determine the point in time when an ESM question is asked. This provides researchers with the possibility to react to a user interaction immediately and, therefore, minimizes the recall bias. Additionally, appropriate and inappropriate moments for prompting participants can be detected. Second, adequate ESM question can be asked dependent on a specific event. Therefore, researchers are able to ask context and usage behavior specific questions. The Maestro approach includes both and adds another dimension. It it does not only use contextual information or user actions as a trigger for ESM questions, but is also capable of exploiting users usage behavior over an extended period of time. Researchers are not only able to react to a singular specific context parameter or an actual usage behavior but to respond dynamically to different user behavior patterns. To learn these patterns, it is necessary to log the usage behavior over a period of time and then dynamically assign appropriate ESM questions contingent on a long-term user behavior. With Maestro, it is possible to provide different questions to different user groups, without knowing – a priori – which participant belongs to which group (e.g., frequent SMS users vs. infrequent SMS users). Furthermore, it is possible to dynamically adjust to a change in usage behavior (e.g., the participant used two write on average one email per day and now he writes on average 25 emails per day). It is also possible to predict the probability of a certain user behavior and then react with corresponding ESM questions. Finally, another advantage of this approach is the possibility to conduct a multi-phase study, where the results of the first part of the study can impact the setup of the subsequent parts of the study (even dynamically). Using traditional tools would require collecting all mobile devices used for the ESM study in order to update the study setup (Meschtscherjakov, Reitberger, and Tscheligi, 2010).

To master user behavior driven and context triggered experience sampling, Maestro follows a client-server paradigm. Contrary to many other ESM tools, we propose a radical shift of system intelligence from the client (the mobile device) to the server. On a mobile device, only a lightweight client software has to be installed, which allows developing relatively easily clients on a multitude of mobile platforms in various contexts. Logged events are not stored in a local database on the mobile device but are immediately sent to a web server and stored in a global database. Each of these events can serve as a trigger for user behavior driven and context triggered ESM. Additionally, researchers can define rules whether the specific event triggers an ESM question and

– based on the user history – determine which questions are asked (Meschtscherjakov, Reitberger, and Tscheligi, 2010).

The following scenario exemplifies the Maestro approach. Maestro has logged a certain user behavior over a period of time. For example, the user has written on average three short messages (SMS) per week and is, therefore, categorized as an infrequent SMS user. One day the user behaves different than before and sends 35 short messages on one day. Whenever the user sends a short message a "SMS_sent" event is sent to the server. Based on predefined rules (e.g., change of SMS usage behavior) it is decided whether an ESM question is sent to the user. The appropriate question is then displayed on the client accompanied with an acoustic and tactile signal. The user is prompted to answer the question immediately, thus minimizing recall bias. Since most events on the mobile device are user triggered, questions are likely to be asked in moments when the user is interacting with the device. This minimizes the burden for the user and can increase the answer rate. If the user answers the question, this answer is immediately sent to the server. Depending on the answer an additional question may be asked (Meschtscherjakov, Reitberger, and Tscheligi, 2010). In the following section, an overview of the Maestro architecture is provided. The Maestro architecture is described in detail in Baumgartner et al. (2010).

4.3.3 Maestro Architecture

As stated previously, Maestro provides a platform for researchers to log events and the context of end user devices and allows questions to be asked dependent on these events and contextual parameters. To this end, Maestro uses a client-server architecture in which multiple clients connect to one server via a TCP connection (see Figure 4.1 on the next page). The Maestro server bears two rather simple responsibilities. First, it manages connections to and from clients; and secondly, it dispatches events between clients, if an event addresses a specific client. Generally, two types of clients can be distinguished: End User Clients (EUCs) and Application Modules (AMs). Although all clients communicate with the server in the same way, their responsibilities can differ.

EUCs comprise applications executing on devices used by study participants. An EUC logs user interactions, internal activities or status information provided by sensors on a user's device (e.g., a mobile phone) and transmits this information to the Maestro server or an application module. Typically, the client software should be running as long as the device is powered and active. Thus, it should be implemented to start with

the mobile device operating system. EUC responsibilities include:

➣ record user interaction and sensor data

➣ send gathered data as events immediately to the Maestro server or AM

➣ respond to incoming events, primarily starting a questionnaire

➣ facilitate the completion of a questionnaire

AMs are applications under direct control of researchers. They may receive a copy of all events coming in from EUCs by the server, store these messages in a database and potentially generate events for EUCs to trigger participants in an ESM study to complete a questionnaire. AM responsibilities may include:

➣ provide an access point for foreign EUCs by tunneling to the server

➣ to store all events received from clients in a database

➣ analyze participants' activities from the server's event store

➣ generate events for specific participants with a questionnaire request

➣ provide data analysis facilities for researchers
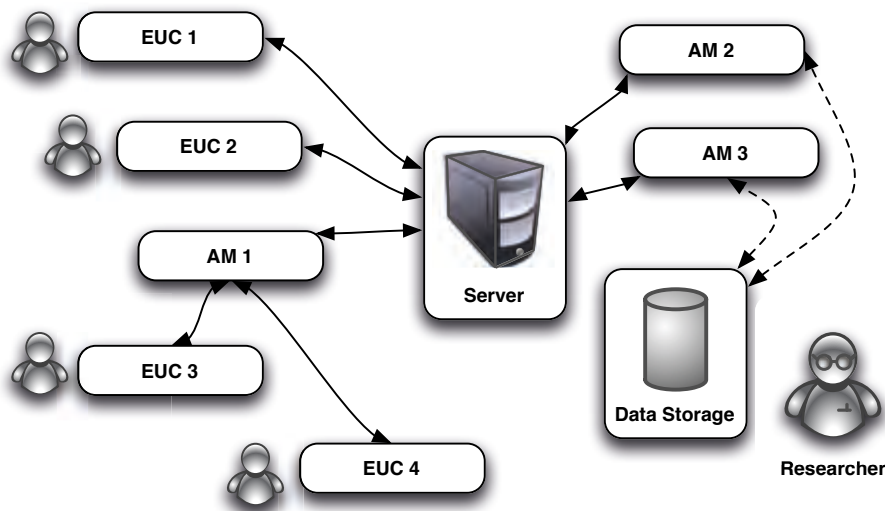
Figure 4.1: Overview of the Maestro client-server architecture as described in Baumgartner et al. (2010); multiple End User Clients connect either directly (EUC 1 and EUC 2), or via an Application Module (EUC 3 and EUC 4 via AM 1) to the Maestro server. Application Modules with different purposes (AM 2 and AM 3) receive copies of all events received by the server and store these events in a database and react with events themselves (e.g., ESM questions) which they address to EUCs via the server.

The communication between clients and the Maestro server is implemented via single TCP connections. The server's host name and port number are read from a configuration file held by the client. EUCs implementations can choose a persistent or

non-persistent connection. Persistent connections requires the EUC to open a connection as soon as possible and keep it alive as long as possible. with non persistent connections the ECU only opens a connection if it needs to send a message to the server or wants to poll the server for a message. In either case, it opens the connection, transmits any desired messages and closes the connection after a given time, in which the server may send messages to the EUC. AMs always requires a persistent connection.

Once the connection has been established, it is ready to be used by an XML stream, which forms the actual transport method for all messages. XML streams form the container for the exchange of XML elements called "XML stanzas"[13] between any two entities (client or server) over the TCP connection. XML streams follow a well defined protocol, which describe detailed how XML streams are initiated and terminated, as well as error handling issues. A client's communication with a server may be seen as consisting of two open ended contiguous (Bray et al., 2008) documents. Until the end of the stream, either entity can send an unbounded number of XML stanzas over the stream. Each client, which implements this protocol may be connected to the Maestro server and, therefore, be part in an ESM study. Since the implementation of a client is only dependent on the implementation of the communication protocol, different lightweight clients for various platforms may be developed easily. A brief description of how XML stanzas look like is found below.

The most prominent XML stanzas within the Maestro concept are *events*. An event either describes what happened on a client or a command for a specific client. EUCs generate events from user interaction with the device (e.g., a user makes phone call), internal device activity (e.g., a mobile phone vibrates because of a calendar alarm), sensor data (e.g., a mobile phone transmits GPS coordinates) or as a reaction to an event from an AM. Events sent from an AM are usually commands to an EUC to complete a questionnaire. The following message stanzas give examples about how events generated on an EUC could be sent to the server. Listing 4.1 on the facing page exemplifies an XML stanza, which bears the information that the user placed a call, which lasted 349 seconds and was thereafter disconnected by the user. Listing 4.2 on the next page depicts that the user terminated a web browser application, which was used for 586 seconds.

For the purpose of an ESM study, an AM generates events named "esfRequest" for EUCs and sends them via the server in message stanzas. These events prompt the EUC

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[13]An XML stanza is a discrete XML element that is sent from one entity to another over an XML stream.

to take an action (e.g., facilitate the completion of an ESM questions that are contained within the payload of the stanza or send sensor data to the AM). Thereafter, the EUC alerts the user (e.g., by an audio cue) and displays an ESM questionnaire (ESF) to the user. It collects all answers and additional requested data (e.g., camera pictures or GPS coordinates) and sends it back as an event to the server in a replying message stanza with the name "esfReply". Again each esfRequest and esfReply is coded in the same XML schemata as described before. In Appendix B, an example for a typical XML stream as well as an example for an ESF are provided.

Listing 4.1: Event: Call Disconnected

```
<message from="imei_302099201662481" generated="2009-06-29T15:36:09
    .614+02:00" id="23">
 <event name="callDisconnected">
  <param name="duration">349</param>
  <param name="origin">local</param>
 </event>
</message>
```

Listing 4.2: Event: Application Terminated

```
<message from="imei_302099201662481" generated="2009-06-29T15:36:49
    .574+02:00" id="25">
 <event name="applicationTerminated">
  <param name="application">Browser</param>
  <param name="duration">586</param>
 </event>
</message>
```

In Baumgartner et al. (2010) the communication protocol between clients and the server are defined in detail. Following this protocol lightweight clients for a multitude of different devices on different platforms could be implemented. Based on this protocol so far clients for BlackBerry OS have been implemented. Since the protocol uses a simple XML structure the implementation of clients is not restricted to mobile phones but may also be implemented on other ICTs like computers or TV set top boxes. As long as the system is capable of sending and receiving XML streams over TCP, it could connect to the server and logging and ESM studies could be implemented. In the next section, the implementation of Maestro for the BlackBerry attachment study (see Chapter 6) is provided.

4.3.4 BlackBerry Implementation of Maestro

The implementation of Maestro for the BlackBerry attachment study uses a slightly different approach then described before. In this version, application modules for capturing data to a database or the definition of ESM triggers are implemented within the Maestro server. Conceptually, this implementation consists of a light-weight client software for BlackBerry OS and the Maestro server. The Maestro server itself is implemented as a web server, consisting of a web application and a database (see Figure 4.2).
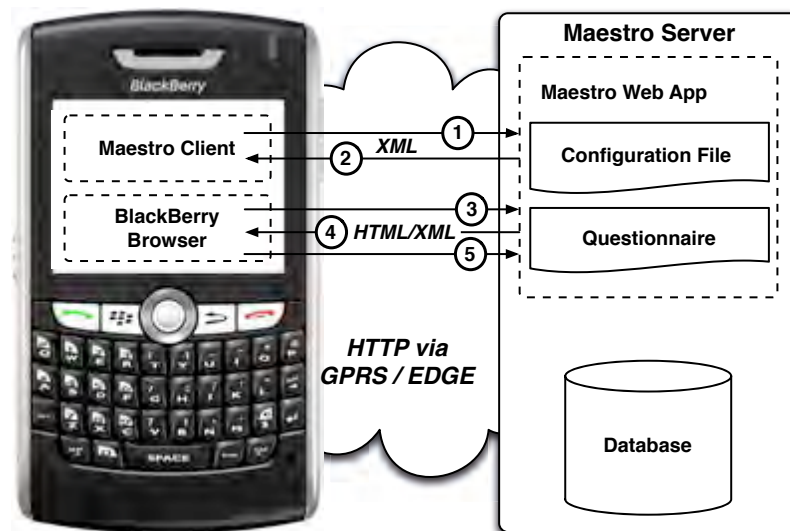
Figure 4.2: Maestro implementation on BlackBerry devices for the BlackBerry attachment study

The client was built in Java 2 Micro Edition especially adapted for BlackBerry devices. It is designed as a system module, which starts automatically with the BlackBerry OS. As mentioned in the previous section, the client's task is twofold. First, it sends predefined events using HTTP via GPRS or EDGE to the Maestro server. This is done in the background and happens without explicit user interaction. If at the time of the event no connection is available (e.g., too weak signal strength), the data is stored internally and will be sent as soon as possible together with the next event. The second task is the presentation of ESM questionnaires as well as the capturing of user responses. In this approach, this is achieved through a web application and the utilization of the BlackBerry's internal web browser. Whenever the client receives an ESM questionnaire the BlackBerry's internal web browser is directed to a web site to display the questions defined by the researcher which allows the user to answer them (Meschtscherjakov, Reitberger, and Tscheligi, 2010).

The Maestro web application is implemented with PHP and MySQL. To setup a study, the researcher has to define questions, answers, structure of the questionnaire, and a configuration file which holds the triggers for questions (see Figure 4.2). When the server receives an event from the mobile client, it stores it automatically in the database (1). The server determines whether the event triggers a question and which question. The particular question ID is sent back to the client (2), where the Black-Berry internal browser is opened and directed to request a URL containing the question ID from the web application (3) and then displays the question to the user (4). The user's answer is sent back to the server and stored in the database (5). Depending on the answer, the next question is sent to the user. Figure 4.3 illustrates sample questions as displayed on the BlackBerry (Meschtscherjakov, Reitberger, and Tscheligi, 2010). A detailed setup of this approach can be found in Losbichler (2008).
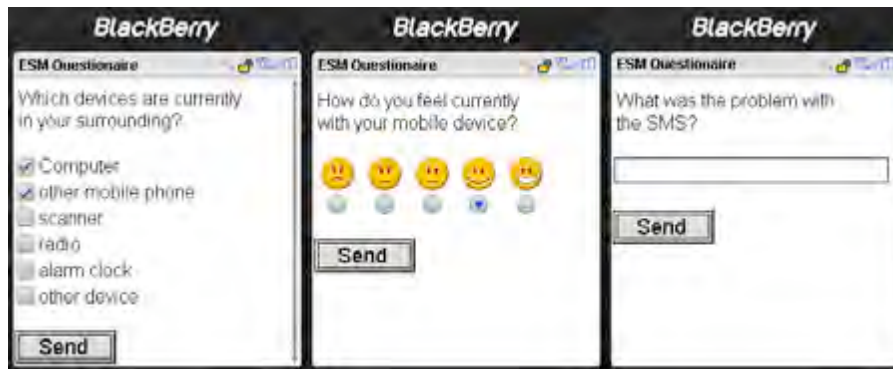
Figure 4.3: ESM questions as displayed on the BlackBerry

Maestro in the Field

As mentioned before, this BlackBerry implementation of Maestro was used in the BlackBerry attachment study presented in Chapter 6. In this section, a short overview of the study with relevant aspects for the Maestro approach is provided. The study included 20 participants and lasted for eight weeks. During this time each participant was provided with a BlackBerry device. On each device, the client software was installed. Using a BlackBerry Enterprise Server (BES), it would be possible to install the software without having the participant physically come to the lab. This could reduced the effort for the researcher and the participant alike. Since we handed out new BlackBerry phones to participants in the here mentioned study, we installed the client software locally without using a BES. Setting up the client involved selecting events which the researchers want to be logged during the study (e.g., sent and received text

messages and phone calls, accesses to contacts, application usage). This was achieved by editing a configuration file on the client, which can also be remotely updated during the study over the air (Meschtscherjakov, Reitberger, and Tscheligi, 2010).

The number of ESM questions were limited to avoid to be too burdensome for the participants. We decided to react to events three times a day: in the morning, in the afternoon, and in the evening. Once the user answered the first question, he or she was presented with five to six follow-up questions. Due to the fact that we only asked questions as a reaction to an event on the mobile device, we were able to present mobile device usage context specific questions. During the study, we analyzed the logged data and the collected answers. This gave us the possibility to react to problems and adapt questions depending on the usage behavior (Meschtscherjakov, Reitberger, and Tscheligi, 2010).

From a user's perspective, a typical experience sampling, where the context trigger was activated by sending a text message, looked like the following: After the user sent the text message at 10:30 am the Maestro client logged contextual information (e.g., time, user id) and sent it to the server. Based on different rules, it was decided whether a sample was triggered or not. Example rules were that questions were asked only between 9:00 am and 12:00 am or that the last time a text message related question was not asked within a certain time period (e.g., the last two days). If all the rules applied, the set of questions were displayed on the BlackBerry device.

All in all 127,255 events (e.g., email sent, contact updated, keyboard unlocked) were logged. The number of actual fully answered set of questions was 2,041. Altogether 10,216 answers for single questions were collected, which signifies that we got in average nine answers per day per participant. This huge amount of data was analyzed by using prepared SQL-scripts. The results of the BlackBerry attachment study with a special focus on mobile attachment will be presented in Chapter 6.

In the meanwhile, Maestro was applied to two further studies. The first study was carried out in 2010 and was a cooperation with A1 Telekom Austria AG. It investigated perceived work efficiency enhancement and employee satisfaction as user experience factors for the success of new technologies within a company. For the study, we equipped 62 employees with new BlackBerry Bold devices which were provided by the mobile network operator and replaced the employees official cellphone. A new Maestro client was developed especially for BlackBerry Bold devices. For nine weeks, participants' interactions with their new BlackBerry were logged continuously and prompted five to seven times a week to answer ESM questions. Each ESF (expe-

rience sampling form) consisted of five to nine questions. After the study, both logged data, as well as ESM answers in relation to the logged data were analyzed. During the study, a total of 185,290 activities (incl. received emails and ESM answers) were logged, whereof 100,777 were activities by users (e.g., deleting, reading, writing, answering or forwarding emails, making or receiving phone calls, using the calender, address book, browser). Overall 1,986 from 2,852 possible ESM questionnaires were answered (69.63%). The study showed the practicability and power of the Maestro concept. The setup of the study and detailed results can be found in Meschtscherjakov, Moser, and Tscheligi (2010).

The second study was carried out in 2011 within the national project ELVIS[14]. The project dealt with the exploration of UX factors and psychosocial barriers during the usage of traffic and transport systems as well as in the area of traffic and transport information systems. For a six-week field study the Maestro concept was applied with a Maestro client integrated into an iPhone navigation app and an Application Module to handle communication.

Chapter Summary

This chapter has addressed RG4, which aims at providing an instrument to measure the degree of mobile attachment, and RG5, which targets at developing and implementing an in-situ evaluation method to assess the development of mobile attachment over time. To reach RG4, the FeatMo questionnaire has been presented. It is a validated, multi-dimensional mobile attachment measurement tool, which was already used in different studies. Regarding RG5, the Maestro approach has been introduced. Maestro is a concept based on the experience-sampling method to study user behavior and experiences in-situ. It may be applied to investigate how mobile attachment develops over time.

In the next three chapters, empirical studies will be presented in which in some cases the FeatMo questionnaire and the Maestro approach have been used. From a methodological point of view, they show the feasibility of FeatMo and Maestro. Additionally, these studies have contributed to the development of the conceptual mobile attachment model, as well as the temporal mobile attachment model. Furthermore, design implications are derived based on insights gained from these studies.

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[14]More information about the project ELVIS can be found at http://www.cure.at/researchprojects#ELVIS – last accessed April 21, 2011.

Empirical Study 1: Pilot Mobile Attachment Study

In this and the following two chapters, RG6 is addressed. RG6 aims at strengthening the understanding of mobile attachment and assessing the feasibility of the proposed models, questionnaire, and method by means of empirical studies. The study presented in this chapter served as a basis for an increased understanding of mobile attachment. It was conducted in 2007 as part of a project at the University of Salzburg in cooperation with Research In Motion (RIM) on mobile attachment. The project's overall aim was to research users' emotional relationship with mobile devices and services with a special focus on mobile attachment.

The goal of this particular pilot field study was to get initial insights on mobile attachment and how to evaluate this phenomenon. Therefore, we studied the experience of users when using their own standard mobile devices, the context in which this experience is made, and the emotional relationship which arises between users and their mobile devices and services. We were mainly interested in questions like: Which factors are relevant for emotional attachment to mobile devices or services? How do users describe their experience with mobile devices? Which emotional terms do people use to describe their mobile phones and usage of the services? What is the user's personal (pre-)experience with a product?

With traditional methods, this kind of information is hard to acquire. A major drawback of current methods is that they measure emotions at one particular moment in time. However, users' emotional attachment is a dynamic process, which changes over time. It is influenced by the interaction with the product itself, as well as by social interaction, and is highly context dependent. Therefore, we decided to use the Experience Sampling Method (ESM).

The insights gained from the study were used twofold. First, with regard to contents the study provided a basis for understanding mobile attachment. Results were used to elaborate different levels of mobile attachment hierarchy (see Chapter 3.1.2), to gain knowledge on mobile attachment causes, influencing factors, and consequences (see Chapter 3.2), as well as to better understand the temporal dimension of mobile attachment (see Chapter 3.3). Thus, results of the study were used to reach RG1 (mobile attachment definition), RG2 (conceptual mobile attachment model), and RG3 (temporal mobile attachment model).

Second, it helped us to get valuable insights on how to evaluate mobile attachment from a methodical viewpoint. Results were used for the formation of FeatMo questionnaire items (see Chapter 4.2). Additionally, experiences in conducting an ESM study were gained which finally led to the development of the Maestro concept (see Chapter 4.3). Thus, these methodically findings helped to reach RG4 (mobile attachment questionnaire) and RG5 (in-situ mobile attachment evaluation method over time).

The next sections describe the setup and results of the pilot mobile attachment study (in the following referred to as "pilot study") and findings important for the understanding of mobile attachment are presented. A more detailed description of the study can be found in Meschtscherjakov et al. (2008).

5.1 Pilot Study Setup

As pointed out above, the research aim of this field study was to capture information about factors affecting user experience and mobile attachment in real life settings. We were interested in the feelings, emotions and subjective opinions of users during their usage of a mobile phone and the specific context in which the interaction took place. Furthermore, we were interested in methodological challenges on how user experience and mobile attachment can be evaluated over time.

As a foundation for our research, we created an evaluation framework taking different user interaction levels, as well as relevant contextual factors into account. Based on this framework, we conducted a field study on participants experiences while using their own mobile devices in order to get a starting point for the analysis of mobile attachment. To conduct this study, we used the ESM combined with questionnaires and interviews. Regarding measuring mobile attachment, we formulated single item questions based on various factors borrowed from attachment theory research, such as the desire to maintain proximity to the mobile device and separation distress (see Chapter

2.1.1). At the point in time of this, neither the FeatMo questionnaire nor the Maestro concept were developed.

5.1.1 Evaluation Framework

As previously mentioned, mobile attachment is not a single dimensional, static value but depends on different experience levels and changes over time. Single UX episodes influence the resulting mobile attachment. These UX episodes are dependent on the context in which the interaction takes place (Hassenzahl and Tractinsky, 2006). To build an evaluation framework for the study, we followed Norman's (2004) three experience dimensions: the visceral level, the behavioral level, and the reflective level.

As outlined in Chapter 2.4.2 people can get attached to an object without having used it yet just by its appealing design at the visceral level. The mobile device can be seen as a combination of function and content, which appear in a specific way and provide specific interaction modalities. The perception process results in an overall impression – the personality of a product (Norman, 2004). This level might be evaluated by observing the out-of-the-box experience a user has when unwrapping the mobile device (e.g., in focus groups) or by asking questions on the design of their mobile device.

At the behavioral level, people can get attached to their mobile phone by using and experiencing it (Norman, 2004). It is discovered how well the functions of the mobile device are implemented and easy it is to be used. Relevant emotional and cognitive responses in this aspect are satisfaction (e.g., product fulfills user expectations with focus on user not on product), enjoyment (users expectations are exceeded), pride (related to object), surprise (positive/negative), or attraction (love/hate – emotional attribution with long duration). For evaluating the usage of a mobile phone on this level unobtrusive in-situ methods (e.g., ESM) are suggested.

Finally, mobile devices evoke stories within people and they become attached to things at the reflective level. The reflective level implies judgement (i.e. an attribution of something with a specific positive or negative value). Users base their judgements on the overall experience with a product or on single elements. Judgement is embedded in the current situation, which is based on the cognitive status of the user and the context (Norman, 2004). This level should be investigated when people are relaxed and have time to think about their mobile device or service. Questionnaires, interviews or focus groups with storytelling to get information about emotional attachment might be appropriate at this level.

Additionally, the context in which the interaction takes place has to be taken into account for a full understanding of UX and the possible resulting attachment. To distinguish between different context dimensions, we used Huuskonen's (2005) classification of mobile context as a basis: the environment, the phone and services, and the user. In this context model, the environment includes the geographical environment, other things around (e.g., people, devices), other phones in the pocket, the physical environment, time and date, and other available services in the vicinity. The mobile phone and services include sensors, network services, current application, and the user interface (e.g., the use of headphones, screen size). Finally, the user is specified by the user's profile, the social context, the mental context, and the physical context of the user, as well as the user's activity. In addition, we have to be aware of the fact that the context, in particular for mobile devices, is constantly changing.

By combining Norman's (2004) experience dimensions and Huuskonen's (2005) context classification, an evaluation framework was built (see Table 6.1). Based on this framework, we conducted a field study using experience sampling combined with personal interviews. The next section describes how the framework was used in the pilot study.

	Environment	Phone and service	User
Visceral level	1A	1B	1C
Behavioral level	2A	2B	2C
Reflective level	3A	3B	3C

Table 5.1: Evaluation framework consisting of Norman's (2004) three experience dimensions and Huuskonen's (2005) classification of mobile context

In the pilot study, the three experience dimensions were investigated by a combination of different methods. The visceral and reflective level were especially addressed by the use of pre- and post-study interviews. The behavioral level was investigated by means of an ESM study. We made use of the research framework, in particular for setting up the field study, and defined a set of mobile attachment related questions for each relevant experience dimensions in relation to each contextual parameter. The questions are based on an extensive literature review and were formulated during a series of expert focus groups. Since it has been proposed that product personalization has an effect on product attachment (Mugge et al., 2004), we included questions on mobile phone personalization in the setup. A comprehensive list of questions related to the different context dimensions is exposed in Meschtscherjakov et al. (2008). Table 5.2 on the facing page exemplifies question samples used during the ESM study and the corresponding context dimensions.

2A: Environmental context related questions:
Where are you right now?
Would you miss your mobile device here?
Are you using a special profile for this environment?
How satisfied are you with your mobile device in this environment?

2B: Phone and service related questions:
What was the last service you successfully used on your mobile device?
Did this service work as expected?
How satisfied have you been with this service?
How bad would it have been if this service would not have worked?

2C: User related questions:
Did someone talk to you today about your mobile phone?
How do you feel when thinking about it?
Do you show your mobile device to others?
How important is it that your mobile device differs from others?

Table 5.2: ESM question samples used during mapped into the different context dimensions

5.1.2 Methods and Setup

On the basis of the evaluation framework, we conducted a field study in May 2007. This study aimed to get information about the emotional attachment of users with their everyday mobile phones. We decided to use the participants own mobile devices as a means for ESM. This setup had two advantages. First, users did not need to adapt to a new device and second, users did not need to carry an additional device with them. A disadvantage of this approach is that the device in the focus of the study (the mobile phone) also is the tool by means of which the ESM questions are asked. If questions are annoying for participants, this feeling might be projected onto the device itself. We, therefore, carefully took this danger into account in the study setup and when interpreting the results.

Participants were recruited via the University of Salzburg mailing list. Prior to selection, short telephone interviews were carried out based on a recruiting guide (see Figure C.1 in Appendix C). This was necessary to get a broad range of different mobile devices and make sure that participants mobile phones met technical requirements for the ESM study (e.g., the possibility to access the Internet on their mobile device for retrieving the questions). Contrary to most other ESM tools which were available at the time of the study (see Chapter 4.3.1), our ESM approach was designed to run on a variety of different mobile platforms because it used a combination of SMS and WML

(Wireless Markup Language) that is supported by the vast majority mobile devices in use today. The pilot study consisted of three parts, which are described in detail in the following:

1. Pre-interviews including a demographic questionnaire

2. One-week ESM field study

3. Post-interviews including mobile attachment and methodical questions

Pre-interview Set Up

Prior to the field study, participants took part in an individual introduction session. During these sessions, structured interviews with participants were conducted. See Figures C.2–C.3 for the detailed interview guide. Participants were asked to to fill out a preliminary questionnaire. Besides demographic data (e.g., gender, occupation, education), questions about media and mobile phone usage patterns (e.g, "How often do you take pictures with your mobile phone?") were asked. See Figures C.5–C.7 for the original pre-questionnaire. Thereafter, participants were introduced into the study setup and an exemplary ESM question was sent to the participant's mobile device. This not only had the advantage of giving participants a hands-on experience how to answer ESM questions but also of proofing the technical feasibility of ESM on the participant's own mobile device. After asking participants to take pictures with their mobile device in situations of pleasure or annoyance and providing a subset of participants with a Microsoft SenseCam[1], participants had to fill out a form permitting to use the generated data (see Figure C.8). Finally, a set of questions regarding mobile attachment to the own mobile phone were asked. This part of the study refers to both visceral and reflective level of the evaluation framework.

Experience Sampling Set Up

Subsequent to the interview, a one-week field study was conducted by using experience sampling. During that period, participants were prompted seven times a day to answer a short questionnaire about their activities and experiences with their mobile phone on the basis of the previously described evaluation framework. With the ESM study, we aimed at covering mainly the behavioral level of the evaluation framework.

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[1]Five participants were asked to carry a Microsoft SenseCam around their neck during one day. The SenseCam automatically took a picture of the environment every minute. The results of the SenseCam study are beyond the scope of this thesis and will not be reported here. A description of the SenseCam can be found at http://research.microsoft.com/en-us/um/cambridge/projects/sensecam/ – last accessed April 17, 2011).

As described, the main purpose of the experience sampling study was to gather in-situ data from the participants and their usage of mobile devices in several contexts. Thus, we used time triggered experience sampling (see Chapter 4.3.1) to cover a broad range of different contexts. Prompting to answer a question was done through short message service (SMS). The user received an SMS whenever he or she needed to answer a questionnaire. This was done based on a predefined timesheet. The SMS, used for notification, contained a link to a webpage which was serving the experience sampling questions. Users' responses were captured via a submission of the filled out form back to the web-server and stored in a database. Care has been taken to interrupt the user as little as possible, by formulating the question in a way that the user only had to choose amongst several answers, without the need to enter free-form text which usually is a distracting and time consuming task on mobile devices. Used answer categories were yes/no questions, multiple answer questions, rating questions, and emoticons. We decided to use emoticons in the question sample as they are often used to capture emotional reactions and feedback from users (Meschtscherjakov, Weiss, and Scherndl, 2009). Example questions are illustrated in Figure 5.1.

Figure 5.1: (a) Single answer pull down question; (b) Emoticon question

The study lasted for one week (including a weekend). Participants received seven notifications per day, where each ESF (experience sampling form) consisted of four questions. As time frame for the notification we defined 9:00 am until 8:00 pm during weekdays and between 10:00 am and 9:00 pm during the weekend. The time-triggered sampling was scheduled for about every second hour, resulting in a total of 196 ESF per participant.

The technical implementation for the time triggered ESM was based on open source technology and open standards. The server holding the timetable was an apache server,

running a Perl CGI script that sent personalized (per participant) SMS containing a URL to a specific ESF on predefined points in time. Upon receiving the SMS on the mobile device, the participant used the link to request a page from the web-server where the CGI script produced a WAP page containing the sample with four questions (one question per WML card). When the participant had answered all questions in the sample, the results were sent back to the CGI script which in turn saved the results along with user specific information and time-stamps into a MySQL database for later evaluation.

Post-interview Set Up

After the study, a post-interview was conducted with all participants. These interviews lasted approximately one hour. See Figures C.9–C.12 for the detailed interview guide. Foremost, participants were asked mobile attachment questions, such as, "I (dis)like my mobile phone, because . . . ", "Do you like to show your mobile phone to other people?", "Do you like the design of your mobile phone?", "With which five emotional terms would you describe your mobile phone?". Second, questions regarding concerning methodical issues were asked, such as, "What did you (dis)like about the study?", "What do you feel about the overall effort to answer the questions?". Additionally, pictures taken with the mobile phone were discussed and, if appropriate, set in relation to the ESM answers at that moment. Finally, participants were asked if they were willing to participate in a closing workshop[2] and paid 25 €. This part of the study refers to the visceral and reflective level of the evaluation framework.

5.2 Pilot Study Results

In the following, results of the pilot study are presented. Relevant findings for this thesis are highlighted. A more detailed analysis can be found in Meschtscherjakov et al. (2008).

5.2.1 Participants and Mobile Phones

Twenty people participated in our study (8 female and 12 male). Their age ranged from 26 to 52 years. There were 9 participants between 25 and 30 years old, 6 participants

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[2]The closing workshop targeted at gaining additional qualitative data about mobile attachment of the participants of the pilot study. Another goal of the focus group was to develop ideas for future services of mobile devices together with the study participants. Again, this closing workshop is not part of this thesis.

were between 30 and 35 years old, 3 participants were between 35 and 40 years old, and 2 participants were older than 40. We had 16 employed participants (3 manager, 5 engineers, 5 employees, 3 scientists) and 4 students. Participants worked in different fields (e.g., financial service, university, IT industry, television station, pharmacy, politics, civil engineering or publishing house) and 12 participants owned a university degree. There were 19 native German speakers and 1 participant whose mother tongue was English. All participants stated that they had at least good English and German skills. The study itself was conducted in German.

All participants stated that they use computers and the Internet daily. There were 19 participants who stated that they write emails daily, 1 participant stated to write emails several times a week. All participants said that they use their mobile phone daily whereas only 3 participants used a fixed line telephone daily. There were 16 participants who said that they use their mobile phone for private and business purposes equally, 3 participants stated that they use it more for private purposes, and 1 participant more for business purposes.

Video telephony seemed to be not very common. Only one participant used video telephony once a month, 7 participants less than once a month, and 12 participants not at all. Text messaging is very popular. We report that 9 participants write SMS daily, 6 several times a week, 2 once a week, the rest more seldom. Only one participant played games on his or her mobile phone daily, 2 several times a week, 8 more seldom, and 9 not at all. The photo functionality of the mobile phone was used rarely. No participant used the photo camera of his or her mobile phone daily, 2 several times a week, 6 several times a month, 3 once a month, 6 more seldom and 3 not at all. The Calendar application and the To-Do List of the mobile phone seemed to be diametric. Participants used this functionality daily (9 participants Calendar, 6 participants To-Do List) or not at all (4 participants Calendar, 8 participants To-Do List). The alarm ringer seemed to be, beside the telephone itself, the most used application on mobile phones. All participants did use the alarm and 16 participants said that they use their mobile phone as an alarm daily. Surprisingly participants did not use the mobile phone as a music player very often. Only 2 participants listened to music on their mobile phone daily, while 9 participants did not listen to music on their mobile phone at all.

As mentioned previously, all participants used their own mobile phones for the study. The mobile phones came from 10 different manufactures: 4 Nokia, 4 Sony Ericsson, 3 QTEC, 2 Motorola, 2 BlackBerry, 1 Palm, 1 Samsung, 1 Siemens, 1 Vodafone, 1 IMATE (see Figure 5.2 on page 159). There were 9 mobile phones equipped

with a numeric keypad, 9 with an alphanumerical keyboard and 2 solely with a touch screen. Participants owned their mobile phones on an average for 8.45 months (from one to 18 months). All participants had Internet access on their mobile device but only 11 participants actively used it (only 2 participants on a daily basis, 4 weekly, and 4 at least on a monthly basis).

5.2.2 Pre-interview Results

In this section, the main results gathered from the pre-interview are presented.

General Attitude and Used Services

In the pre-interview, we focused on the users pre-experience with mobile devices and their general meaning about mobile phones. All participants had primarily a positive attitude towards their mobile phone. Most participants (75%) said to be very happy with their mobile phone. They used terms like "very good", "very satisfied" and "great", as well as "good", "satisfied" or "practical". Only 5 (25%) participants had a neutral attitude towards their current mobile phone. They used terms like "middle-rate", "neutral" or "pros and cons". Participants were asked to describe why they have a positive or negative attitude about their mobile device. We counted 11 (55%) positive statements which were rather general ranging from "user friendly" and "practical" to "a wide range of applications" and 7 (35%) negative statements like "too big", "too slow", "too little memory", "unstable". It is noticeable that the positive statements are very broad and general whereas the negative comments were narrow and specific.

Moreover, we asked the participants which service they used the most. Participants were allowed to give multiple answers. If they provided answers, they were asked to rank the answers. Of those participants 3 (15%) gave 2 answers, 10 (50%) participants gave 3 answers, 4 (20%) participants gave 4 answers, 2 (10%) participants gave 5 answers, and 1 (5%) participant gave 6 answers. A majority of participants (85%) stated that they use their mobile device mostly for phone calls. All participants (100%) ranked the answer "making phone calls" among the top three. All participants stated that they use their mobile phone several times a day. Thus, it can be said that "making phone calls" is still the most used service on their mobile phones. "Short messaging" was ranked as most important and most often used mobile service by 11 (55%) participants, 8 (40%) ranked this answer as second most important. The "alarm clock" application was the most often used application of their mobile phones to 5 (25%) participants. Interestingly, this answer was always within the top three answers.

Figure 5.2: Participants' mobile devices as used in the pilot study

Overall, it can be summarized that all participants used their mobile phone primarily to make phone calls on a daily basis. "Short messaging" (55%) ranked amongst the most used services on their mobile phones followed by the "organizer" application (35%). A fourth of the participants (25%) ranked the "email", "alarm" or "Internet" application among the most used services on their mobile phones.

Mobile Attachment

During the pre-interview, participants were additionally asked to describe, what makes their mobile phone special. Most answers were related to design and usability aspects as well as technical qualities of their mobile device. In numbers, 5 participants stated their mobile device is "practical" and 6 participants said that the design of their mobile device makes it "special" for them. A total of 8 participants noted that they personalized their mobile device with special ring tones and 4 participants with personal pictures. Participants generally denied having an emotional attachment to their mobile device. However, when they would lose or forget it somewhere, they would miss it.

Regarding the question of what the three most important properties of their mobile device are, we received the following answers:

➢ 8 times: "design" (e.g., "look", "small", "clamshell")

➢ 6 times: "ease-of-use" (e.g., "menu navigation", "clarity")

➢ 6 times: "organizer" (e.g., "contacts", "appointments")

➢ 6 times: "input possibility" (e.g., "touch screen", "keyboard")

➢ 4 times: "display" (e.g., "size", "resolution")

➢ 4 times: "extensibility" (e.g., "application", "capacity")

➢ 3 times: "long battery life"

➢ 1 to 2 times: "camera", "email", "Internet", "stability", "wireless LAN", "TV", "ring tones", "T9", "MP3 ring tones", "Bluetooth", "short messaging", "additional applications", etc.

Additionally, we also asked participants what they do not like about their mobile devices, and received the following answers:

➢ 7 times: "too big"

➢ 5 times: "unreliable"

➢ 4 times: "bad technical quality"

➤ 4 times: "buttons on the side"

➤ 3 times: "joystick" (e.g., "too small", "not user-friendly")

➤ 3 times: "short battery-life"

➤ 3 times: "slow"

➤ 1 to 2 times: "T9 problems", "too little storage capacity", "not optimal for listening music", "sound too low", "complicated", "in built camera has too little resolution", "not enough ring tones", etc.

Pre-interview Summary

Generally, it can be summarized that the participants did not express a high emotional attachment to their mobile phone. Nevertheless, they seem to be satisfied with their mobile phones. It can be said that the participants have primarily positive impressions about their mobile phones. Most of them are satisfied or even very satisfied, some identify positive and negative aspects but no one had really bad impressions about their mobile phone. Although they state that they are not very emotionally attached to their specific mobile device, they feel that they miss something when they lose or forget their mobile phone. When looking at the terms people use to describe their impression of their mobile phone, it is noticeable that the positive statements are very general whereas the negative comments are specific. They perceive their mobile phone as a practical companion; they like it but do not love it. The mobile phone itself is replaceable but not the service. People customize their mobile phone with stickers or add-ons, not to make it more beautiful but to make it distinguishable from others. They often customize ring tones or background images. The most important thing for the participants is that the mobile phone works correctly. The design comes in at second place.

5.2.3 ESM Results

In this section, the main results gathered from the experience sampling study are presented. We split the results into methodological results and, according to the evaluation framework, the three context dimensions: environment, phone and service, and user.

Methodological Results

As described in Chapter 5.1.2, the 20 participants in our one-week study were triggered seven times a day to fill out an ESF. Each ESF consisted of 4 questions defined based on the main elements in the evaluation framework. Thus, each participant had to answer 49 ESFs or 196 questions. With 20 participants, we expected overall 980 ESFs or 3,920 single answers to be returned. Due to technical reasons three ESF could not be delivered to three participants. Therefore, the maximum number of returned ESFs was 971 or 3,884 single answers.

During the study, we logged three points in time. The first point is when we sent the SMS which contained the link to the ESF (ESM notification). The second point is when the participant followed the link within the SMS and fetched the ESF from our website (ESM delivering). The third point is when the participant pressed the submit button to send back the four answers within an ESF at once (ESM capturing). Our logging shows that from the 971 ESM notifications 941 answered ESFs were sent back, which is a return rate of 94.1%. On the average it took participants 41 seconds to answer the four questions within an ESF. Hektner et al. (2007) suggest that it should not take longer than two minutes to answer an ESF.

From the post-study interview, we know that participants would be willing to answer more than four questions within one sample form and to participate in a longer study as well, but only under the circumstances that the samples per day (in our study seven) would be reduced.

Emotional Responses

We asked participants in which environmental context they were (home, work, in transit or somewhere else), if they would miss their mobile device within this particular environment, and by use of the previously mentioned emoticons[3], if they were happy with it. Regardless of the situation, 79.7% of the participants would miss their mobile device, 83.3% of the participant would miss their mobile device at home, 85.7% would miss it at work, and 70% would miss it in transit. On the question what participants would miss most if they lose their mobile device, most participants named their contacts (78.4%) or the mobile device itself (64.9%). Only 1 participant declared that he or she would miss nothing at all. Nevertheless, even this participant stated that information stored on the mobile phone is very important, as for 92% of the participants.

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[3]For being able to evaluate emotions, represented by emoticons, the emoticons had to be recoded into "very happy", "happy", "neutral", "unhappy", and "very unhappy".

Regarding happiness, 74.6% were "happy" or "very happy" with their mobile device within the respective environmental context. Overall 73% expressed "very happy" or "happy" feelings to be able to reach others, 25.7% had no emotions, and only 1.3% expressed negative feelings. We asked participants whom they contacted last before they got the ESF and which service they used. Friends were contacted last at 60.3%, family members ranked second at 19.2%, and 15.4% contacted a colleague at work. Most times (83%), participants made phone calls using their contact list (89.4%). As Figure 5.3, shows most participants were "very happy" or at least "happy" to be able to reach friends, whereas reaching family members resulted in positive and negative feelings and most of the contacts to colleagues were neutral. We also asked how participants felt when others called them. In this case, the positive emotion rate was 52.2% and 42.3% experienced no emotions. In total, only 5.6% were "unhappy" or "very unhappy" to be called. Generally, it can be argued that participants miss their mobile device regardless of their specific environment, and they are mostly happy with it.
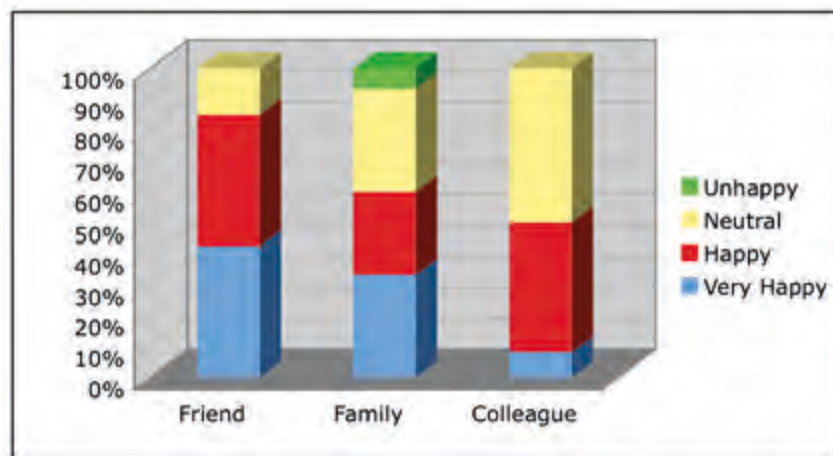
Figure 5.3: Happiness of participants when contacting others with their mobile devices

Satisfaction and Importance

Overall, participants were satisfied with their mobile phone. When asked about personal satisfaction, participants answered 9 out of 10 questions with "very satisfied". Not a single answer was "very unsatisfied". In general, 98.3% of the answers were positive, while only 3 had a negative result. Regarding services, 44% of the participants were "very satisfied" and 31.5% were "satisfied". A high correlation has been found when examining satisfaction levels for SMS (63.6%). The only case when a par-

ticipant answered with "not satisfied" has been, when it came to using Web Services on the mobile handset.

As a conclusion from the pre-interview, we saw that participants use their mobile phone most for making phone calls. The ESM study supports this outcome. In 59.3% of the answers, participants said that the last used service was telephone, 20.4% were SMS, 3.7% were email, 5.6% were Web applications and 11.1% could not remember. In 98.1% the service worked as expected. In 44.4% participants were "very satisfied" with the service, 31.5% were "satisfied" and 22.2% were "neutral". For 31.5% of the cases, it would have been "very bad" if the service would not have been working. In 25.9%, it would have been "bad", in 27.8% it would have been "not very bad" and in 14.8% of the cases it would have been "not bad at all". In 45.3% of the cases, participants complained that the mobile phone did not work as expected. In 35.8% of the cases, participants blame the phone for the malfunction and 47.2% of the users would change the mobile phone if this happens again.

The ESM data provides us with additional interesting information. Of the given answers, 51.4% stated that mobile phones are used more for private purposes than business purposes, 32.4% stated that mobile phones are used more for business use. and 16.2% stated that the usage is equal. When asking participants how important their mobile phone is for private issues, 70.3% said it is "very important" and 29.7% said that it is "important". For business purposes 54.1% stated that it is "very important", 32.4% stated that it is "important" and a few stated that it is "not very important" or "not important at all". Despite the fact that participants think their mobile phone to be more important for private purposes, they did not use a different profile at home (73%) as they have at work. Only 5.6% of the participants used a "home profile" and 14.3% used a special "work profile". If participants used profiles at all, it is remarkable that they did not use different profiles for different environments, aside from only one profile either for home or for work. Profiles seemed to be not very common among participants. To enhance the emotional attachment, it could be important to support functionalities of a mobile phone for private purposes. It should be fostered that the mobile device is not only a tool for business purposes but a supporter in life.

We also asked participants if they would like to have another mobile device at the moment of the question. Only 28.2% of the participants stated that they would like to have a different mobile phone. Not surprisingly, participants who did not want to have another mobile device were either "very happy" (35.7%), "happy" (50%), or at least "neutral" with their mobile phone. More surprisingly though, only 9% of

the participants who would like to have another mobile device were "unhappy" with their own handset, 40% were "happy" and 27.3% were "very happy". Nevertheless, they still would have liked another mobile device. These results indicate that positive emotional responses are not enough to built an emotional attachment to mobile devices.

Regarding the question how important it is that the owners mobile phone is different from other handsets, 54.3% of the participants did not care, 34.3% stated that it is unimportant and only 11.4% said that it is important. On the question if participants like to show their mobile devices to others, 42.9% stated "yes". This indicates that some of the participants give their mobile device a symbolic meaning, despite the fact that they deny having a strong mobile attachment.

Personalization

As Mugge et al. (2004) have shown personalization could lead to a higher emotional attachment to products. We asked our participants how important it is to personalize their mobile devices. Only two participants answered it would be "not important at all". In sum, 79.5% of the participants answered that it is "very important" or at least "important" to have the possibility to personalize a mobile device. We also asked if they already have personalized their handsets. Only 5.1% did not do any personalization, 38.5% have installed a new application, 61.5% have chosen a special background image and 76.9% used a special ring tone. When asking participants after they received a call if they used a special ring tone for that caller, only 8.5% stated to do so.

5.2.4 Post-Interview Results

For the post-interview, we focused on areas the experience sampling study revealed to be relevant as well as questions related to our research framework, in particular those addressing the reflective level of emotional attachment.

Specific Usage Scenarios

On the question if they were using their mobile phone more often in certain situations (e.g., Christmas, holidays), 20% of the participants answered with "no" and 30% replied with "yes", specifically for business reasons. Moreover, 60% of the participants noted that they are using their mobile device less often when they are on vacation, either because of high roaming costs or because they did not want to be annoyed. Due to high roaming costs 25% stated that they use their mobile phone less when they are

abroad and 40% mentioned they use their mobile devices more often at certain times (e.g., during Christmas time or for New Year). Moreover, 60% mentioned they do not switch off their mobile phone during the night, because they use it as "alarm clock" in the morning. Sometimes, they put it in silent- or vibration-only mode. Another reason participants did not switch off their mobile during the night is because people are trained not to call during the night and if someone calls, it must be something very important. Only 20% completely switched off their mobile phone during night. One participant mentioned that he or she did not like to have the mobile phone in the bed room, because of radiation concerns.

Perceived Importance, Replaceability, Likeability, and Status Symbol

Most participants stated that their mobile phones make their life easier rather than complicated. One participant stated: "My mobile phone makes my life more flexible, more time-efficient and more up-to-date, without being bounded to a stationary infrastructure." Participants liked the functionality of their mobile phones most. They wanted to have access to important data (contacts, dates, files) and used several applications (telephone, alarm, email). They also cared about the fact that they can reach other people, are reachable themselves, and are able to communicate with others. This leads to a feeling of more flexibility and mobility.

Most participants did not stick to mobile phones from a specific brand; they switched several times between manufacturers. Important buying decisions for a new mobile phone were special functionality features of the mobile phone like UMTS, triband or email. Other important buying factors were the price and the design of the mobile phone. Participants were asked to complete the following sentence: "I like my mobile phone because ...". High functionality was why 60% of the participants liked their mobile phone, 25% liked the design of their mobile phone, 25% liked their mobile phone because it enabled them to communicate, and 25% enjoyed their mobile phone because it made them more mobile. Only 5% stated they did not like their mobile phone at all.

However, we also asked participants to complete the sentence: "I don't like my mobile phone because ...". Malfunctions in one-way or another was why 55% of the participants did not like their mobile phone and 35% stated their mobile phone was sometimes annoying (being available all the time). One participant also said: "I don't like my mobile phone because it is a pocket big brother. One is obliged to be reachable. Privacy is being minimized."

Generally, participants did like the design of their mobile device. They liked small, handy and well-designed phones. Nevertheless, most participants preferred functionality over design. In general, participants were satisfied with the display of their mobile phones liking a big and well laid-out display. They did not like it when it is too small or confusing.

Finally, we also asked participants what they would miss if they lost their mobile device. Half (50%) of the participants mentioned their contacts. Contacts seemed to be the most important information users have on their mobile phone. This is also confirmed by the fact that 7 participants made a backup of their contacts (synchronized the device with their computer or noted contacts elsewhere) and 5 participants additionally made a backup of all their data from the mobile phone. In addition to that, 3 participants mentioned pictures, appointments, the device itself, and short messages as important data on their mobile phones. Some participants also stated that the data on their mobile phone is not so important, as everything is restorable.

Most participants did not see their mobile phone as a status symbol but as a commodity. They did not actively show their mobile to other people. If they showed their mobile phone to somebody, they did not show the mobile phone itself but for instance pictures on their mobile phone. One (male) participant stated: "I don't show my mobile phone to other people. It belongs to my private sphere. I don't like someone else to use my mobile phone." This particular participant seemed to enrich rather the private self with his mobile device than his public self.

As defined in the evaluation framework for emotional attachment, we included emotional terms as indicator for emotional attachment to mobile devices. Thus, we asked participants to describe their mobile phone with five emotional terms. Participants connected with their mobile phone characteristics like "practical" (45%), "reliable" (15%), "ergonomic and user friendly" (10%) or "easy to use" (10%). Single terms were: "enjoys me", "cool", "freedom", "I like it", "friendly", "feeling of connectedness". Participants also used negative terms describing their emotional relation to their mobile phone, such as "annoying and disturbing" (15%) or "to become angry and cumbersome" (10%). One participant confirmed again, that the mobile phone is a "pocket big brother". It was even described as "necessary evil" by one participant. While 20% participants had no emotional terms for their mobile phone, participants mentioned, overall, more positive emotions and meanings they connect with their mobile phone than negative emotions.

Personalization

As mentioned previously, participants stated that personalization is important for them. Most mobile phone users did personalize their mobile device by installing new background images, ring tones and special themes, and by defining shortcuts. A product to which a person is attached means a lot to the owner and triggers his or her emotions. People sometimes give names to products which are personally important to them. Therefore, we also asked participants if they named their mobile phone. None of the participants gave his or her mobile device a name, because most of them did not consider it as important enough. However, participants gave names to other devices and products. Interestingly, 6 participants gave names to their car, 2 of them named only their first car. A total of 50% also had a name for their personal computer or notebook (for the device itself or at least for the representation of their computer in a network). One (female) participant additionally explained it as follows: "I usually give names to my devices. For my mobile phone I don't have a name, as I'm not so attached to it. With the computer, for instance, I spent a lot of time. The mobile phone, however, I just carry around, but I don't use it actively. [...] Another reason maybe is that the mobile phone is a short-dated device – after one year you change it, so it is easily replaceable."

Emotional Terms

In the post-interview, participants were also confronted with 32 emotional terms which were extracted from the AttrakDiff questionnaire (Hassenzahl et al., 2003). The selection of items was based on expert consensus. Same as in the AttrakDiff terms were grouped in pairs of pairs of bipolar adjectives building a semantic differential (see Figure 5.4 on page 170). Participants were asked to state if they think their mobile phone is either the one (e.g., "beautiful") or the other term (e.g., "ugly") of the semantic differential, or they could answer that they do not associate one of the terms to their mobile device. Figure 5.4 on page 170 visualizes in a 'kind of' tag cloud, which terms participants assigned with their mobile device. More often chosen terms are visualized bigger than less often used terms.

The table shows that participants associate positive expressions (left column) with their mobile device rather than negative ones (right column). In sum, 61.3% of the answers are positive terms and only 8.4% of the answers are negative terms with 30.3% "neither nor" answers (middle column). Most participants stated that their mobile device is presentable (95%), practical (95%) and conjunctive (80%). When participants

used negative terms, they chose terms like unmanageable (25%), conservative (25%), conventional (20%), or complex (20%).

5.3 Pilot Study Findings

Our field-study surprisingly revealed that despite a general positive attitude towards their mobile device, participants did not explicitly express an emotional attachment to their mobile phone. They rather have an emotional attachment to the services a mobile phone provides. The mobile phone itself is perceived as a replaceable and functional object. Our study did not indicate that participants love or hate their mobile devices. During the interviews, study participants generally denied having a mobile attachment at all. However, when having a deeper look at ESM data in combination with the post-interview answers, it can be argued that an emotional tie exists in an unconscious way with special regards to the data stored on the device as well as provided services. The mobile device itself seems often to be exchangeable but certain services and individually different characteristics of the mobile device are seen as irreplaceable.

This has two major reasons. On one hand, the pace of technical innovations for mobile devices is high, which motivates participants to change their mobile phone more often. Technical features play a more important role than the manufacturer. On the other hand, network providers try to reach a high degree of user binding by offering cell phones in combination with contracts. Mobile phones are given away for free or with a low price tag. Because participants tend to change their mobile device every time they extend their contract or sign a new one long lasting and strong mobile attachment hardly develops.

Our study revealed that participants perceive their mobile device as a mainly functional object. When asked about the properties that make their mobile phone special to them, most of the participants answers referred to its functionality. Nevertheless, participants seemed to be satisfied or even happy with their mobile devices. When we asked about "most liked" or "disliked" properties of their mobile devices, participants answers referred to the design of the mobile phone (beautiful design vs. big size), which leads to the assumption that design is an important property. This indicates that a more emotional design could strengthen mobile attachment.

The post-interview provided more qualitative insights into the reflective level of users emotional experience with their mobile devices and services. When asked to describe their mobile phone, participants used more positive expressions than negative

Positive terms	Neither nor	Negative terms
Beautiful (60%)	⊘ (40%)	Ugly (0%)
Stylish (55%)	⊘ (35%)	without style (10%)
Attracting (30%)	⊘ (70%)	Repellent (0%)
Presentable (95%)	⊘ (5%)	not presentable (0%)
Compelling (15%)	⊘ (70%)	Lame (15%)
Likable (65%)	⊘ (35%)	Dislikeable (0%)
Valuable (65%)	⊘ (35%)	Valueless (0%)
Good (65%)	⊘ (35%)	Bad (0%)
Practical (95%)	⊘ (5%)	Impractical (0%)
Easy (55%)	⊘ (25%)	Complex (20%)
Clear (70%)	⊘ (15%)	Confusing (15%)
Manageable (60%)	⊘ (20%)	Unmanageable (25%)
Novel (50%)	⊘ (30%)	Conventional (20%)
Innovative (50%)	⊘ (25%)	Conservative (25%)
Conjunctive (80%)	⊘ (20%)	Insulating (0%)
Bringing together (70%)	⊘ 25%)	Separating (5%)

Figure 5.4: Tag cloud of positive and negative terms participants assigned to their mobile devices (translated from German)

ones. The most important positive term used was "practical", which again is describing functionality aspects. Going into more detail regarding mobile attachment, 50% of the participants mentioned that they would miss their contacts, or other personal content stored on their mobile phone, such as pictures, short messages, or personal data. Most participants reported to have difficulties to find emotional expressions for their mobile device when asked to describe their mobile phone in emotional terms during the post-interview. They rather use terms like "practical" or "reliable", which cannot be categorized as emotional terms. Other terms they used were "presentable", "practical", or "conjunctive". Looking at the social context, participants stated that they would miss their mobile phone, in particular the possibility to reach loved ones. These results comply with Vincent (2006) who stated that only a few people think of their mobile device in emotional terms but use it to achieve emotional goals.

In summary, it can be stated that functionalities supporting the user to reach his personal goals, as well as personal content on the mobile device, are major driving factors for mobile attachment. The mobile device has become a daily companion in everyday life. Our results support the suggestion that personal history between the user and the mobile device, as well as the degree of identification with the mobile device has influence on the mobile attachment. Both factors can be influenced through product personalization. Nevertheless, it has to be mentioned that the study has some shortcomings. First, it was carried out before the iPhone hype changed many peoples emotional attachment to their mobile phones. Second, since the number of participants is very small, and the sample is not statistically representative (e.g., no teenagers are included) general conclusions need to be regarded with care.

The used combination of methods seemed to be very promising to gather user feedback on emotional aspects. In particular, the experience sampling method in combination with personal interviews supported us in gaining deeper insights into user experience, attitudes and, consequently, into mobile attachment. Feedback from participants was mainly positive. They did not feel that it was too time consuming, because answers could be given very fast. Only 3 participants stated that it was too much effort because of the length of the post-interview. A total of 14 participants assumed that it took less than 1 minute to answer a sample. As mentioned above, it took on average 43 seconds. One of the major problems was that participants could not answer every single question at the very moment the question was asked. Therefore, it happened that samples were put together and answered at one time. One suggestion for improving the study was to reduce the samples per day and extend the length of the whole study.

The results from the field study were used to build the conceptual and temporal mobile attachment models. The methodical lessons learned were used as a starting point for the FeatMo questionnaire and the Maestro concept.

Chapter Summary

In this chapter, a pilot mobile attachment study was presented. It consisted of interviews and a one-week ESM field study with 20 participants. The aim of the study was to get preliminary insights on mobile attachment. The findings of the study surprisingly showed that participants did not express an emotional attachment to their mobile device, but rather to services provided. In general, participants had a positive attitude and positive feelings towards their mobile device. Nevertheless, the mobile phone itself is seen as a functional and replaceable convenience. This might be the case due to the fact that the participants in the study often exchange their mobile phones. Thus, mobile attachment does not emerge. However, mobile attachment seems to be evident in an unconscious way. The particular mobile device might be exchangeable, but an entire abandonment of owning a mobile phone is unimaginable.

The study presented in this chapter broadens the understanding of mobile attachment providing answers to RG6. It has shown that mobile attachment is a multifaceted property that can be hardly addressed directly. The empirical study presented in the next chapter is built on the results of this study. Contrary to this study, attachment objects are not the user's own devices but new BlackBerry mobile phones.

CHAPTER VI

Empirical Study 2: BlackBerry Attachment Study

In this chapter, the second empirical field study which aims to answer RG6 is presented. It strengthens the understanding of mobile attachment by providing insights of people's emerging mobile attachment with new BlackBerry mobile phones. Within the study, both the FeatMo questionnaire as well as the Maestro concept were used. Findings from this study helped to build the conceptual and temporal mobile attachment model and were used for the construction of mobile attachment design implications (see Chapter 8). In addition, it provided methical insights for the future development of the FeatMo questionnaire as well as the Maestro concept.

Similar to the pilot mobile attachment study presented in Chapter 5, the BlackBerry attachment study (in the following referred to as "BlackBerry study") was part of the mobile attachment project in cooperation with Research In Motion Limited and the support of A1 Telekom Austria AG. Contrary to the pilot mobile attachment study, which had participant's personal mobile devices as attachment objects, this field study investigated the emergence of a relationship between users and new BlackBerry devices. We, therefore, equipped participants with new BlackBerry devices and accompanied them through an eight-week contextual and behavior driven ESM study. During these eight weeks, we logged participants' usage of the BlackBerry devices and asked them to report on their usage experiences as a reaction to certain events (e.g., an SMS was sent). For the ESM study we utilized the Maestro concept presented in Chapter 4.3. Study setup and results are presented exhaustively in Meschtscherjakov, Scherndl, Losbichler, and Tscheligi (2009).

6.1 BlackBerry Study Setup

As outlined in Chapter 4.1, measuring mobile attachment over time is challenging because participants' user experience, which again influences mobile attachment, may differ at different times and in different contexts. In order to assess the potential development of mobile attachment, different user experiences in various contexts have to be addressed. To evaluate UX over time and the possible resulting mobile attachment as accurately as possible, we decided to use several methods (group discussions, questionnaires, interviews, ESM study) for a methodical triangulation. Based on the experiences with the evaluation framework developed for the pilot mobile attachment study (see Chapter 5.1.1), we again differentiated between Norman's (2004) three experience dimensions: the visceral level, the behavioral level, and the reflective level. Norman's visceral level contains the first impression of the product through its appearance, mainly captured through workshops at the beginning of the study. The behavioral level aims at the actual usage of the product in daily life. This level was assessed through an eight-week experience sampling field study. The reflective level comprises the cognitive appraisal of the product after the actual usage. This level was addressed with questionnaires and interviews at the end of the study. The usage of the utilized different methods in order to assess different aspects of Norman's levels is illustrated in Table 6.1.

Methods:	Visceral (workshop)	Behavioral (field study)	Reflective (post-interview)
Group Discussion	X		
Questionnaires [a]	X	X[b]	X
Interview		X[c]	X
ESM-Study		X	
Keyboard test	X		X

Table 6.1: Methods to capture data at visceral, behavioral and reflective level

[a]FeatMo, AttrakDiff (Hassenzahl et al., 2003), BFI-10 (Rammstedt and John, 2007)
[b]Questions from questionnaires were partially comprised in the ESM study
[c]Short telephone interviews during in the fourth week of the ESM study

Apart from the FeatMo questionnaire (see Chapter 4.2), we used another two questionnaires, called the 10-item Big Five Inventory (BFI-10) and the AttrakDiff. The BFI-10 is a short measure for assessing participants' personality in contexts with only limited time. Reliability and validity of the test are in an acceptable range (Rammstedt and John, 2007) and, therefore, the BFI-10 is an economic and apt instrument for

measuring the Big-Five personality traits (extraversion, agreeableness, openness for experience, consciousness and neuroticism). We included this test, because it seems plausible that personality plays a role in the perception and feeling of mobile attachment (see also the discussion on mobile attachment influencing factors in Chapter 3.2.2).

In order to assess UX, we handed our participants the AttrakDiff (Hassenzahl et al., 2003). The AttrakDiff is a German questionnaire using a semantic differential for measuring the attractiveness of interactive products. Users can indicate their perception of the product using 21 pairs of opposite adjectives (e.g., technical – human, beautiful – ugly). These 21 items result in the dimensions of pragmatic quality and hedonic quality; the last dimension consists of two separate and independent aspects: stimulation (hedonic quality – S) and identity (hedonic quality – I). All scales range from -3 (as lowest rating) to +3. Generally speaking, a rating of 0 is a neutral rating and every rating above 0 represents a positive rating – the higher the better. Pragmatic quality describes the usability of the product and how easy users achieve their goals with the product. Hedonic quality stimulation describes the extent to which users feel stimulated by the product and see it as novel, interesting and innovative. Hedonic quality identification indicates to what extent the product allows the user to identify with it. The global dimension called "attractiveness" describes the (subjective) global value of the product. The dimensions of hedonic and pragmatic quality contribute equally to this overall scale.

6.1.1 Participants and BlackBerry Devices

All in all, 20 participants (10 female, 10 male) between 21 and 45 years old took part in the study. Half of the sample were business mobile phone users, meaning that they had a "business tariff", and the other half had a "private tariff". For the study, we cooperated with the national mobile phone provider A1 Telekom Austria AG. For recruiting, A1 provided us with selected contacts from business and private users. Based on these contacts, the 20 participants were recruited directly via email. Non of the participants owned a BlackBerry. A1 also supplied us with 20 SIM cards and took over telephone and data costs during the eight-week ESM study. The other cooperation partner, Research In Motion (RIM), provided 20 new BlackBerry mobile devices (including packaging and accessories): 10 BlackBerry 8800 and 10 BlackBerry 8100 Pearl devices. These models differ from each other most notably in their size and keyboard. The 8800 model (see Figure 6.1(a) on the next page) is larger and equipped

with a QWERTY keyboard, whereas the 8100 Pearl (see Figure 6.1(b)) is smaller and has the BlackBerry proprietary SureType keyboard.

(a)   (b)

Figure 6.1: (a) BlackBerry 8800 with larger screen and QWERTY keyboard; (b) BlackBerry 8100 Pearl with smaller screen and SureType keyboard

Summed up, participants were evenly distributed concerning gender, BlackBerry type and usage type (see Table 6.2). As incentives, we used $60 \in$ as payment at the end of the study and a cinema voucher in the middle of the study. Furthermore, there were no data transfer and call charges within the limits of a fair-use model. Additionally, 4 of the 20 BlackBerry devices were drawn in a lottery among all participants at the end of the study.

20 participants							
10 x 8800 users				10 x 8100 users			
5 business users		5 private users		5 business users		5 private users	
3m	2f	1m	4f	3m	2f	3m	2f

Table 6.2: Even distribution of participants regarding gender (10 female / 10 male), usage type (10 business / 10 private users), and BlackBerry model (10x 8100 / 10x 8800)

6.1.2 Procedure

In the following paragraphs, the procedures of the workshop, the field study and the post-interviews are described.

Initial workshop

At the beginning of the study, we conducted four workshops (with 5 participants each) in order to hand over the devices. During these workshops we evaluated first impressions of the BlackBerry devices (visceral level). The workshops took approximately two hours and were held at the evening to enable business participants to take part.

In the course of the workshops, participants were welcomed and given a short overview of the study and a data privacy policy. We indicated that we would not abuse their data (logging data, contacts etc.) or report any data on individual level in any other way than anonymously. We handed participants questionnaires to collect socio-demographic data and data concerning their usage and attitudes of their personal mobile devices including the FeatMo questionnaire with their personal device as the target object (see Figures D.1-D.3 in Appendix D). Afterwards, participants were given the BlackBerry devices (in the original box) including a new SIM card, holster, power supply unit, headset and instruction manual, and told to go through the BlackBerry setup wizard[1] individually. If any questions occurred, researchers would give advice and help participants to finish the wizard.

Thereafter, we asked participants to type and send a pre-defined message to one of our mobile devices and clocked them. The text which had to be entered is a German nursery rhyme:

Ene' mene Tintenfass,
geh in die Schul und lerne was.
Lerne aber nicht zu viel -
denn du bist jetzt am Spiel!

This text includes 106 characters with spaces including capital and small intial letters, as well as special characters. This was, on one hand, to give participants the opportunity to have first contact with the (for most participants) new type of keyboard and, on the other hand, to get a baseline in order to assess the improvement in handling the keyboard as we repeated the same task at the end in the final interview (see below). Then we made a short break. Participants were free to explore their BlackBerry on their own and gain first individual experiences.

After the break, we handed participants the AttrakDiff to measure participants' UX and first impression (see Figure D.4). Meanwhile, we transferred the personal data

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[1]When starting a new BlackBerry for the first time the user has to go through an initial setup wizard. This includes entering information (e.g., language, date, time, email) as well as an introduction how to operate the device (e.g., keyboard handling).

(e.g., contacts, dates) from the participants' personal device to a computer and later from the computer on their new BlackBerry. Finally, we conducted a guided group discussion concerning general questions toward experience and important aspects of mobile devices for users. In addition, participants were equipped with diaries in which they were asked to write comments whenever they had a positive or negative experience with the BlackBerry. At the end of the workshop, we gave advice how to forward their calls and emails to the BlackBerry in order to give participants the opportunity to fully use their new devices from that point in time. After the workshop ended, the field study began.

Field study

For the eight-week field study, we used contextual and behavior driven experience sampling based on the Maestro approach. We decided to combine aspects of time- and event-triggered ESM; meaning, we posed questions when a special event occurred (e.g., an email was sent) or at a given time, if no triggering event has occurred. Participants were prompted three times a day to answer a set of questions (experience sampling forms – ESFs). When prompted, participants were alerted through sound and vibration. After the alert participants had 30 seconds to start answering the ESF. After this time period the ESF expired and a new one was sent later on. Samples occurred in the time spans from 9:00 am to 12:00 noon, 12:00 noon to 4:00 pm and 4:00 pm to 8:00 pm. Typically, each ESF consisted of questions in relation to the occurred event. If no event occurred during these time-slots, shortly before the end of each period a 'save-sample' was sent which consisted of general questions concerning UX and mobile attachment. ESFs consisted of approximately five to seven questions with possible branches. This means that the question could be based on the answer of a previous question, thus allowing us the possibility to pose additional theoretically interesting questions and so gaining more extensive information. A detailed description of the technical setup of Maestro as used in this study is explained in Chapter 4.3.4.

During the study, we periodically checked if events were logged and ESFs answered. If participants did not answer ESFs for more than three days we called the participant to check whether a technical problem had occurred (e.g., no ESF was delivered) or the participant was too busy to answer questions. After four weeks we sent a letter to each participant and conducted a short structured telephone interview. The reason for this was to ask participants if the study went fine or if problems occurred and whether they already experienced special events with their BlackBerry. After the interview we sent

a sent a cinema voucher to each participant in order to motivate them to actively take part in the study.

Post-interview

After eight weeks, participants were interviewed in semi-structured individual sessions (see Figure D.5–D.6 for the post-interview guideline). In these sessions, which lasted for approximately one and a half hours, participants returned the BlackBerry and the diaries, filled out some questionnaires and were asked a set of predefined questions. Questionnaires included again the AttrakDiff, which also had to be answered during the initial workshop (see Figure D.4), the FeatMo questionnaire with the BlackBerry as target object (see Figure D.7) and the previously mentioned BFI-10 for measuring personality traits. The interview included mobile attachment related questions (e.g., "Did you give the BlackBerry a name?") and method related questions (e.g., "How large was the effort to answer questions during the study?"). Additionally, participant had to text the before mentioned German nursery rhyme for a second time. This allowed us to measure learning effects. Finally, data which was stored on the BlackBerry (e.g., new contacts) were transfered to the participant's personal mobile phone and participants were paid 60 €. After all post-interviews had been conducted four BlackBerry devices were drawn in a lottery among all participants and sent to the winners.

6.2 BlackBerry Study Results

In the following paragraphs, results from the BlackBerry study will be presented. After providing information on sample and event distribution within the ESM study, usability and UX related results will be presented. Finally mobile attachment related results are discussed. These results will highlight differences between private and business, as well as BlackBerry 8100 and 8800 users.

6.2.1 Experience Sample and Event Distribution

During the eight weeks, all in all, 127,255 events were recorded where 45,800 of these events were 'heartbeats'[2] from the Maestro client. In 10,262 cases a question of our ESF has been answered. We recorded 18,120 times that the backlight of the BlackBerry was switched on and 10,211 times a call has been ended (parameters in the

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[2]Approximately every 30 minutes the Maestro client sent a ping to the server to signal that it is turned on. This ping was also used to send a 'save-sample' if needed.

Maestro protocol give insights about what has occurred during call: who has ended, who called, was call held, etc.). Other often occurring events were that the BlackBerry was taken out of holster (5,145 times), the keyboard was unlocked (4,194 times), an email was received (4,186 times), the keyboard was locked (4,155 times), an application was started (3,180 times), or a call was rejected or not taken (2,838 times). Most predefined events occurred several times. Only six events had no sample at all. Nevertheless, the distribution of event types is not equal, which lead to a different number of posed and answered samples. The ratio between 'occurred event type' and 'posed sample' ranged from 22% to 0.1%.

Events were not evenly distributed over time. We noted a significant drop of events (and answered samples) on weekends. This can be explained by the fact, that half of our participants used their device mainly (and partly solely) as business device. Therefore, they simply did not use the BlackBerry on weekends. When comparing private and business users, we realized the drop was only apparent for business users. While business users' usage was cyclic and dynamic, private users' usage seemed more constant over time. The number of events did not differ between private and business users (private: 40,710 vs. business: 41,238). Interestingly, this tendency also showed on the individual events level. Almost no events were primarily triggered from business or private users. A deeper analysis showed that event timelines often were heterogeneously within groups and pattern changes were also observable within persons. Individual participants did change average dramatically and, therefore, minimized group differences. Overall, the amount of events seemed to diminish over time which can possibly be explained by failing motivation of participants towards the end of the study.

All in all, 2,015 ESFs were received, 1,263 were '(re)active samples' containing contextual as a reaction to a specific event and 752 were 'save samples' with general questions. In the first half of the study, received ESFs were not evenly distributed between users because business male users answered significantly more questions than others. These differences were caused by a relatively complex ESM setup (see also 4.3.4). ESF were sent only when certain preconditions occurred. These could either be general preconditions (e.g., only one sample between 9 am to 12 noon) or preconditions dependent on the last time the same event has triggered a sample. For example, the trigger "smsReceived@2daysbetween_2" would only prompt an ESF, when an SMS is received on the mobile phone and all general preconditions are met. In addition, at least 2 days have to be passed since the event "SMS received" has triggered a sample last time. For each event, we have defined multiple ESFs which means differ-

ent questions in order to gain more information – this is symbolized by the "_2"at the end of the trigger.

A clustering of different events into categories brought the following results[3]: 52.27% system related events, 24.22% calls, 12.69% messages (email and SMS), 4.99% applications (e.g., options, games, media player), 3.03% personalization, 2.80% PDA (e.g., alarm, calendar, contacts). System related events included "backlight on", the usage of the holster and the keyboard lock, as well as the usage of the USB cable. The data allowed us to distinguish between mainly 'holster users' (5 participants), mainly 'keyboard lock users' (9 participants) and those who used both system equally (6 participants)[4]. Half of the users tried out both possibilities in the beginning but sticked to one possibility towards the end of the study. Interestingly, fewer females used the holster. The reason for this was mainly because they regarded the holster as not feminine enough, as stated in post-interviews. Another user stated that he uses the holster at home but not at work because it is "not presentable". Other users did not use the holster because of practical reasons (e.g., use of a headset, inability to see who is calling at the first glance). These findings indicate that the appearance of mobile phones is highly important for some users, indicating that it should be representative, whereas others often act for practical reasons.

6.2.2 Usability and UX Related Results

At the begin of the study (i.e. during the initial workshop), participants stated that they were confident to master the device soon, although the BlackBerry was new to them. After eight weeks, at the end of the study, almost all users said that they all felt quite sure about the keyboard and had mastered the device in a short time. This subjective mastery was not backed up by objective measure. Some users, for instance, did not know how to write an SMS, other users had difficulties to switch between input modalities (i.e. (de)activating SureType), whereas again others searched the keyboard for single symbols (e.g., the @ symbol).

To assess learnability of keyboard mastery and to evaluate differences concerning efficient keyboard usage between the BlackBerry 8100 and 8800, we utilized the previously mentioned German nursery rhyme. As stated before, participants texted this

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[3]Events, which were study-designed (e.g., 'heartbeat' or Maestro client restarted) or malfunctioning (e.g., alarm test) or simply not interesting for our purposes (e.g., languageChanged) were dropped in this categorization.)

[4]The keyboard could either be locked manually by a keystroke combination or by putting the device into a holster which activated the keylock automatically.

standardized number of characters at the beginning and at the end of the study. The difference in time between beginning and end was computed and used to assess the participants' improvement of keyboard mastery. Aside from the time, the number of errors were notes as well. Since almost no errors were made, no differences could be identified. Regarding time, not surprisingly, a significant difference between the BlackBerry 8800 (with a QUERTY keyboard) and the BlackBerry 8100 (with the SureType system) could be observed. At the beginning of the study, it took for 8800 users on average 200.1 seconds (SD=77.76) to type in the nursery rhyme and for 8100 users 342.1 seconds (SD=93.22). After eight weeks it took on average 103.8 seconds (SD=23.68) for 8800 users and 218.4 seconds (SD=58.97), which signifies that participants improved significantly over time with both devices. Surprisingly 8100 users did not improve significantly more than 8800 users.

We then calculated which variables could serve as a predictor for efficient use of keyboard. The results show that keyboard efficiency after eight weeks of study was best explained by the efficiency at the beginning (β=.529) combined with the BlackBerry type (β.408) and gender of the participant (β=.199). All together the explained variance adds up to (adjusted) R^2=.836. Other variables as for example number of SMS or email sent during the study did not improve the prediction.

Regarding UX, we asked participants to fill out the AttrakDiff questionnaire at the beginning and the end of the study. Both devices, in general, were rated above average. The mean scores for the 8800 and 8100 devices are given in Figure 6.2 on the facing page. Although the BlackBerry 8100's ratings were almost in every aspect higher, the findings must be interpreted cautiously. The big error bars give evidence of the usually quite big deviation of the individual participants' rating. This imprecision is caused by the relative small sample size and the quite heterogeneous group (which was part of the study design). This could be also the reason why there was no statistically significant difference found between male and female users.

When looking at UX over time, we found a significant difference between private and business users. Business users stated low pragmatic quality at first sight. During the study they seemed to become more apt at using BlackBerry and rated pragmatic quality better at the end of the study. Regarding hedonic quality, private users' assessment deteriorated over time, whereas business users' ratings remained at same level. Concerning the overall attractiveness of the BlackBerry devices, we found an interesting tendency over time. The attractiveness for private users decreased and the attractiveness for business users increased. Possible explanations for this effect could

	pragmatic quality	hedonic quality - I	hedonic quality - S	attractiveness	hedonic quality
8800	-0.23	1.11	0.96	0.81	1.04
8100	0.34	1.59	1.50	1.44	1.54
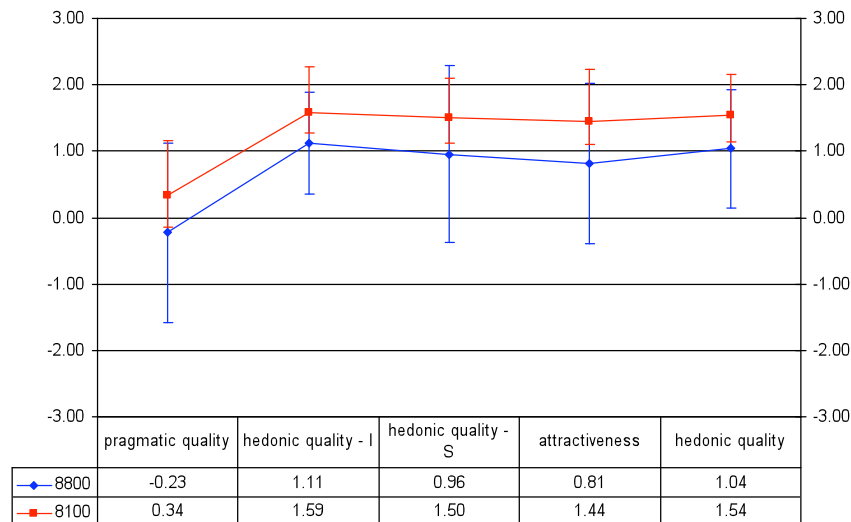
Figure 6.2: Graphical illustration of AttrakDiff factors' mean scores of the 8800 and 8100 BlackBerry with error bars

be that business users are skeptical in the beginning and can take advantages of full features only after time, but then are satisfied. Private users were especially excited because of brand and the opportunity which would not have been present without the study. This effect wore off along the study.

6.2.3 Mobile Attachment Results

As described previously, the FeatMo questionnaire was answered by all participants twice: during the initial workshop at the beginning of the study with their personal device as target object and as part of the post-interview at the end of the study with the BlackBerry as target object. Figure 6.3 on the next page illustrates results of these questionnaires split into the different factors of the FeatMo: likeability, importance, symbolism, personalization, and emotional valence, as well as the direct question. As can be seen in the Figure, there was almost no difference for the factors likeability, symbolism, personalization and emotional valence. Differences were found for importance and for the direct question regarding emotional attachment. The following paragraphs present results for each factor based not only on the illustrated results from the FeatMo questionnaire but also on the other used methods.

   As can be seen the likeability of the participants' personal device and the Black-Berry did not differ. Participants in our study seem to like their own mobile device and also the BlackBerry after eight weeks of using it. This matches the results from
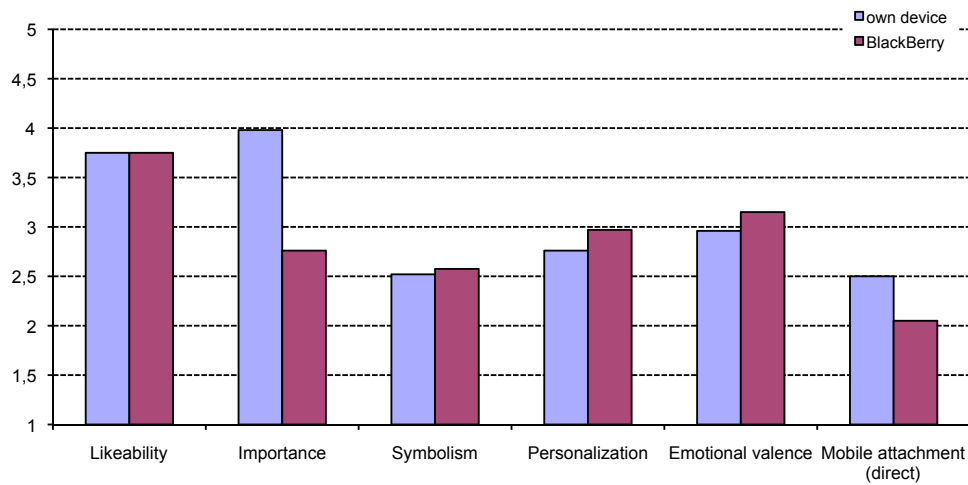
Figure 6.3: Mean FeatMo values for the personal device at the beginning of the study and the BlackBerry at the end of the study (1=low value, 5=high value)

the AttrakDiff questionnaire regarding hedonic quality. Qualitative data suggests that the BlackBerry was liked because of its appearance. One participant reported: "My children call the device 'Black Beauty'! They loved to play games on the BlackBerry."

Regarding the factor importance, the pilot mobile attachment study (see Chapter 5) has revealed that the mobile device itself is not seen as very important but the services provided by the device are necessary (e.g., to be reachable and reach others persons). We, therefore, divide perceived importance into the following two sub-dimensions: importance of services and importance of the device. Within the ESM study, we asked participants how important services were in various situations. Answers had to be given on a five-point Likert scale (from 1="very unimportant" to 5="very important"). Due to the previously described ESM setup the number of answers to different questions varies. In general the importance of most services were rated high. The alarm application (n=23, mean=4.74, SD=0.45) and the email push functionality (n=31, mean=4.19, SD=0.54) were rated especially high. Interestingly the email send functionality (n=17, mean=3.29, SD=0.77) was rated very below other services like SMS (n=17, mean=3.88, SD=0.93) and the general access to emails (n=43, mean=3.60, SD=0.82). This might be due to the fact that users complained about too small keys. Another reason could be that most business users did not reply emails back because their usual email address would not appear in the address field (all users got a new email address for the time of the study). In addition, specific properties of a mobile device were seen as highly important, such as, having access to contacts

(n=24, mean=4.71, SD=0.46) or a good battery capacity (n=44, mean=4.93, SD=0.25). The importance of the BlackBerry in general (n=129, mean=3.57, SD=1.02) was rated lower than to be available all the time (n=88, mean=4.47, SD=0.57) and to be reachable for a certain person (n=125, mean=4.14, SD=0.95).

The high rated importance during the ESM study could not be reproduced at the end of the study. Figure 6.3 illustrates that there is a notable difference in the perceived importance between the personal device and the BlackBerry. This might be influenced by the fact that the personal device was assumed to be very importance for daily life since it was the only device at this point in time. During the study, the BlackBerry was not the only device; participants could also use their own personal mobile phone. Although the importance of the BlackBerry was rated low on the FeatMo scale at the end of the study, it was rated higher during the ESM study, as outlined previously, indicating that while interacting with BlackBerry (in ESM), services and device form one whole experience and users do not split into components. This assumption is strengthened by the telephone interview during the study, where participants mainly mentioned the possibility to receive emails and look up things on the Internet to be very important with the BlackBerry. When asked during the initial workshop and the final interview why the mobile device is important, business users stated that they need to keep in contact with the office and customers while traveling. Private users mentioned the desire to reach others (e.g., family, friends). Furthermore, each person gave individual reasons why a mobile device (and its services) is most important to them (e.g., be available for (ill) grandparents, who are living in another state; possibility to help in case of emergencies while doing outdoor sports). Among these statements were no reasons given concerning their device. The mobile device is seen only as a means to an end (be available). Nevertheless, some participants (business as well as private users) have a critical point of view; meaning for them, continuous availability is not desirable. They question whether a mobile device is more 'blessing or curse'. They do not question the importance, but fear of the consequence of 'total availability' in business as well in private context.

The factor symbolism is rated lowest for all five emotional attachment factors – both for the personal device and the BlackBerry (see Figure 6.3). Interestingly, single participants had a considerable higher rating on this factor. These participants reported remarkable life episodes. One (male) participant stated: "At the gas station I was checking my emails and a stranger asked me about this device" The participant answered: "The email functionality and so on is great ...I like it." Another (female) participant mentioned: "At a meeting my colleagues usually place their mobile device

on the table. I did the same with my BlackBerry and they put theirs back into their pockets. I had the feeling that now I was 'technically' accepted – especially from men in the IT sector."

The factor personalization was rated for both the own mobile phone, as well as the BlackBerry slightly negative (see Figure 6.3). In general two different kinds of personalization could be differed. 'Functional personalization' allows users to change certain functions to their convenience (e.g., the assignment of hot keys or profiles) with the goal to make the device be more usable and faster to operate. 'Aesthetic personalization' allows users to change audio-visual aspects of their device (e.g., ringtones, covers) with the aim to make the device more beautiful and unique for the user. With respect to functional personalization, most users (18 out of 20) stated in the post-interview that this is very important to them and that they use shortcuts on their personal device. Nevertheless, only four participants found out that shortcuts existed (i.e. could be changed) on the BlackBerry and one among those could not change the shortcut to his convenience. Many users customized the main menu (i.e. they changed the sequence of icons and let only icons show which they needed regularly), which points out that functional personalization is important. Aesthetic personalization could be either achieved 'outside' the device (e.g., covers, ornaments) or 'inside' the device (e.g., ringtones, wallpapers, themes). Since the BlackBerry provided hardly any possibilities to be changed during the study (e.g., no exchangeable covers), we focused on inside personalization.

Altogether, participants have downloaded 495 files (51.92% ringtones, 14.34% games, 14.14% applications[5], 10.91% wallpapers, 8.69% themes), which means on average 24 personalizations. Every user stated that he or she personalized the Black-Berry the extend to which differed among participants. When personalizing the background image of the BlackBerry often emotional content was used (see Figure 6.4 on the facing page). Concerning personalization over time, it has been revealed that participants intensely customized their BlackBerry at the beginning of the study which ebbed away towards the end. This was also confirmed in the interviews after the study. Most participants choose ringtones and wallpapers at the beginning and experiment with them (try them out) before they decide on their favorites.

The factor emotional valence was rated rather neutral for both the personal device and the BlackBerry (see Figure 6.3). Again, the ESM data and interviews showed higher values for this factor. Users expressed positive attitudes which are strongly

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[5]Here it has to be mentioned that the study took place before the success of Apple's app store success story and the download of additional applications was not very common at this time.
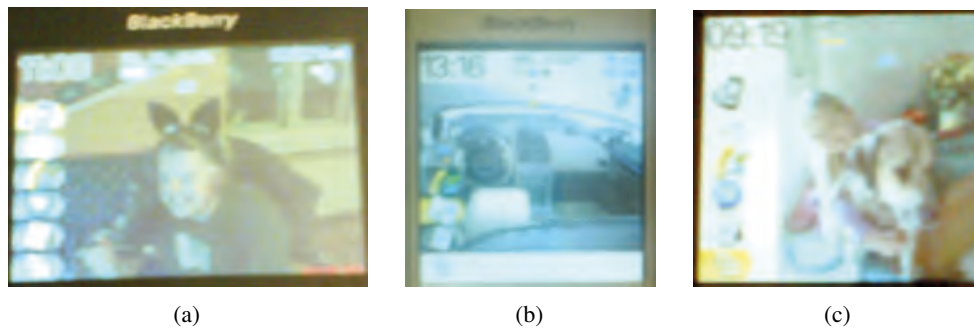
Figure 6.4: Examples of wallpapers and theme utilization; emotional content was often used: (a) boy friend, (b) old timer, (c) child with dog

connected to the device's functionality and empowerment. Some participants gained emotional memories with the BlackBerry through using it in emotional moments. One user's baby was born during the study. He received congratulation text messages and emails on his BlackBerry, henceforth, positive feelings towards the device arose. Another participant used her BlackBerry to get information about train arrivals while hiking, so her family could reach their train by time. Again positive emotions were ascribed to the BlackBerry. Analyzing emotional valence for differences between genders, we found that males and females did not express different amount of emotion. This is interesting as, in literature, it is often found that women are normally more emotionally expressive (Kring and Gordon, 1998).

As can be seen in Figure 6.3, the direct question regarding mobile attachment was rated rather low for both the personal mobile phones as well as the BlackBerry, whereas the BlackBerry was rated even lower. Similar to the pilot mobile attachment study, interviews revealed that the devices were often seen as nothing 'special' or 'solely a technical artifact' which can be exchanged easily. Nevertheless, a certain dependency and mobile attachment towards services is evident. Regarding personality traits measured with the BFI-10 questionnaire, we found that low agreeableness leads to higher emotional valence and attachment reported in interview (i.e. participants who had low agreeableness had the courage to admit an emotional attachment). A possible explanation for this tendency could be that attachment toward the device seems to be extraordinary in society and, therefore, high social desirability leads to suppression of feeling as it is not socially accepted.

When looking at the correlation between the different FeatMo factors and the direct question, we found the highest correlation between symbolism, importance, and emo-

tional valence withe the direct question. Thus, people who see their mobile device as a symbol (i.e. more than a technical, exchangeable device), perceive it as important for life, and have emotional feelings and memories with the device admit a bond openly.

6.3 BlackBerry Study Findings

Overall, these results testify that participants in our study did not experience a strong mobile attachment to their personal mobile device nor to the BlackBerry in the sense of "I feel attached to my BlackBerry 8800 and only this. Even if I would buy another BlackBerry 8800 – it would not be the same." Especially the BlackBerry was not seen as an irreplaceable part of the owner. What is irreplaceable are the services coming along with the device (e.g., being reachable) and the memories stored on the device (e.g., text messages, pictures). These findings could be an effect of the study setup. The fact that participants neither chose the BlackBerry for themselves nor would they own it for more than the eight weeks could have prevented the emergence of a strong mobile attachment. Nevertheless, participants did not express an emotional attachment to their personal devices either. Possible reasons for this could be that the device's value is considered low since providers offer some mobile devices for free and that the device could easily be replaced. Above this, modern mobile phones are outdated rather soon since almost every year a successor is presented. Some participants even mentioned that they believe that mobile phones are produced to work only for a limited lifetime. After this time either the battery is broken or the device is out of order.

Nevertheless, an emotional attachment to the device and especially to services do exist in an unconscious way. The study showed that this tie could be strengthened when the device is capable of eliciting emotions within users. Thus, emotional content and memories on the device are a powerful tool to enhance emotional attachment. In addition to that, the results suggest that symbolism especially is a relevant factor for mobile attachment. Since the main reason for not being attached to the mobile device is the perceived replaceability of the device a higher attachment could be achieved by allowing participants to make an unique device. Personalizing the device could make it more difficult to exchange as although there would be the same model of device to buy, it would not be the same. Another way to strengthen mobile attachment could be to promote the mobile phone from 'just a technical device' to a companion in daily life. This could be achieved by more natural dialogues with the mobile phone and providing the possibility to give the device a unique name.

Next to findings with regard to mobile attachment, methodical lessons have been learned. First, the triangulation of different methods have proven to be a promising approach to evaluate mobile attachment. Both the ESM study and the final interview have helped to get a deeper insight on the data gained from the FeatMo questionnaire. Second, the FeatMo questionnaire proved to be a valid measurement tool to assess mobile attachment. The procedure to evaluate mobile attachment in different dimensions allowed a differentiated reflection. Third, the use of Maestro provided insights on the dynamic nature of mobile attachment. The combination of data logging and short in-situ surveys were fruitful. The ESM setup to ask three times a day a sample of five to seven questions over eight weeks was perceived not to be too burdensome for participants.

Here it should be noted that the tool with which mobile attachment was assessed (the BlackBerry device) was also the target object for the attachment. Thus, the ESM study itself could have had an influence on mobile attachment to the BlackBerry. Above this, participants did not choose the BlackBerry themselves and most of them[6] were not allowed to keep the device after the study. This knowledge probably had an influence on the emergence of mobile attachment.

Chapter Summary

This chapter has presented an empirical field study to evaluate mobile attachment over time with new BlackBerry mobile devices. For an eight-week contextual and behavior driven ESM study, 20 participants (business and private users) were equipped with two types of BlackBerry mobile phones. The use of a method triangulation (workshop, ESM study, interviews, questionnaires) revealed that participants did not explicitly express a strong emotional attachment to the new BlackBerry devices. Mobile attachment rather exists in an unconscious way, mainly to services offered by the device than the device itself. The study showed that participants liked the BlackBerry and perceive the ownership of a mobile phone as important for their lives. Nevertheless, they did not ascribe the BlackBerry a symbolic meaning. For a strong mobile attachment, it seems to be of utmost importance that the mobile phone bears a symbolic meaning for the owner.

The study addresses RG6 by strengthening the understanding of mobile attachment and utilizing the FeatMo questionnaire as well as the Maestro concept. It informed

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[6]At the end of the study four BlackBerry devices were drawn in a lottery among participants.

the construction of the conceptual and temporal mobile attachment model. In the next chapter, a study on mobile attachment to MP3 players is presented.

Empirical Study 3: MP3 Player Attachment Study

The last two chapters approached RG6 by addressing the topic of mobile attachment with mobile phones as target objects. This chapter focuses on emotional attachment to MP3 players, henceforth called *MP3 player attachment*. MP3 player attachment can be seen as a special case of mobile attachment. Similar to mobile phones MP3 players are devices which accompany people in their everyday life and which could be personalized to fit the users needs and desires. MP3 players might be seen as even more personal objects than mobile phones, since it is the purpose of an MP3 player to store favorite music. Therefore, it can be argued that emotional attachment develops not only for mobile phones but for MP3 players as well.

This chapter presents an MP3 player attachment study (in the following referred to as "MP3 player study"). The aim of the study was to investigate, whether people are emotionally attached to their MP3 player or not. Furthermore, differences concerning device brands and ownership duration were evaluated. Investigating these aspects could give insights if the extent of emotional attachment is brand dependent and if this influences MP3 player usage and ownership. A longer ownership duration could contribute to more sustainability in HCI. Contrary to the pilot mobile attachment study and the BlackBerry attachment study the focus of this study laid solely in the reflective level. The results of this study contribute to RG6 to strengthen the understanding of mobile attachment. Additionally, the study provides a validation of an MP3 player adapted version of the FeatMo questionnaire.

7.1 MP3 Player Study Setup

We set up an online survey based on the FeatMo questionnaire and additional questions in order to understand MP3 player attachment, and if this affects the usage frequency and ownership duration. We had three research questions for this survey. Foremost, we wanted to know if people feel attached to their MP3 player and which factors are dominantly relevant for this attachment (MP3-RQ1). Second, we were curious if a correlation can be found between different brands and the strength of MP3 player attachment (MP3-RQ2). Finally, the correlation between the strength of MP3 player attachment and usage frequency and ownership duration was assessed (MP3-RQ3).

To measure emotional attachment to MP3 players, we adapted the FeatMo questionnaire presented in Chapter 4.2. The adaption was necessary as some items regarding personalization were not identically usable for MP3 player. Again, the five factors for MP3 player attachment covered within the questionnaire were: likeability, emotional valence, importance, symbolism, and personalization. Table 7.1 shows sample items and the corresponding factors. Additionally, one question was included directly asking participants on their emotional attachment to their MP3 player. All questionnaire items and their corresponding factors are given in Table E.1 in Appendix E.

Item[a]	Factor[b]
My MP3 player is beautiful.	L
I have positive memories holding my MP3 player for the first time.	EV
My MP3 player is not important for me. (reversed score)	I
I invest much time and energy to make my MP3 player inimitable.	P
My MP3 player has no special meaning to me. (reversed score)	S
My MP3 player is always with me.	I
If I would lose my MP3 player, I would feel sorry.	EV
My MP3 player is a status symbol for me.	S
I like my MP3 player.	L
I have personalized my MP3 player (e.g., new cover, ear phones).	P

Table 7.1: Sample items from the MP3 FeatMo questionnaire

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[a]As the whole survey was conducted in Austria, the statements used in this table are translated from German into English.

[b]L: likeability; I: importance; P: personalization; S: symbolism; EV: emotional valence

For the purpose of distribution, an online survey (created with LimeSurvey[1]) was set-up and sent out via various email lists to reach a broad target group. The online survey included the MP3 FeatMo questionnaire, demographic questions, and additional

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[1]www.limesurvey.com

questions regarding MP3 player brand, ownership duration, and usage frequency. Answers for the MP3 FeatMo questionnaire had to be given on a five-point Likert scale from 1="absolutely disagree" to 5="absolutely agree".

7.2 MP3 Player Study Results

A total of 156 participants (68 female, 86 male, 2 no answer) took part in the online survey. Participants were, on average, 26.21 years old (SD=6.35) ranging from 15 to 66 years. Users taking part in the study owned between one and five MP3 players (mean=1.86, SD=1.04). Participants got their first MP3 player between the years 1998 to 2008[2]. The currently owned MP3 player was on average used since 2006 (median).

When asked if participants were planing to replace their current MP3 player with a new one, 79.63% of participants denied this, 16.05% planned to exchange their MP3 player, and 4.32% gave no answer. Those participants who planned to replace their current MP3 player would do this within the next month (8.33%), in the next 1 to 6 months (20.82%), in 6 to 12 months (45.83%), in 1 to 3 years (20.82%), or later (4.167%). When asked why people would exchange the current MP3 player with a new one, participants gave the following (predefined) answers (n=50): up-to-date model (30%), more functionality (22%), more storage capacity (18%), dissatisfaction with current MP3 player (12%), other reasons (18%). Interestingly, none of the participants stated that he or she would exchange the MP3 player because of a different brand.

We also asked participants how likely it is for them to exchange their device and how likely it is they repair their MP3 player with a new one in case the current one gets broken. Answers to these two questions had to be given on a five-point Likert scale from 1="very unlikely" to 5="very likely". Out of the 156 participants 129 participants answered these two questions. For 74.42% of the participants, it is likely to exchange their MP3 player with a new one in case of a defect (56.59% "very likely", 17.83% likely) and for 15.5%, this is unlikely (10.85% "very unlikely", 4.65% 'unlikely"). Regarding the question if people would repair their MP3 player, 26.35% stated that this would be likely (16.28% "very likely", 10.08% "likely"), whereas for most participants (in aggregation 61.24%) it is unlikely to repair their MP3 player (41.86% "very unlikely", 19.38% 'unlikely").

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[2]The study was conducted in November 2008.

MP3 FeatMo Factor Analysis

To analyze the scores for the five factors of the MP3 FeatMo questionnaire Cronbach's Alpha was calculated to check for the internal consistency. In psychology, an alpha of 0.7 and higher is considered acceptable (Decoster and Claypool, 2004). The five factors were formed by summative joining the scores for the questions that represented it. As Table 7.2 shows, the scores on the factors for symbolism and personalization were slightly under 0.7, however all factors were taken into account for answering the research questions.

Factor	Cronbach's Alpha
Likeability	0.727
Symbolism	0.671
Emotional valence	0.761
Importance	0.815
Personalization	0.650

Table 7.2: Factor reliability

Next, correlations within factors and between each factor and the direct question ("Do you feel emotionally attached to your MP3 player?") were analyzed. Table 7.3 shows that the correlation between all influence factors and the direct question are strong and highly significant. This proves our assumption that likeability, symbolism, emotional valence, importance, and personalization are influencing the emotional attachment. Strong correlations between each factor also show the interplay between them. The highest correlations can be found between symbolism and the direct question, as well as between emotional valence and the direct question.

	L	S	EV	I	P	DQ
L	1					
S	.566**	1				
EV	.624**	.680**	1			
I	.374**	.571**	.664**	1		
P	.422**	.597**	.547**	.482**	1	
DQ	.481**	.715**	.716**	.645**	.498**	1

Table 7.3: Pearson's Correlation for the factors and the direct question (DQ)

** Correlation is significant at the 0.01 level (2-tailed)

In the following, we computed an overall scale, the Emotional Attachment Scale (EA Scale), including all factors. The EA Scale can be assumed as an overall attachment scale regardless of particular factors. It represents the strength of MP3 player

attachment. Table 7.4 shows the correlation between the factors and the EA Scale. The highest correlations with the EA Scale have the factors symbolism and emotional valence.

Factor	EA Scale
Likeability	0.694**
Symbolism	0.858**
Emotional valence	0.884**
Importance	0.780**
Personalization	0.774**

Table 7.4: Pearson's Correlation for the factors and the EA Scale

** Correlation is significant at the 0.01 level (2-tailed)

MP3 Player Attachment

Based on the previously mentioned methodical considerations, we analyzed the gathered data material regarding MP3 player attachment. In general, participants rated their emotional attachment to their MP3 player rather low in the direct question (mean=2.77, SD=0.65) as well as on the EA Scale (mean=1.99, SD=1.22). To descriptively analyze the data for each factor (likeability, emotional valence, importance, symbolism, and personalization) minimum, maximum and mean values were computed. Table 7.5 gives an overview of this analysis. It shows that the proposed influence factors for emotional attachment equaled a mean value between 2.20 and 2.87; meaning, that these factors are not ascribed to MP3 players by the survey participants. Only the factor likeability was rated high (mean=3.95, SD=0.64), indicating that likeability is the dominant factor for MP3 player attachment.

Factor	Min	Max	Mean	SD
L	1.83	5.00	3.9572	0.63770
S	1.00	4.33	2.2054	0.74712
EV	1.00	4.83	2.8719	0.81801
I	1.00	5.00	2.4751	0.91294
P	1.00	4.50	2.2810	0.93536

Table 7.5: Descriptive statistics for the factors

A more detailed analysis is possible when examining single items of the MP3 FeatMo questionnaire. Regarding the factor likability, participants particularly liked the music selection on their MP3 player (mean=4.56, SD=0.78) and that it is fun using it (mean=4.01, SD=0.92). Concerning symbolism, participants especially denied

that it is important to own an up-to-date MP3 player model (mean=1.47, SD=0.85) and that their MP3 player is a status symbol (mean=1.67, SD=0.96). With respect to the factor emotional valence, participants agreed they would feel sorry if their MP3 player gets lost (mean=3.68, SD=1.26) but denied to feel panic if the MP3 player is missing (mean=2.03, SD=1.17). Regarding importance, participants stated that their MP3 player is generally important to them (mean=3.64, SD=1.32), but it is not an important part of their self (mean=1.86, SD=1.16). Concerning personalization, participants stated that they did not individualize their MP3 player (mean=2.07, SD=1.34). Additionally, they denied to invest much money or energy to make their MP3 player inimitable (mean=1.60, SD=0.99).

Age and Gender Influences

We did not find any significant differences concerning the ratings for the independent variables age and gender, except one significant difference for the influence factor emotional valence (t=131, p=0.037), indicating that women rate the emotional valence of the MP3 player higher than men.

Brands and Attachment

As brand attachment and emotional attachment to objects are related concepts (Thomson et al., 2005), we analyzed if the brand of the MP3 player influences the strength of MP3 player attachment. Therefore, we asked participants to state the brand of their MP3 player and clustered the results into the following categories (n=156):

- Apple (48)
- Creative (16)
- Mobile phones (14)
- Sony (12)
- Philips (10)
- Samsung (9)
- others (47)

When investigating differences in participants' ratings regarding the emotional attachment because of the brand, an ANOVA showed significant results for the direct question (F=2.982, p=0.09), likeability (F=6.416, p=0.00), symbolism (F=3.546, p=0.003), and personalization (F=2.64, p=0.019). A Bonferroni post-hoc test revealed

that, in all cases, Apple was rated significantly better than the category others in terms of likeability, symbolism, and personalization. Apple was also rated higher than Philips regarding the direct question. It also revealed that Sony was rated significantly better in terms of likeability than the category others (see Table 7.6).

Factor	ANOVA F-value	POST-Hoc Bonferroni Mean Difference	
L	6.416, p 0.000	Apple vs. others	0.699, p 0.00
		Sony vs. others	0.722, p 0.43
S	3.546, p 0.003	Apple vs. others	0.636, p 0.01
P	2.640, p 0.019	Apple vs. others	0.622, p 0.02
DQ	2.982, p 0.09	Apple vs. Philips	1.400, p 0.02

Table 7.6: Bonferroni post-hoc test revealing relationships between brands for attachment factors

Ownership Duration and Usage Frequency

To investigate how the ownership duration influences the emotional attachment, a correlation between the ownership duration, all influence factors, the direct question, and the EA Scale was conducted. The results show strong and significant direct correlations between the factors likeability and ownership duration, as well as emotional valence and ownership duration. This means that the longer a participant possessed his or her MP3 player, the higher these two factors were rated. Also, the factors symbolism, importance, and the overall EA Scale showed significant correlations with the ownership duration. However, no correlation could be found for the direct question and the ownership duration. Table 7.7 shows the Pearson's Correlation for all factors, the direct question, the EA Scale and ownership duration.

Factor	Ownership Duration	Usage Frequency
Likeability	0.388**	0.281**
Symbolism	0.215*	0.285**
Emotional valence	0.266**	0.282**
Importance	0.174*	0.530**
Personalization	0.159	0.319**
EA Scale	0.236*	0.389**
Direct Question	0.124	0.230 **

Table 7.7: Pearson's Correlation for each factor, the direct question, the EA Scale and ownership duration, as well as usage frequency

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** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

We also asked participants how frequently they use their MP3 player on a five-point scale (from 1=never to 5=daily) to investigate if the usage frequency influences MP3 player attachment. Results show strongest correlation for the influence factor importance: the higher the importance of the MP3 player is for a participant, the higher is the usage frequency. However, this kind of correlation could be found for all influence factors, as well as for the EA Scale and the direct question. Again, the revealed correlations can be seen in Table 7.7 on the preceding page.

7.3 MP3 Player Study Findings

Based on these results, the research questions formulated in Chapter 7.1 can be answered. Results for (MP3-RQ1) indicated that participants did not express a strong attachment to their MP3 players. Neither the direct question nor the overall EA Scale indicate that participants in the study had a strong MP3 player attachment. Regarding the five factors building the MP3 FeatMo scale (likeability, emotional valence, importance, symbolism, and personalization), only likeability was rated high. When analyzing the data more deeply, it can revealed that participants especially liked the music on their MP3 player, had fun using it and stated that it is generally important to them. Nevertheless, participants did not ascribe a symbolic meaning to their MP3 player (e.g., status symbol), nor do they perceive them as a part of their self. Although participants would feel sorry if they lose their MP3 players, they do neither associate positive nor negative emotions to them. With the exception of putting cherished songs onto their MP3 player, participants did not state that they personalized it in a special way.

Regarding the second research question (MP3-RQ2), we could identify difference in MP3 player attachment between different brands. Results show that these differences exist both regarding the functionality of the device and the status that is transported through the brand. Both concepts may play together in devices that offer functionality that is very unique for a certain brand or manufacturer (e g. click-wheel on Apple iPods).

The findings for (MP3-RQ3) show that, especially, likeability and emotional valence of the device influence the ownership duration; meaning, participants that rated those factors high were keeping their MP3 player significantly longer. Thus, it could be argued that a high emotional attachment increases the ownership duration of the MP3 player. A better understanding of people's emotions towards their personal belongings

might lead to the design of emotionally durable objects (Chapman, 2005). The emergence of new forms of sustainable design is necessary. The reduction of consumption and waste by increasing the durability of relationships established between users and products may be achieved. These findings can be the first building blocks to better understand how emotions influence the durability of the design of MP3 players and provide high level recommendations on how to influence the usage and the ownership frequency respectively duration.

Chapter Summary

This chapter reports the empirical results of an online survey on the extent to which users are emotionally attached to their MP3 player, utilizing an adapted version of the FeatMo questionnaire. It reveals that participants liked their MP3 player but are not strongly attached to them. Irrespective of age, gender and the probability of exchanging the device, participants rated the emotional attachment significantly different with respect to the brand, the ownership duration, and the usage frequency.

Together with Chapter 5 and 6, this chapter provides deeper insights in the substance of mobile attachment. It shows that a strong mobile attachment is capable of extending the life time of a product supporting sustainability in HCI. In the next chapter design implications to foster mobile attachment are presented.

CHAPTER VIII

Design Implications

In chapter 3.2, a conceptual mobile attachment model was presented. This model describes causes, influencing factors, and consequences for mobile attachment. Mobile attachment implicates a kind of mobile-self connectedness. Causes for mobile devices may result in emotional attachment when they provide meaning for the individual's self concept. The linkage between the self and the mobile device may be fostered via different routes (self empowerment, self enrichment, self gratification). Following this argument, mobile attachment may be achieved through the strategic design considerations of the functional, symbolic and hedonic meaning offered by the mobile device (see Chapter 3.2.1). This chapter addresses RG7 by elaborating design implications to facilitate the emergence of mobile attachment based on the conceptual mobile attachment model. For each part of the model design implications are given. Additional design implications were derived from related work and from findings of the three empirical field studies.

8.1 Design for Self Empowerment

Mobile devices which empower the self through their utilitarian functions may serve as a determinant for mobile attachment. This means that a designer who wants to facilitate mobile attachment via this route should design mobile devices capable of empowering the user to achieve mastery goals. Design implications which can be derived are design for utility as well as design for long-term usability.

Design for Utility

Contrary to many other loved possessions (e.g., a wedding ring), mobile devices (almost always) are not only symbols but have always a utilitarian meaning for the owner. Mobile devices and services are used and operated on a daily basis. As the empirical studies indicated, people are mainly attached to the services, which are perceived as irreplaceable for users. Thus, even a strong mobile attachment will vanish if a mobile device does not work properly. Reliability and trust should be, as a result, one of the most important design goals for mobile attachment. Another design requirement for contemporary mobile devices should be the possibility to expand functionality. If a person is strongly attached to his or her mobile device and perceives it as an extension of the self in a utilitarian way, new services provided by the mobile device will be perceived as an augmentation of personal powers.

This is even more true for mobile phone owners in the developing world. In these countries humans are often completely dependent on their mobile phone. It means literally everything for some people. The mobile device is their one and only computing resource and it is often needed to survive (e.g., to coordinate water transportation). Additionally, mobile phones are often shared in developing countries (Chavan and Gorney, 2008). Mobile design for this target group has to provide reliability and stability above all.

Design for Long-term Usability

Not surprisingly, good usability of a mobile device is a core element of mobile attachment. Since the mobile device is a tool for the owner used everyday, its ease-of-use is of high importance. This ease-of-use does not necessarily mean that complex interactions are not allowed, but participants should be able to learn to work efficiently with their mobile devices. Even though usability might not be an initial trigger for mobile attachment, the absence of usability will influence mobile attachment over time. Success and longevity are dependent on a positive interaction with the mobile device. Thus, long-term usability is important for mobile attachment. Attachment is not formed with overly complex and hard to use designs requiring excessive effort because they do not allow for a continual positive user experience (Klauser and Walker, 2007).

8.2 Design for Self Enrichment

Mobile attachment may be facilitated when the mobile device enriches the self by providing symbolic functions. These symbolic meanings may support the user in serving as a container for memories, in creating and maintaining an identity, as well as in protecting and enhancing the self concept. Based on different dimensions of the self (past self, private self, public self, collective self) the following design implications are conveyed.

Design for Memory

A strong enabler of mobile attachment is when the mobile device provides an autobiographical meaning to the owner. This may be achieved when the mobile device serves as a container for memories or is related to pleasurable memories of past user experiences. In the former case, the mobile device should be capable of storing memories (e.g., old text messages, pictures, videos). A concrete example how ICTs can be used as reminders of one's past was suggested by Lindström et al. (2006). Their affective diary system provides a possible to mirror bodily experiences so that the design allows interpretation, empowerment and a diary-like experience. Transfered to mobile devices diary applications could serve as a promoter for mobile attachment.

The latter case may be achieved through the design of particular user experiences. As an example, the out-of-the-box experience could be designed to evoke pleasure and pride. The mobile device could actively serve as a reminder of this day. The boxes in which Apple's iPods, iPhones and iPads are sold are not only a container for these products but for a well-designed user experience. Blythe and Cairns (2009) have reported that hundreds of people have uploaded their videos on YouTube of 'unboxing' their iPhone for the first time showing the special moment of this process for the owners. It should not be a mere opening of a box but a very special moment for the user. The out-of-the-box experience becomes a special event fostering the bond between the user and the product. Another example can be found when looking at the automotive industry. Car buyers are often offered the possibility to pick up the new car from factory. The car is presented in a pleasing ambience and the customer is the first person who drives the new car which was produced exclusively for him or her. The pick up of a mobile device directly from factory might not be suitable, but making the out-of-the-box experience a special moment is a worthwhile consideration. In this phase, also personalization processes could be designed to tighten the binding between the user

and the mobile device. The date on which the mobile device was touched for the fist time could be highlighted and celebrated.

Design for Self-Image

While design for memory targets at the past self, design for self-image aims the present and future self. To enrich the private self, mobile device should be able to reflect the owner's identity or help to define the self. This could be achieved by either representing the owner's self perception or by symbolizing the owner's desired identity. In doing so, user characteristics have to be taken into account. For women, who want to express their personality with their mobile device, a feminine design could be appropriate; whereas for men, the mobile device might have to reflect a masculine image. Since user characteristics are very heterogeneous a possible solution is to design mobile devices which can be easily personalized. Mobile devices can be personalized to give them a personal meaning. (e.g., mobile devices or services can be changed in their appearance by adding a personal history to the product).

From research in the UK, we also know that naming phones and other devices has become a significant culture Kindberg and Jones (2007), which influences users' attachment toward mobile devices and services. As described in Chapter 2.2.3, not only the result of personalization (i.e. a unique mobile device) can lead to strong emotional attachment, but also the process of personalization. Time, energy and (sometimes) money is invested to make the mobile device unique when a user personalizes his or her mobile device. Consequently the mobile device is an expression of the user's self and, in turn, positively affects mobile attachment (Mugge et al., 2004). In sum, designers should facilitate personalization and foster individuality of mobile devices.

Design for Affiliation

Some individuals feel strongly attached to their mobile devices because they serve as a symbol. They may symbolize either the connection to a specific group (e.g., family, friends or social groups) or a specific status. The design of mobile devices should foster group affiliation and status. The former can be done by providing features only for a specific group of users. An example could be that the mobile device offers the access to a private conversation room only for people with a specific mobile device or service. In addition, the mobile device could be personalized not only by an individual, but by a group of people. Thereby, a customization of one mobile device, would have an effect on all other 'connected' mobile devices.

Another way to foster group affiliation is to provide the possibility to add emotions to communication channels. This could be either achieved through explicit interactions (e.g., the user squeezes the mobile phone) or implicitly (e.g., by means of biophysical sensors). A good example how emotions can be transmitted via mobile phones was presented by Park et al. (2010). They presented an affective interaction technique (CheekTouch) by combining tactile feedback, delivered through the cheek, and multi-finger input, while speaking on the mobile phone. The success of emoticons has shown the need for emotional communication. Business users again might seek for a status symbol in their mobile device. As a design implication it can be suggested to use precious materials for the design of the mobile device.

Design for World View

Similar to design for affiliation, mobile devices serve as a symbol when designed for a specific world view. In this case, not specific people within the reference group are symbolized but the reference group itself, an idea, or a philosophy of life. Thus, the mobile device should be designed to represent this reference group or world view. An example is when a mobile device is designed for particular nations or ethnic groups. Another example is for people who prefer a sustainable life style. Mobile devices, which are designed to foster strong mobile attachment in these people, should be produced in a sustainable way and made of sustainable components. Another possibility is that the mobile device is equipped with a photovoltaic cell or may be recharged by movement. Furthermore, participation in news groups or blogs just for the specific mobile device should be facilitated.

8.3 Design for Self Gratification

Another way to facilitate mobile attachment is by gratifying the self. The mobile device may achieve this by providing superior hedonic pleasures to the user. Design implications for pleasure and durable emotions can be derived.

Design for Pleasure

Designers can influence mobile attachment by stimulating the experience of pleasure from a mobile device. Pleasure might be achieved through an aesthetic design, the use of valuable materials or joyful applications. By doing this, the mobile device elicits positive emotions within the user. Additionally, the creation of affective or emotional

content on the mobile device should be fostered. This affective content should be linked to the device itself. For instance, a picture of a beloved person taken with the mobile device should be recognizable as such.

Design for Durable Emotions

As emphasized previously, the existence of strong mobile attachment elicits strong emotions within the user. Thus, it could be argued that designer should create mobile devices which evoke huge pleasure from the moment of first usage. In doing this, there is a danger that these strong emotions might not be maintained over a longer period. As Park et al. (2006) points out, when attachment is developed by creating high arousal emotions such as passion, attachment might be difficult to sustain over time. Since mobile attachment is dynamic, the absence of once great feelings might lead to disappointments and frustration. It may be more prudent to design mobile attachment through moderate arousal emotions such as warm and pleasant feelings (self gratification), feelings of competence and trust (self empowerment), and feelings of inspiration and pride (self-enrichment).

8.4 More Design Implications

Design for Different User Groups

As outlined in Chapter 3.2.2, human characteristics influence the degree of mobile attachment. These properties also have an influence which device-self linkage route is most suitable to foster strong mobile attachment. Thus, design cannot facilitate mobile attachment for all people but needs to be tailored towards different user groups. These groups may be divided according to different categories. These categories include gender, age, or user character properties. Thus, different design strategies are advisable when designing for mobile attachment in women or men, in young people or elderly, in business users or private users. Women might prefer mobile devices which provide pleasure; men might be more attached to mobile device which demonstrate status; for teenagers, group affiliation might be most important; for elderly, ease-of-use and usefulness might be the right determinant for a strong mobile attachment. Govers and Mugge (2004) showed that extrovert individuals perceived a stronger attachment to 'extrovert' objects, whereas conscientious people were more attached to objects that were congruent with their personality. Obrist et al. (2011) suggested to differentiate

five experience types of mobile phone users (mobile phone as object of high emotional attachment, as status symbol, as object of criticism, as support for daily routines, as enabler of social connectedness). Based on these experience characters different routes of mobile attachment causes may be appropriate. For the design of mobile devices, it can be concluded that designers can foster mobile attachment by including a predetermined personality into the mobile device that matches the personality characteristics shared by the members of the target group.

Design for Theater Beyond the Honeymoon Phase

As described in Chapter 3.3.2 the first phase of mobile attachment can be seen as the honeymoon period (Chapman, 2005). During this phase the user is heavily engaged with the mobile device and strong feelings might occur. Nevertheless, honeymoon does not last forever and is followed by a normalization process. If the mobile device promises utopian expectations within the owner at the time of purchase disappointments are guaranteed. Thus, designers should create mobile devices which do not raise false hopes when they are aiming long-term mobile attachment; they should aim for authenticity. A once lost trust is hard to gain back. Mobile devices should be design not only for simple UX episodes but for 'theater'. This means that the whole UX should be taken into account when designing interactions with the mobile device. Interactions should not just happen, but be a happening for the user.

Design for Transferability

Personal data stored on a mobile device (e.g. pictures, text messages, contacts) should be easily transferable from one mobile device to another. This might be not true if the designer is longing for emotional attachment to a device specimen, but for the transfer of attachment among device variants this is essential. Since mobile devices are often replaced this level of mobile attachment is more likely to emerge.

Design for Companionship

The success of Tamagotchi and AIBO (see Chapter 2.2.1) has shown that people feel attached to artifacts which evoke a sense of companionship. This might be true for mobile phones as well. Battarbee and Mattelmäki (2003) argue that emotional attachment only emerges when the product is perceived having its own personality. Based on the analysis of collected stories about meaningful products, they presented a tentative

framework of meaningful product relationships consisting of three main categories: meaningful tool, meaningful association, and living object. As a meaningful tool, the object is significant for the owner because of the activity the tool provides. Although the hardware is necessary and an integral part of the experience, it is not in the core of the relationship. The product could be replaced with a similar or better tool at any time. In meaningful association, relationship products are meaningful because they carry a symbolic function given by culture or an individual. Products in this category refer to something outside the product itself. As a living object, the product is a companion, that is perceived as having personality, soul, character, is loved and cared for. It has a personal history of how it was made, acquired, and how it has survived. According to Battarbee and Mattelmäki (2003), an emotional bond is created only in this form between the person and the product. They argue that people may have many, overlapping relationships with meaningful objects at the same time depending on the life situation.

For the design of mobile phones this means that they should be designed to pretend to have their own personality. This could be achieved by persuading people to give their mobile phone a name (e.g., within an initial set-up procedure or at the beginning of a personalization process). Wording could be used to suggest the mobile phone is living. Instead of charging the battery the mobile device could ask for food. Another approach could be to let a virtual companion live within the mobile device. The mobile device is the house for the cherished avatar. This would have the advantage that the companion could move from one mobile device into another when replacing the mobile device. The success of virtual pets and avatars in different app stores show the desire of people to bring life into their smartphones. In addition to that the mobile device might change its personality according to the situational context. It could look and behave differently according to the situation and the user's emotions.

Design for Alter Ego

A counter-argument to the "design for companionship" design recommendation is that a companion could be perceived less as a part of the self since it has a personality of its own. Groom et al. (2009) revealed interesting findings about the degree to which a person will extend one's self into a robot based on the type of robot (humanoid vs. non-humanoid) and the assembler of the robot (self vs. other). Their findings show that people who assembled the robot by themselves were more attached to it than those who interacted with a robot assembled by somebody else. Additionally, they found that people showed a greater self extension with the non-humanoid robot (in their study,

a car) than with those with a more anthropomorphic form. They argue that people perceive humanoid form as an indicator of unique identity and are less prone to treat the robot as an extension of the self.

A combination of both approaches (to animate the mobile device and at the same moment not to constitute a companion) could be to design an avatar which lives in the mobile device representing the owners self. Following the example of Nintendo's Mii[1] the mobile device could be the accommodation for the owner's 'alter ego'.

Chapter Summary

This chapter provides answers to RG7. Based on the conceptual mobile attachment model and findings of the three empirical field studies, it presents design implications in order to facilitate the emergence of mobile attachment. Design implications include design for utility, design for long-term usability, design for memory, design for self-image, design for affiliation, design for world view, design for pleasure, design for durable emotions, design for different user groups, design for theater beyond the honeymoon phase, design for transferability, design for companionship, design for alter ego. In the next chapter answers to all research goals of this thesis (RG1-RG7) are concluded.

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[1]A Mii is are customizable player character which can be created by the owner. Miis are often designed too look like the creator representing him or her.
http://www.nintendo.com/consumer/systems/wii/en_na/channelsMii.jsp#for – last accessed May 3, 2011

Results

In this chapter, the findings of the seven research goals (RG1-RG7) that were presented in Chapter 1.2 are summarized.

RG1

RG1 aims at providing a definition of mobile attachment, along with a discussion from an HCI perspective. Based on literature from different disciplines and definitions on emotional attachment to products in general, mobile attachment has been defined within this thesis as "a cognitive and emotional target-specific bond connecting a person's self and a mobile device that varies in strength". This definition suggests to interconnect mobile attachment with the self-concept of an individual. Mobile attachment is assumed to be a state of mind in which a strong tie connects the individual with a mobile device in such a way that the mobile device is assumed to be a part or an extension of the self. The empirical attachment studies showed that people do not necessarily differentiate between the mobile device itself, the services it provides and resulting qualities. As a result, the attachment object does not only include the device itself but also the services it provides. As indicated by literature the empirical studies have shown that mobile attachment arouses cognitive and emotional processes within the user. It is a multifaceted property that evolves and changes over time and has strength. Mobile attachment is strongest when the mobile device bears a symbolic meaning for the user and is perceived as irreplaceable.

Mobile attachment can emerge on different levels. If the mobile device is categorically irreplaceable, the individual is attached to a mobile device specimen. If the mobile device is replaceable by a mobile device variant, three levels can be differen-

tiated: twin (replaceable by an exact replica), brother (replaceable by another device from the same product family), and cousin (replaceable by a device which shares certain characteristics). Especially the pilot mobile attachment study has indicated that people are often not attached to a mobile device specimen but rather to the services and freedom it offers. The mobile device specimen was regarded as replaceable by the same model or a better device with similar properties (e.g., from the same brand, providing the same features) as long as no personal valuable information (SMS, contacts, pictures) are lost. Other forms of attachment (e.g., brand attachment, the attachment to mobile phones in general, or attachment to other products) are related to, but not included in the concept of mobile attachment.

In HCI, attachment is often related with UX research. Based on the definition, differences between (mobile) attachment and UX have been elaborated. UX may be seen as the experience of a single interaction; whereas, attachment most often evolves over time. Individuals have user experiences with all products they interact with; whereas, attachment only emerges with a few objects. UX may elicit positive, negative or no emotions at all; whereas, emotional attachment elicits mainly positive feelings and thoughts. Emotional attachment with objects is always rewarding; whereas, UX does not have to be. UX is context dependent; whereas, emotional attachment is stable across various contexts. Strong attachment requires the existence of a connectedness between the individual's self and the attachment object; whereas UX does not need this bond.

Despite these differences, UX and emotional attachment are related. On one hand, UX is a factor of mobile attachment since the latter is influenced and shaped by each UX episode. Every single interaction with the mobile device and the related user experience shapes mobile attachment. As shown in the empirical studies these mobile attachment is related to emotional valuable UX episodes. On the other hand, mobile attachment can be regarded as a UX factor since it affects each interaction with a mobile device. Whenever a user uses his or her mobile device this interaction is influenced by the strength of mobile attachment. A highly attached person might feel pleasure when using the mobile device and pride when showing it to others, whereas within a person who is not attached to his or her mobile device no positive emotions might arise.

RG2

RG2 targets at the development of a conceptual model of mobile attachment including determinants influencing the strength of mobile attachment. Mobile attachment can be

conceptually understood as an interplay between different attachment causes, general factors that influence mobile attachment, and behavioral and emotional consequences which emerge when a user is connected to his or her mobile device.

Mobile attachment causes provide a linkage between the mobile device and the self via three different routes which overlap each other. These routes include the empowerment, the enrichment, and the gratification of the self. First, the mobile device may empower the self by providing a utilitarian meaning to the owner. If an individual is dependent on services the mobile device offers and simultaneously perceives the gained possibilities and amenities as part of the self, mobile attachment emerges. The individual cannot live a fulfilled life without a mobile device any more. Even though the individual might not be attached to a mobile device specimen, he or she is attached to the services the mobile device provides. Primarily this form of attachment was observed in the empirical attachment studies.

Second, the mobile device may enrich the self by providing a symbolic meaning to the owner. The mobile device may enrich the past self by providing memories. The empirical attachment studies have shown that some people associate positive memories with their mobile device. These could be either cherished moments or value pictures and text messages. The mobile device may enrich the private self by reflecting the individual's actual or desired self-image. As shown in the empirical studies people choose their mobile device because it suits them and they personalize its appearance and features. The mobile device may enrich the public self by reflecting one's affiliation with a peer group serving as a status symbol. Although the empirical attachment studies did not indicate that participants perceive their mobile device as a symbol the importance of symbolic meaning and social value to strengthen product attachment is indisputable in product attachment literature. The mobile device may enrich the collective self by symbolizing an attitude or world view. This includes both, the refusal of certain mobile devices and brands because of the connected image, as well as the development of mobile attachment to a device that symbolizes a belief or community. Again, this cause of mobile attachment was not observed in the empirical studies.

Third, the mobile device may gratify the self by providing hedonic qualities. This may be achieved through an aesthetically pleasing design or by providing fun and pleasure when interacting with the mobile device. The empirical studies have shown the relevance of emotional and hedonic aspects for the emergence of mobile attachment. Aside from importance, likeability and emotional valance was rated highest in the BlackBerry as well as the MP3 player attachment study. Aesthetic appearance was

also mentioned as one of the main factors when making a decision to buy a new mobile device.

Mobile attachment influencing factors may be user, environment or device related. Regarding the user personality, cultural or demographical aspects may have an influence on mobile attachment. The empirical studies, presented in this thesis, show that some people feel an emotional attachment to their mobile devices, whereas others refuse having any kind of emotions to inanimate objects. Such differences seem to be cultural-dependent (in Asia, for instance, the relationship with mobile phones is a very intimate), as well as age-dependent (especially teenagers are reported to have a strong mobile attachment). In addition, the user's brand and mobile device history influence mobile attachment. Environmental related influencing factors include mobile device advertisements, the public opinion, other mobile devices on the market, as well as narratives and recommendation of colleagues, friends, or family members. The pilot mobile attachment study showed that some people have a mobile device because a friend or family member has the same. Device related influencing factors are the design of the mobile device, the provided functions and applications, as well as the quality of used materials and supplied services. Needless to say that characteristics of the mobile device influence mobile attachment. Nevertheless, mobile attachment only evolves as an interplay between an individual and the device. Even the most beautiful mobile device will not elicit emotional attachment in every person, nor is it excluded that a hideous mobile device evoke somebody's mobile attachment.

If an individual is emotionally attached to his or her mobile device, mobile attachment consequences evolve. These consequences may be the investment of limited resources like time, money or energy. The empirical studies have shown that almost all participants have invested energy to make the mobile device more usable or unique. In addition, the user may invest self-image resources by publicly displaying, defending, advocating, or promoting the mobile device. Thus, the user might express commitment to the mobile device. Simultaneously, behavioral, cognitive and emotional responses may occur. The individual may seek proximity to the mobile device and feel distressed when separated. Again the empirical studies showed that most participants have their mobile phone always with them. Narratives of feeling panic when the mobile device was undiscoverable were collected. Thus, the mobile device might be perceived as irreplaceable as a consequence of a strong mobile attachment. Positive feelings and thoughts may come to mind when thinking of the mobile device and the mobile device might be personalized to fit the user's personality and needs. These observable consequences may be used to measure mobile attachment.

RG3

RG3 is concerned with the development of a temporal mobile attachment model in order to understand the mobile attachment life cycle. The temporal mobile attachment model classifies mobile attachment into three phases: pre-experience, ownership, and remembrance phase. Particularly the six-week BlackBerry attachment study has provided insights in the temporal development of mobile attachment.

The pre-experience phase starts with the first detection of the mobile device. It is characterized by advertisements, other people's narrations, and testing. The Black-Berry study has shown that expectations prior to the first usage have a strong influence on mobile attachment. Unmet expectation may weaken attachment whereas exceeded expectations may strengthen the emotional bond. During the ownership phase different UX episodes take place. On the behavioral level, the mobile device is perceived while interacting with it. On the reflective level, the mobile device is perceived when the user thinks of it and judge its qualities. These two levels stay in constant interplay with each other. Each interaction with the mobile device has an influence on the reflective level and may, therefore, strengthen or weaken mobile attachment. The strength of mobile attachment, in turn, influences the user experience of each interaction. UX and its effect on mobile attachment may vary for different types of interaction. A unique out-of-the-box experience, the personalization of the device, or the proud showing of the device to others may strengthen mobile attachment, while malfunctions or the sight of a newer and better device might weaken mobile attachment. The remembrance phase starts after the separation from the mobile device. Most often this is the case when the mobile device is replaced by another one (e.g., twin, brother, cousin) because the device is either broken or outdated. Some aspects of attachment might even be transfered to the new mobile device. The stronger the mobile attachment is, the longer the cherished mobile device will stay in mind. The empirical mobile attachment studies showed that people feel a bond to particular mobile devices even after years. Finally, the mobile attachment life cycle ends with the oblivion of the mobile device.

RG4

RG4 aims at the construction and validation of an instrument (questionnaire) to measure the degree of mobile attachment. In this thesis, such a measurement instrument is presented with the FeatMo questionnaire (Form for the evaluation of emotional attachment to mobile devices). FeatMo is a multidimensional measurement instrument to assess an individual's emotional attachment to a mobile device. Since the empiri-

cal pilot mobile attachment study has shown that mobile attachment is a multifaceted phenomenon and available product attachment scales were insufficient to assess the different aspects of mobile attachment we decided to construct an own measurement instrument. FeatMo consists of 29 items, which were derived from exploratory research, theoretical considerations, and lessons learned from the pilot study.

The items of the FeatMo are clustered into five dimensions: importance, symbolism, personalization, likeability, and emotional valence. The factor importance measures the significance of the mobile device for the owner and his or her life. The factor symbolism refers to the symbolic meaning of the device for the owner. This includes the device's ability to serve as a status symbol, as well as its non-utilitarian meaning. Personalization addresses issues whether the user has customized the mobile device to his or her personal needs and made it unique fitting the owner's personality. The factor likeability measures how much the owner is fond of the mobile device and has fun using it. Emotional valence measures emotional responses of the user associated with the mobile device. Aside form the items which assess the different factors, an additional item addresses mobile attachment directly. An adapted version of the FeatMo questionnaire has been used in the BlackBerry attachment study as well in the MP3 player attachment study. Both studies have proven the applicability of the FeatMo questionnaire. In addition to FeatMo an initial set of items for a second version of the FeatMo questionnaire (FeatMo2) was presented. This set of items could serve as a basis for an iteration of the FeatMo which addresses the different device-self linkage routes proposed in the conceptual mobile attachment model.

RG5

RG5 targets at the development and implementation of an in-situ evaluation method to assess the development of mobile attachment over time. To reach this research goal, the Maestro concept had been developed. Maestro is a variation of the experience sampling method based on a client-server architecture. Therefore, each mobile device is equipped with a Maestro client. Its purpose is to log user activities and send this information in real-time to a Maestro server. The server stores the data in a database and uses it as a trigger to send back a set of ESM questions depending on a variety of parameters. The Maestro client again displays these ESM questions, signals the user that an ESM questionnaire has to be answered (e.g., through a sound or vibration), and sends back the answers to the ESM server. With this approach it is possible to dynamically and remotely orchestrate experience-sampling studies for evaluating

user experience and mobile attachment over time. Simultaneously every single user interaction in question is logged and stored for analysis.

Maestro had been used in the empirical BlackBerry attachment study as well as in a variety of other UX related studies. From a methodological point of view the Black-Berry study has shown the power and unobtrusiveness of Maestro. Rich experience sampling data as well as the data logging have helped to understand the development of mobile attachment. Due to a complex setup the method itself was perceived as not burdensome and easy to accomplish. One of the major advantages of Maestro is that it assess user experiences and mobile attachment in different situations which allows to measure the effect of different context factors. The logging of user behavior enables to differentiate between diverse user types (e.g., heavy users vs. light users) and their influence on mobile attachment. Furthermore, it allows the evaluation of mobile attachment at different points in time over a longer period. Self-critical it has to be mentioned that the Maestro study alone would have brought less insights without the other applied methods (e.g., interviews) in the BlackBerry study. Only the triangulation of different quantitative and qualitative methods has allowed a deeper understanding of mobile attachment.

RG6

RG6 is concerned with strengthening the understanding of mobile attachment and assessing the feasibility of the proposed models, questionnaire, and method by means of empirical studies. In order to do this, three empirical studies have been conducted.

The pilot mobile attachment study consisted of a one-week ESM field study with 20 participants. The findings of the study showed that participants did not express an emotional attachment to their mobile devices, but rather to the services the mobile devices provide. Although participants had positive feelings towards their mobile devices, the mobile phone itself is seen as replaceable. Mobile attachment is evident in an unconscious way. The particular mobile device is replaceable, but a life without a mobile phones is not desired. Possible reasons are that mobile phones are easy to exchange, newer and better models are offered often for free, and none of the participants owned an inimitable mobile device. The results of this study helped to broaden the understanding of mobile attachment in general and informed the setup of the second empirical study.

The BlackBerry attachment study was based on the pilot mobile attachment study. In this study, 20 participants were equipped with new BlackBerry mobile devices. It

lasted for eight weeks and included a mixture of different methods. In this study, the FeatMo questionnaire and the Maestro concept were applied. Again, participants did not explicitly express a strong emotional attachment to their new BlackBerry devices nor to their current mobile phones. The results showed that the factor likeability was rated high for both devices and importance was rated high for the own mobile phone. Neither the BlackBerry nor the personal mobile device were ascribed with symbolic meanings. Qualitative results show that the symbolic meaning, above all, is an important factor for the existence of mobile attachment. The BlackBerry attachment study validated the FeatMo questionnaire and can be seen as a proof of concept for Maestro. It helped to build the conceptual and temporal mobile attachment model.

The MP3 player attachment study utilized the FeatMo questionnaire in an online survey to research MP3 player attachment. Similar to the BlackBerry study, participants liked their MP3 player but were not strongly attached to them. Participants rated the emotional attachment significantly different with respect to the brand, the ownership duration, and the usage frequency. The results showed that MP3 player brand has an impact on the strength of MP3 player attachment. Additionally, it has been shown that people who are stronger attached to their MP3 player, keep hold of it for a longer time and use them more often. This indicates that a strong mobile attachment could support sustainability in HCI.

RG7

RG7 is the elaboration of design implications in order to facilitate the emergence of mobile attachment. Based on the conceptual mobile attachment model and the three empirical studies, design implications to foster mobile attachment have been presented. Design implications include aspects in relation to the conceptual mobile attachment model as well as additional design implications drawn from the empirical mobile attachment studies.

Design for utility suggests to include the possibility to extend features of the mobile device based on personal needs as well as reliability and stability of the mobile device. Design for long-term usability strive for ease of use and efficiency over time. Design for memory demands the possibility of the mobile device to store memories as well as to design cherished UX episodes with the device. Design for self-image allows the user to be reflected in the mobile device. Design for affiliation calls for the possibility to exchange emotions over the mobile device. Design for world view demands the refection of certain ideologies in the mobile device design. Design for pleasure asks

for more pleasing aesthetics and joyful applications. Design for durable emotions proposes to design warm and pleasant feelings rather than high arousal. Design for different user groups suggests to develop mobile attachment for various categories of users. Design beyond the honeymoon phase strives for authenticity and exceptional UX episodes. Design for transferability demands the possibility to transfer personal data from one device to another. Design for companionship suggests to equip the mobile device with an own personality. Design for alter ego recommends to allow the user to built a virtual version of the owner within the mobile device.

Conclusion, Discussion and Future Work

In this chapter, conclusions and discussions on the empirical attachment studies and the proposed attachment models are presented. A reflection on the used methods to measure mobile attachment, as well as a discussion on what mobile attachment could contribute to a sustainable society are provided. Finally, an outlook on topics which could be researched in the future on the basis of this thesis are outlined.

10.1 Conclusion and Discussion

The overall research goal of this thesis is to strengthen the understanding of mobile attachment with a special focus on HCI relevant aspects. Although a variety of studies have reported on the existence of mobile attachment from different perspectives a common perspective on this phenomenon has not bee established yet. Consumer and design researchers have focused on product attachment in general but not taken the specific characteristics of mobile devices in to account. HCI researchers have witnessed the existence of mobile attachment but neglected the development of a conceptual foundation. UX researchers have suggested to put emotional attachment on a level with (overall) user experience. This thesis provides the basis for a conceptual understanding of mobile attachment.

Overall, it can be concluded that participants in the three empirical attachment studies did not express a strong emotional attachment neither to their mobile phones, nor to their MP3 players. For participants in these studies, their mobile devices are perceived as important to live a fulfilled live and participants mainly liked their mobile devices. The services and the associated freedom a mobile phone offers were especially valued.

A symbolic meaning was perceived rather implicitly but not expressed as such among participants. Thus, it can be argued that mobile attachment sometimes happens in an unconscious way.

Here it has to be mentioned that the results of the empirical studies can be hardly generalized. With the rather small sample sizes and the disregard of various user groups (e.g., teenager, other cultures) these studies can therefore not be considered representative. Other user groups may openly admit a strong emotional attachment. Reflecting on literature, especially teenagers and technology savvy people are reported to have a strong emotional attachment to their mobile devices. Innovators and early adopters may built a stronger emotional bond to a new technology than others. Also cultural differences seem to be important for the way mobile attachment is experienced and expressed. For Japanese teenagers decorating their loved mobile device is an expression of their personality. African rural women are attached to their mobile device because they rely on it to survive. In addition, types and brands of mobile devices have an impact on mobile attachment. Hyped technologies such as the iPhone are more likely to elicit mobile attachment than others. These aspects have not been covered in the empirical studies. Nevertheless, causes, influencing factors and consequences proposed in the conceptual mobile attachment model can be assumed to be valid for these user groups as well.

In this thesis, mobile attachment has been defined as the degree of how the mobile device is connected with the self of an individual. Mobile attachment is complex, evolves over time, varies in strength, and associated with positive emotions and thoughts. Mobile attachment is shaped by different UX episodes and, in turn, can influence UX when the user is interacting with the mobile device. Different levels of mobile attachment can be distinguished based on the degree of replaceability of the mobile device. Mobile attachment differs from other kinds of product attachment due to specific characteristics of mobile devices (e.g., ephemerality, technical progress, large choice, tool character). Due to short life cycles of mobile devices, it is difficult to built a durable emotional attachment. Thus it is argued that mobile attachment is intense but short-dated with mobile specimens and transferable across mobile variants. Although pleasurable experiences and the symbolic meaning of the mobile device are essential determinants for mobile attachment, core features of the mobile device such as telephone and SMS (with modern smartphones email, Internet and the access to social networks) are prerequisites for mobile attachment. People want to be socially connected throughout the uninterruptible continuum of life. They want to have the possibility to reach others and (with exceptions) be reachable anywhere and anytime.

If the mobile device is not capable to cover these needs emotional attachment to a mobile specimen will vanish regardless how 'hot' or 'cool' the mobile device is.

As described above mobile attachment is sometimes perceived in an unconscious way. As a consequence, it is difficult to measure directly, let alone with a direct question like "Are you emotionally attached to your mobile device?". The direct question sometimes led to reactions in the empirical studies indicating a principle denial having an "emotional" bond to an inanimate artifact at all. Thus, we developed a multidimensional attachment scale (FeatMo) in order to assess mobile attachment. The factors importance, likeability, symbolism, personalization, and emotional valence have been conceptualized to represent elements of mobile attachment. Although the FeatMo questionnaire has been validated and proven to be an apt instrument in the BlackBerry and MP3 player attachment study it bears some shortcomings. First, it does not reflect the structure of the conceptual mobile attachment model. A future iteration should take the different routes that cause mobile attachment into account. Second, a questionnaire might not be the best way to assess mobile attachment on principle. As the empirical studies showed structured interviews have proven to give deep insights into mobile attachment. Another possibility could be to study consequences of mobile attachment in more detail. This could be achieved through qualitative text analysis in the tradition of grounded theory in mobile device online forums or blogs. Another possibility could be to utilize stress experiments (e.g., blocking particular services and monitor reactions) to evaluate attachment to certain services. Third, FeatMo measures mobile attachment at one point in time. The development of mobile attachment over time could be evaluated through diary studies. Also the Maestro concepts could be used to measure mobile attachment over complete mobile phone life cycle. With the introduction of easy to download and installable apps Maestro clients could be widely-used.

In our throwaway society many objects that were once bought because of their functionality or hedonic qualities are eventually discarded, even when they still function properly at the time of disposal, because they are outdated or replaced by newer products, that offer more possibilities. From sustainability point of view short product life cycles cycles are often undesirable, because they produces waste and scarce resources are spent citepSchifferstein2008. As we have seen, consumers judge some of their personal possessions in general, and particular mobile devices, as important. Often, they are among their favorites. Facilitating mobile attachment might increase the lifespan of mobile devices; owners might preserve their mobile devices for a longer time, and would be more likely to repair them. Therefore, stimulating mobile attachment may

result in a decrease of unnecessary waste[1], in a decreased use of limited resources of energy and raw materials, and thus contribute to a more sustainable society (Schifferstein et al., 2003). A person who is attached to an object is more likely to treat the object with care, repair it when it is broken, and postpone its replacement as long as possible (Schifferstein and Zwartkruis-Pelgrim, 2008). Studies have shown product attachment has significant implications for the consumption activities by effecting the lifespan of products (Savaş, 2003). Huang and Truong (2008) have suggested various mobile design opportunities to increase mobile phone ownership duration by presenting opportunities for sustainable interaction design for mobile phones (e.g., making information about responsible disposal more available, attaching value to mobile phones). There is a challenge for designers to strengthen the tie between people and their mobile devices through the design process in order to lengthen the life span of mobile devices (Schifferstein and Zwartkruis-Pelgrim, 2008).

10.2 Future Work

This thesis builds a strong conceptual basis for the phenomenon of mobile attachment. Aside from the definition of mobile attachment, two mobile attachment models – a conceptual as well as a temporal – were constructed. Additionally, a questionnaire to assess different factors of mobile attachment as well as a methodical concept have been established. This thesis can serve as a basis for future research activities on mobile attachment. The following topics are especially interesting.

Mobile Attachment Studies

As described previously, mobile attachment is dependent on different user types as well as the mobile device itself. Future research should investigate both aspects. Interesting research questions could be as follows: Which mobile devices evoke a strong mobile attachment? What is the difference between attachment to a mobile phone (e.g., iPhone) and a tablet PC (e.g., iPad)? Which causes for mobile attachment correlate with which mobile device type? What is the difference between various adopter categories (innovators, early adopters, early and late majority, laggards) regarding mobile attachment? How are different attachment patterns (e.g., secure, avoidant, resis-

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[1] A mobile phone is made of approximately 45% plastics, 20% copper, 20% other metals (e.g., iron, aluminum, tin, silver, gold, indium, tantalum, lithium, platinum), 10% ceramics, and 5% other materials. Currently only 3% of all mobile phones which have an average usage period of 1.5 years are recycled (Schmidt, 2010).

tant, disorganized, ambivalent attached people) linked to mobile attachment? What differences exist for attachment causes in different user groups (e.g., gender, age, personality, culture)? How do other influence factors (see Chapter 3.2.2) affect mobile attachment? Additional, research questions may be derived from both mobile attachment models (conceptual and temporal). Examples are: Which attachment causes (self empowerment, self enrichment, self gratification) lead to which attachment consequences? How does mobile attachment develop over an entire attachment life cycle? Which user experience factors have an influence on mobile attachment?

Cultural and Social Differences in Mobile Attachment

As outlined before huge differences regarding mobile attachment and different cultures have been proposed. Interesting research activities could deal with questions like: How does mobile attachment vary between diverse cultures (e.g., europe vs. asia vs. north america). How does causes and consequences for mobile attachment differ between developed countries and the developing world? What are the social consequences of mobile attachment on an individual level, as well as on a global level?

Mobile Attachment for Sustainability

The MP3 player attachment study has shown that MP3 player attachment has an influence on the duration of MP3 player ownership. It can be argued that this is the case for mobile phones as well. Future research could investigate the impact of mobile attachment on ownership duration and if this has a positive influence on sustainability. Research in this direction could provide valuable insights into the field of Sustainable Interaction Design (SID). Blevis (2007) has formulated a set of open research questions concerning SID. With this as a basis, the following research questions are worth investigating concerning mobile attachment: How can mobile attachment be used to promote longevity of mobile devices? Will mobile attachment lead to more sustainable consumption and what are the tools that can allow designers to do so? How have mobile technologies already transformed notions of ownership and identity, and what is the sustainable design response to the present condition?

Mobile Attachment for Persuasion

Over the last years, the HCI community has developed its interest in persuasive technologies. Fogg (2003) has defined Persuasive Technology (PT) is defined as "any in-

teractive computing system designed to change people's attitudes or behaviors". Mobile devices have been suggested to be used as PT (Eslambolchilar et al., 2010) and in studies, in order to improve of health behavior (Consolvo et al., 2008). In my research group, PTs have been researched in various environments such as the shopping context (Meschtscherjakov, Reitberger, Mirlacher, Huber, and Tscheligi, 2009) and the automotive context (Meschtscherjakov, Wilfinger, Scherndl, and Tscheligi, 2009). The success of a persuasive strategy is dependent on a variety of factors, such as social facilitation, persistence, simplicity, or the intervention at the right moment at the right place (Fogg, 2003). In one of our studies, we used a persuasive picture frame to foster healthy sitting habits in an office environment (Obermair et al., 2008). Feedback about the current sitting posture was shown in a video sequence of a person displayed on a video screen situated on the desk of the user. The findings of this study showed a correlation between proximity between participant and person in the picture frame and strength of the persuasive effect. For example, girlfriends and boyfriends had a stronger effect than colleagues or strangers. Applied to mobile attachment, it can be argued that mobile devices to which users feel a strong emotional attachment might be utilized as strong PTs. Future studies could investigate possible causality between the intensity of mobile attachment and the strength of the persuasive effect.

The Dark Side of Attachment: Addiction

In this thesis, mobile attachment has been described mainly as something positive for the user since it is accompanied by positive feelings and thoughts. Nevertheless, mobile attachment, as everything else, might have a negative side for individuals as well. This is the case when attachment turns into addiction. Future research should reflect on negative aspects of mobile attachment like the dependency on mobile devices or sprawling usage of mobile services. Some teenagers, for instance, send thousands of text messages each month and are distressed when their mobile phone is withdrawn. As described in Chapter 3.2.3, taking away mobile phones from teenagers is often used as a punishment in schools. Future studies could illuminate the negative side of mobile attachment for individuals as well as for society. In addition to that proposed gender differences (cf. Geser, 2006) could be illuminated.

The Literally Extension of the Body

The concept of the extended self (Belk, 1988) was used for motivating the definition of mobile attachment. Thereby, the extended self was regarded in a rather metaphor-

ical way. Warwick (2004) has gone a step further by literally implanting ICTs into his body. Other authors distinguish between body extensions (limb, perceptual, and cognitive extensions/prostheses) and incorporation of non-bodily objects into the body (Preester, 2010). Form a mobile attachment perspective this extreme form of extension of the self could be a fruitful research stream to strengthen the understanding of mobile attachment and extend its scope.

Construction of FeatMo2

The FeatMo questionnaire was developed after the pilot mobile attachment study and applied in the BlackBerry and MP3 player attachment studies. Based on these studies, the conceptual mobile attachment model was constructed. As a result, the FeatMo factors (importance, likeability, personalization, symbolism and emotional valence) do not reflect the structure of the conceptual mobile attachment model (causes and consequences of mobile attachment). In Chapter 4.2.3, items are presented, which could serve as a basis for an iteration of the FeatMo questionnaire. Future research could develop the FeatMo2 questionnaire, which could be composed of a subset of these items and reflect different mobile attachment causes; as well as resulting emotional and behavioral consequences in more detail. In addition, it could be explored how the observation of mobile attachment consequences could be an apt approach to evaluate mobile attachment. In addition, other concepts like the endowment effect[2] might be taken into account. In addition, an evaluation framework including questionnaires as well as observations, interviews, diary studies and experiments may be set up to evaluate mobile attachment and its causes in consequences in a holistic way.

Development of Maestro

As described in Chapter 4.3.4, the Maestro concept has been applied in a variety of studies. So far the concept has utilized mainly mobile phone Maestro clients. Clients have been developed for different BlackBerry mobile phones as well as integrated into an iPhone navigation application. In the future, Maestro clients for different mobile platforms (e.g., Android, iPhone) will be developed. Additionally, a Web API is in construction with the help of which it will be easy to develop clients for all common web browser (Firefox, Internet Explorer, Chrome, Opera Safari). This allows expe-

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[2]The endowment effect suggests that people become attached to objects that are in their possession, and they demand a higher price to sell an object they own than they would be willing to pay to buy the same object (Kogut and Kogut, 2010).

rience sampling, not only on mobile devices and personal computer but all devices which are running a web browser (e.g., tablet PCs, TV set top boxes).

Epilogue

My wife still owns her white iPhone 3G. It has been two years since I gave it to her as a Mother's Day present and nine months since she dropped it in the toilet of the Holmenkollen Ski Jump. It is still working, even though my wife sometimes complains that it is has become slower since the incident. My wife is still attached to her white iPhone despite the fact that it sometimes does not behave like expected (e.g., system crash). The introduction and hype of the iPhone 4 has not changed her attachment. She appreciates the excellent built-in camera and brilliant display but does not like the form of the iPhone 4. She likes the style of her iPhone 3G better because of its feminine form. In the meanwhile she has equipped her iPhone with a green cover and a screen protector mainly to protect it from scratches. Additionally, she has personalized it with dozens of apps (every week new apps are added and others are deleted). She took a picture for almost every contact in her address book and added a special ringtone (our wedding dance).

Concerning the conceptual mobile attachment model, my wife's attachment seems to be fostered by different causes. The iPhone empowers her self by providing important services which she does not want to miss. It gratifies her self by providing pleasure when using it and playing with it. The enrichment of the self seems to be least pronounced. She does not see it mainly as a Mother's Day gift, nor does the iPhone seem to serve as a reminder of her past self. She does not experience it as a part of her private self, nor does she perceive it as a status symbol of her public self. The collective self is not supported as well as she is not an Apple fan[3]. Nevertheless, she is strongly emotionally attached to her iPhone. When the FIS Nordic World Ski Championships was held in Oslo in 2011, the Austrian Ski Jump Team won a gold medal. My wife and I watched this event on TV. When the Holmenkollen Ski Jump was shown my wife said that she connects bad feelings to it, since this is the place where she dropped her iPhone in a toilet.

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[3]She does not know what Steve Jobs looks like.

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Appendix

Appendix Attachment Measurement Scales

This appendix provides attachment measurement scales from literature as well as the FeatMo mobile attachment questionnaire presented in Chapter 4.2. It includes:

➤ Attachment measurement scales from literature (Table A.1-A.4)

➤ Initial set of FeatMo items (Figure A.1-A.2) – in German

➤ FeatMo questionnaire (Figure A.3-A.4) – in German

Possession Attachment Scale
I don't really have too many feelings about my … (reversed scored).
If I didn't have my …, I would feel a little bit less like myself.
If I were describing myself, my … would likely be something I would mention.
If somebody praised my …, I would feel somewhat praised myself.
If someone ridiculed my …, I would feel irritated.
My … reminds me of who I am.
Probably, people who know me might sometimes think of my … when they think of me.
If I lost my …, I would feel like I had lost a little bit of myself.
If someone destroyed my …, I would feel a little bit personally attacked.

Emotional Significance Scale
If I lost my …, another one like it wouldn't be as meaningful.
My … reminds me of important people in my life.
My … reminds me of important things I've done and places I've been.

Table A.1: Ball and Tasaki's (1992) nine-item Likert scale to measure possession attachment and three-item Likert scale to measure emotional significance of attached possessions

Possession Attachment
I am emotionally attached to my ….
I am sentimental about my ….
I have no feelings for my ….
My … reminds me of memories and experiences.

Incorporation Into the Extended Self
My … helps me achieve the identity I want to have.
My … helps me narrow the gap between what I am and what I try to be.
My … is central to my identity.
My … is part of who I am.
If my … is stolen from me I will feel as if my identity has been snatched from me.

Table A.2: Sivadas and Venkatesh's (1995) four-item Likert scale to measure possession attachment and five-item Likert scale to measure the incorporation of an attached possession into the extended self

Attachment
I feel emotionally connected to this product.
This product is very dear to me.
I have a bond with this product.
This product has no special meaning for me. (reversed scored)
This product does not move me. (reversed scored)
I am very attached to this product. [a]
This product has a special place in my life.[a]
This product means a lot to me.[a]
I have no feelings for this product.[a] (reversed scored)

Irreplaceability
Even a completely identical specimen cannot replace this specimen for me.
Another identical product has the same meaning for me (reversed scored).
This specimen is different for me than other specimens of this type.
This specimen is irreplaceable for me.[a]
If this product becomes unusable, I will buy exactly the same one again.[a]

Indispensability
Without this product, my life is fine (reversed scored).
This product is necessary for me.
This product is indispensable for me.
I need this product to live the way I want to live.
For me a life without this product would just not be the same.[a]
This is a product that I can do without.[a] (reversed scored)

Self-extension
This product reminds me of who I am.
If I lost this product, I would feel like I had lost a little bit of myself.
If I were describing myself, this product would likely be something I would mention.
If someone ridiculed this product, I would feel irritated(Not included in final scale)
If someone destroyed this product, I would feel a little bit personally attacked.[a]
If someone praised this product, I would feel somewhat praised myself.[a]
If I didn't have this product, I would feel a little bit less like myself.[a]
Probably, people who know me might sometimes think of this product when they think of me.[a]

Table A.3: Schifferstein and Zwartkruis-Pelgrim's (2008) scales to measure product attachment, irreplaceability, indispensability and self-extension

---

[a]Not included in final scale

Symbolism
Using an up-to-date mobile device is important to me.
My mobile device is an expression of my personality.
My mobile device fits to my personality. [a]
I would not like to use an old and outdated device.
I know which device types my friends use.[a]
It is important to me that my friends like my mobile device.
Modern persons use new and up-to-date devices.

Aesthetics
My mobile device is beautiful.
The design of my mobile device is artistic.[a]
The shape and color of my mobile device are appealing to me.
Having a nice ring tone is important to me.[a]
The overall appearance of my mobile device is appealing.

Perceived necessity
I feel uneasy when I do not have my mobile device with me.
My mobile device belongs to me.[a]
I always have my mobile device with me.
It is fun using my mobile device.[a]
I have an uneasy feeling if somebody else uses my mobile device.[a]
If I do not have my mobile device with me, I feel like something is missing.
I feel more self-confident when I have my mobile device with me.

Table A.4: Wehmeyer's (2008) initial 19-item set to measure his proposed three dimensions of user-device attachment: symbolism, aesthetics, and perceived necessity

[a]Not included in final scale

Sehr geehrte Damen, sehr geehrte Herren,

im Rahmen eines Projekts des ICT&S Center der Universität Salzburg erheben wir die Einstellung zu Handys und deren Nutzung. Wir bitten Sie sich 5 Minuten Zeit zu nehmen und den nachfolgenden Fragebogen auszufüllen.

Geschlecht: ☐ männlich ☐ weiblich Alter: _____

Welches Mobiltelefon besitzen Sie (Marke & Modell)? _____

Seit wann besitzen Sie Ihr Handy? _____

Wieviel hat Ihr Handy gekostet? _____

Wie oft haben Sie Ihr Handy in den letzten 2 Monaten verwendet zum / als...

	Täglich	Mehrmals pro Woche	Mehrmals pro Monat	seltener	nie
Telefonieren	☐	☐	☐	☐	☐
SMS schreiben	☐	☐	☐	☐	☐
Spiele spielen	☐	☐	☐	☐	☐
Fotografieren	☐	☐	☐	☐	☐
Terminkalender	☐	☐	☐	☐	☐
Wecker	☐	☐	☐	☐	☐
Web Surfen	☐	☐	☐	☐	☐
Musik hören	☐	☐	☐	☐	☐
Bezahlen (paybox)	☐	☐	☐	☐	☐
Emails schreiben / empfangen	☐	☐	☐	☐	☐

Bitte bewerten Sie die folgenden Aussagen:

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Mein Handy ist schön.	☐	☐	☐	☐	☐
Auf meinem Handy befinden sich viele wichtige Erinnerungen (SMS, Fotos, ...) aus meinem Leben.	☐	☐	☐	☐	☐
Der Wert meines Handys ist nicht mit Geld aufzuwiegen.	☐	☐	☐	☐	☐
Das Aussehen meines Handys ist unwichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich unwohl, wenn jemand anderes mein Handy benutzt.	☐	☐	☐	☐	☐
Ich erinnere mich gerne an den Moment als ich mein Handy zum ersten Mal in der Hand hielt.	☐	☐	☐	☐	☐
Ich mag die Klingeltöne auf meinem Handy.	☐	☐	☐	☐	☐
Mein Handy ist nicht wichtig für mich.	☐	☐	☐	☐	☐

Figure A.1: Initial set of 33 items and an additional 34th item asking directly about mobile attachment for the FeatMo questionnaire in German as described in Chapter 4.2.2 – page 1/2

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Ich fühle mich mit meinem Handy emotional verbunden.	☐	☐	☐	☐	☐
Ich investiere viel Zeit und Energie, um mein Handy individuell zu gestalten.	☐	☐	☐	☐	☐
Ich würde mein Handy sofort gegen ein besseres Modell eintauschen.	☐	☐	☐	☐	☐
Ich mag das Hintergrundbild auf meinem Handy.	☐	☐	☐	☐	☐
Mein Handy macht mich unabhängig.	☐	☐	☐	☐	☐
Mein Handy ist ein Teil von mir.	☐	☐	☐	☐	☐
Ich informiere mich intensiv, um die Möglichkeiten meines Handys voll auszuschöpfen.	☐	☐	☐	☐	☐
Mein Handy passt zu mir.	☐	☐	☐	☐	☐
Ich würde mein Handy an meine Freunde weiterempfehlen.	☐	☐	☐	☐	☐
Mein Handy erfüllt meine Bedürfnisse.	☐	☐	☐	☐	☐
Ich brauche mein Handy, um mit meinen Freunden verbunden zu sein.	☐	☐	☐	☐	☐
Ich habe mein Handy immer bei mir.	☐	☐	☐	☐	☐
Es macht mir Spaß mein Handy zu benutzen.	☐	☐	☐	☐	☐

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Mir ist egal, was meine Freunde über mein Handy denken.	☐	☐	☐	☐	☐
Ohne mein Handy würde mir etwas fehlen.	☐	☐	☐	☐	☐
Wenn ich an mein Handy denke, kommen mir vor allem positive Gedanken in den Sinn.	☐	☐	☐	☐	☐
Mein Alltag wäre auch ohne mein Handy möglich.	☐	☐	☐	☐	☐
Ich mag mein Handy.	☐	☐	☐	☐	☐
Ich habe meinem Handy eine individuelle Note verpasst.	☐	☐	☐	☐	☐
Ich könnte mir ein Leben ohne mein Handy nicht mehr vorstellen.	☐	☐	☐	☐	☐
Für mich ist mein Handy mehr als nur ein technisches Gerät.	☐	☐	☐	☐	☐
Wenn mein Handy verloren ginge, würde ich auch einen Teil von mir selbst verlieren.	☐	☐	☐	☐	☐
Mein Handy hat keine spezielle Bedeutung für mich.	☐	☐	☐	☐	☐
Ohne mein Handy wäre mir vieles nicht möglich.	☐	☐	☐	☐	☐
Wenn ich mein Handy nicht finden kann, werde ich panisch.	☐	☐	☐	☐	☐

Vielen Dank!

Figure A.2: Initial set of 33 items and an additional 34th item asking directly about mobile attachment for the FeatMo questionnaire in German as described in Chapter 4.2.2 – page 2/2

ICT&S Center
Advanced Studies and Research in Information
and Communication Technologies & Society
University of Salzburg

UNIVERSITÄT SALZBURG

Sehr geehrte Damen, sehr geehrte Herren,

im Rahmen eines Projekts des ICT&S Center der Universität Salzburg erheben wir die Einstellung zu Handys und deren Nutzung. Wir bitten Sie sich 5 Minuten Zeit zu nehmen und den nachfolgenden Fragebogen auszufüllen.

Geschlecht: ☐ männlich ☐ weiblich

Alter: _____

Welches Mobiltelefon besitzen Sie (Marke)? _____

Seit wann besitzen Sie Ihr Handy? _____

Wie oft haben Sie Ihr Handy in den letzten 2 Monaten verwendet zum / für...

	Täglich	Mehrmals pro Woche	Mehrmals pro Monat	seltener	nie
Telefonieren	☐	☐	☐	☐	☐
SMS schreiben	☐	☐	☐	☐	☐
Sonstige Aktivitäten (Foto, Mail...)	☐	☐	☐	☐	☐

Bitte bewerten Sie die folgenden Aussagen:

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Mein Handy ist schön.	☐	☐	☐	☐	☐
Der Wert meines Handys ist nicht mit Geld aufzuwiegen.	☐	☐	☐	☐	☐
Aussehen und Image meines Handys sind unwichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich unwohl, wenn jemand anderes mein Handy benutzt.	☐	☐	☐	☐	☐
Ich erinnere mich gerne an den Moment als ich mein Handy zum ersten Mal in der Hand hielt.	☐	☐	☐	☐	☐
Ich mag die Klingeltöne auf meinem Handy.	☐	☐	☐	☐	☐
Mein Handy ist nicht wichtig für mich.	☐	☐	☐	☐	☐

Figure A.3: Final FeatMo questionnaire with 29 items (including the direct question) in German – page 1/2

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Ich fühle mich mit meinem Handy emotional verbunden.	☐	☐	☐	☐	☐
Ich investiere viel Zeit und Energie, um mein Handy einzigartig zu machen.	☐	☐	☐	☐	☐
Ich mag das Hintergrundbild bzw. Thema meines Handys.	☐	☐	☐	☐	☐
Mein Handy ist ein wichtiger Teil von mir.	☐	☐	☐	☐	☐
Mein Handy hat keine spezielle Bedeutung für mich.	☐	☐	☐	☐	☐
Ich informiere mich intensiv, um die Möglichkeiten meines Handys voll auszuschöpfen.	☐	☐	☐	☐	☐
Mein Handy passt zu meiner Persönlichkeit.	☐	☐	☐	☐	☐
Ich habe mein Handy immer bei mir.	☐	☐	☐	☐	☐
Wenn ich mein Handy verlieren würde, wäre ich traurig.	☐	☐	☐	☐	☐
Es macht mir Spaß mein Handy zu benutzen.	☐	☐	☐	☐	☐
Mein Handy ist ein Statussymbol für mich.	☐	☐	☐	☐	☐
Ohne mein Handy würde mir etwas fehlen.	☐	☐	☐	☐	☐
Mit meinem Handy verbinde ich positive Gedanken und Gefühle.	☐	☐	☐	☐	☐
Mein Alltag wäre auch ohne mein Handy möglich.	☐	☐	☐	☐	☐
Ich mag mein Handy.	☐	☐	☐	☐	☐
Ich habe meinem Handy eine individuelle Note verpasst.	☐	☐	☐	☐	☐
Für mich ist mein Handy mehr als nur ein technisches Gerät.	☐	☐	☐	☐	☐
Ich würde mein Handy an meine Freunde weiterempfehlen.	☐	☐	☐	☐	☐
Wenn ich mein Handy nicht finden kann, werde ich panisch.	☐	☐	☐	☐	☐
Ich habe mein Handy mit einem individuellen Klingelton ausgestattet.	☐	☐	☐	☐	☐
Ich könnte mir ein Leben ohne mein Handy nicht mehr vorstellen.	☐	☐	☐	☐	☐
Es ist für mich wichtig ein topaktuelles Modell zu besitzen.	☐	☐	☐	☐	☐

Vielen Dank für Ihre Mitarbeit!

Figure A.4: Final FeatMo questionnaire with 29 items (including the direct question) in German – page 2/2

Appendix Maestro Architecture

This appendix provides an example for a typical XML stream as well as an example for an ESM questionnaire (ESF) as used in the Maestro concept presented in Chapter 4.3.

XML Stream Example

```
<!-- INITIATION by an EUC -->
<?xml version="1.0" encoding="UTF-8"?>
<stream from="imei_302099201662481" version="1.1">

  <!-- EVENT -->

  <!-- The user placed a call which lasted 349 seconds -->
  <message from="imei_302099201662481" generated="2009-06-29T15:36:09
     .614+02:00" id="23">
    <event name="callDisconnected">
      <param name="duration">349</param>
      <param name="origin">local</param>
    </event>
  </message>

  <!-- The user sent an email -->
  <message from="imei_302099201662481" generated="2009-06-29T15:36:49
     .961+02:00" id="24">
    <event name="emailSent"/>
  </message>
```

```xml
<!-- The user terminated a web browser application which was used
     for 586 seconds -->
<message from="imei_302099201662481" generated="2009-06-29T15:36:49
    .574+02:00" id="25">
  <event name="applicationTerminated">
    <param name="application">Browser</param>
    <param name="duration">586</param>
  </event>
</message>


<!-- A scheduled alarm was activated on the device -->
<message from="imei_302099201662481" generated="2009-06-30T07:00:00
    .003+02:00" id="26">
  <event name="alarmOccured"/>
</message>


<!-- An AM triggers an ESF -->
<message from="ces_trigger" to="imei_302099201662481" generated="
    2009-06-30T14:12:33.992+02:00" dispatched="2009-06-30T14:12:33
    +02:00" session_id="1251808487627" id="68913">
  <event name="esfRequest">
    <card id="1" next_card="2">
      <question id="214" text="Where␣are␣you?">
        <answer id="1" text="At␣home"/>
        <answer id="2" text="At␣work"/>
        <answer id="3" text="On␣the␣way" next_card="0"/>
      </question>
    </card>
    <card id="2">
      <question id="3" type="smilies" text="How␣do␣you␣feel?">
        <answer id="1"/>
        <answer id="2"/>
        <answer id="3"/>
        <answer id="4"/>
        <answer id="5"/>
      </question>
    </card>
  </event>
</message>


<!-- The EUC replies to the ESF -->


<?xml version="1.0" encoding="UTF-8"?>
<stream from="imei_302099201662481" version="1.0">
```

```xml
<message from="imei_302099201662481" to="ces_trigger" generated="
    2009-06-30T14:13:47.201+02:00" id="27" reply_from="ces_trigger"
    reply_session_id="1251808487627" reply_id="68913">
  <event name="esfReply">
    <card id="1">
      <question id="1">
        <answer id="1"/>
      </question>
    </card>
    <card id="2">
      <question id="2">
        <answer id="2"/>
      </question>
    </card>
  </event>
</message>


<!-- CONFIG -->

<!-- An AM sends new configuration parameters to the client -->
<message from="ces_config" generated="2009-06-30T23:59:00.005+02:00"
    dispatched="2009-06-30T23:59:01.008+02:00" id="6138431"
    session_id="1251808487628">
  <config type="updateRequest">
    <param name="server">
      <param name="address">ces.icts.sbg.ac.at</param>
      <param name="port">5234</param>
    </param>
    <param name="alert">
      <param name="vibra_duration">450</param>
      <param name="audio_hz_1">750</param>
    </param>
    <param name="events">
      <param name="holsterIn">false</param>
      <param name="smsRecieved">true</param>
    </param>
  </config>
</message>

<!-- The EUC successfully changed its configuration -->
<message from="imei_302099201662481" to="ces_config" generated="
    2009-06-30T23:59:09.742+02:00" id="28" reply_from="ces_config"
    reply_session_id="1251808487628" reply_id="6138431" >
```

```xml
  <config type="updateReply">
    <param name="server">
      <param name="address" accepted="true">ces.icts.sbg.ac.at</param
          >
      <param name="port" accepted="true">5234</param>
    </param>
    <param name="alert">
      <param name="vibra_duration" accepted="true">450</param>
      <param name="audio_hz_1" accepted="true">750</param>
    </param>
    <param name="events">
      <param name="holsterIn" accepted="true">false</param>
      <param name="smsRecieved" accepted="true">true</param>
    </param>
  </config>
</message>

<!-- Ping / Pong -->

<!-- The server pings the client -->
<ping/>

<!-- The client responds to the ping request -->
<pong/>

<!-- ERROR -->

<!-- An entity received malformed XML and closes the stream -->
<error type="xmlMalformed"/>
</stream>
```

ESF Example

```xml
<!-- An AM triggers an ESF -->
<message from="ces_trigger" to="imei_302099201662481" generated="
    2009-06-30T14:12:33+02:00" dispatched="2009-06-30T14:12:33+02:00"
     session_id="45192" id="68913">
  <event name="esfRequest">
   <esf id="locationDevicesFeelings" trigger_id="locationChange@noon"
        >
     <card id="1" next_card="2">
      <question id="whereareyou" text="Where are you?">
       <answer id="1" text="At home"/>
       <answer id="2" text="At work"/>
       <answer id="3" text="On the way" next_card="6"/>
      </question>
     </card>
     <card id="2" next_card="3">
      <question id="whichdeviceshave" type="multi" text="Which device
         (s) do you currently have with you?">
       <answer id="1" text="Cell phone"/>
       <answer id="3" text="PDA"/>
       <answer id="2" text="Laptop"/>
       <answer id="3" text="MP3 player"/>
       <answer id="4" text="none" next_card="0"/>
      </question>
     </card>
     <card id="3" next_card="5">
      <question id="whichdevicesnear" text="Which device at your
         current location is the most useful to you?">
       <answer id="1" text="Cell phone" next_card="4"/>
       <answer id="2" text="PDA"/>
       <answer id="3" text="Laptop"/>
       <answer id="4" text="MP3 player" next_card="0"/>
       <answer id="5" text="none" next_card="0"/>
      </question>
     </card>
     <card id="4" next_card="5">
      <question id="whatlikedevice" type="text" text="What is it,
         that you like about this device?">
        <answer id="1"/>
          </question>
     </card>
     <card id="5">
      <question id="howfeel" type="smilies" text="How do you feel?">
```

```
              <answer id="1" next_card="6"/>
              <answer id="2"/>
              <answer id="3"/>
              <answer id="4"/>
              <answer id="5" next_card="6"/>
          </question>
        </card>
        <card id="6">
          <question id="howfeelreason" type="text" text="Give␣a␣short␣
             reason␣for␣your␣current␣feelings.">
              <answer id="1"/>
               </question>
        </card>
      </esf>
    </event>
</message>

<!-- The EUC replies to the ESF -->
<message from="imei_302099201662481" to="ces_trigger" generated="
   2009-06-30T14:13:47+02:00" id="27" reply_session_id="45192"
   reply_id="68913">
  <event name="esfRequest">
    <esf id="locationDevicesFeelings" trigger_id="locationChange@noon"
        >
      <card id="1">
        <question id="whereareyou">
          <answer id="1"/>
        </question>
      </card>
      <card id="2">
        <question id="whichdeviceshave">
          <answer id="1"/>
          <answer id="2"/>
        </question>
      </card>
      <card id="3" next_card="5">
        <question id="whichdevicesnear">
          <answer id="1"/>
        </question>
      </card>
      <card id="4">
        <question id="whatlikedevice">
           <answer id="1">It is not just a cell phone, but also an MP3
               player.</answer>
```

```
            </question>
       </card>
       <card id="5">
         <question id="howfeel">
           <answer id="5"/>
         </question>
       </card>
       <card id="6">
         <question id="howfeelreason">
           <answer id="1">I'm␣off␣work␣now.</answer>
␣␣␣␣␣␣␣␣</question>
␣␣␣␣␣␣</card>
␣␣␣␣</esf>
␣␣</event>
</message>
```

Appendix Pilot Mobile Attachment Study

This appendix provides study material presented in the pilot mobile attachment study presented in Chapter 5. It includes:

➢ Guidelines for recruiting participants (Figure C.1) – in German

➢ Interview guide for the individual introduction sessions (Figure C.2-C.4) – in German

➢ Pre-questionnaire (Figure C.5-C.7) – in German

➢ Permission to use data form (Figure C.8) – in German

➢ Post-interview guideline (Figure C.9-C.12) – in German

Leitfaden für Rekrutierungsgespräch "Mobile Studie"

Guten Tag, mein Name ist [*Alexander Meschtscherjakov*], ich bin Mitarbeiter am ICT&S Center der Universität Salzburg. Sie wollen bei unserer Studie über den Umgang und die Erfahrungen mit Mobiltelefonen teilnehmen?

☐ **Projekt:** Es handelt sich dabei um eine Studie, die an der Universität Salzburg genauer

gesagt am Center für Informations- und Kommunikationstechnologien durchgeführt wird.

☐ **Sinn und Zweck:** Es geht in der Studie darum den Umgang und die Erfahrungen mit

Mobiltelefonen wissenschaftlich zu untersuchen.

☐ **Kriterien**

- Geschlecht: M / W

- Alter (25-45): ____

- Mobilgerät mit Internetzugang? Ja / Nein

☐ **Studie:** Die Studie dauert eine Woche in der Sie kurze Fragen beantworten müssen. Sie

werden während des Tages von uns via SMS aufgefordert kurze Fragen zu beantworten.

Die Fragen können mit Hilfe des integrierten Mobiltelefon Browsers beantwortet werden.

☐ **Aufwandsentschädigung:** 20,- + 5,- EUR

☐ **Ablauf:** Als erstes führe ich mit Ihnen ein Vorinterview durch (Dauer: ca. 20 Minuten) bei

dem auch die technischen Details erläutert werden.

☐ **Ort:** _____

☐ **Datum / Zeit:** _____

☐ **Kontakt:** Woher haben wir diesen Kontakt

- Testpersonendatenbank

- Email-Aussendung:_____

- Mitarbeiter / Bekannte:_____

☐ **Telefonnummer:** Alexander Meschtscherjakov, 0662/8044-4813 (Elke -4815),

Mobil: 069914404510 mit Bitte um Absage, wenn was dazwischen kommt

☐ **Daten der Testpersonen:**

Name:_____

Telefonnummer:_____

Email:_____

Kamera am Mobiltelefon: Ja / Nein

Puffer-Testpersonen: Darüber informieren, dass der Test optional ist.

☐ **Gegebenenfalls:** Fragen, ob die Person noch weitere potentielle Testpersonen kennt

Figure C.1: Guidelines in German for recruiting participants for the pilot attachment study as described in Chapter 5.

Briefing „Mobile Studie"   **TP:**

Checkliste
- o *Die TP ist mit Ihrer Telefonnummer in der entsprechenden Datenbank eingetragen.*
- o *Kontaktdatenblatt*
- o *Eigenes Mobilgerät mit Internetzugang*
- o *Datenverwertungserlaubnis*
- o *Sensecam (aufgeladen & freier Speicher)*
- o *SenseCam Übergabebestätigung*
- o *Laptop mit einer Sequenz der SenseCam zum Vorführen und einer Bluetooth Schnittstele, um Bilder vom Mobilgerät auf den Laptop zu transferieren*
- o *Speicherkartenlesegerät (um eventuell Fotos von der Kamera zu transferieren)*

1. Begrüßung & Kontaktdatenblatt
Hallo (Name der Testperson)! Mein Name ist (Name des Testleiters) und ich möchte Ihnen dafür danken, dass Sie bei dieser Studie mitmachen. Bevor ich Ihnen den genauen Ablauf der Studie erkläre bitte ich Sie ein Kontaktdatenblatt auszufüllen.

- *TP füllt Kontaktdatenblatt aus.*

2. Briefing
Dieses Briefing wird ungefähr 20 Minuten dauern. Ich werde Ihnen zunächst die Studie erklären und anschließend einen Test direkt an Ihrem Mobilgerät durchführen. Danach führen wir noch ein kurzes Interview durch. Haben Sie bereits Fragen?

Sie nehmen an einer Studie zum Umgang von Personen mit Mobilgeräten Teil. Ziel der Studie ist es herauszufinden, wann Sie Ihr Mobilgerät stört und wann es Sie unterstützt. Wir wollen herausfinden, wie es Ihnen in bestimmten Situationen mit Ihrem Mobilgerät geht.

Der Test dauert 7 Tage. Ab morgen werden Sie für eine Woche lang jeden Tag 7 sogenannte „Fragen Samples" per SMS erhalten. Ein Sample besteht aus 4 sehr kurzen Fragen, wie beispielsweise „Wo befinden sie sich gerade?" oder „Wie geht es Ihnen?". Die Beantwortung der Fragen dauert im Schnitt weniger als eine Minute. Die Benachrichtigung ein Fragesample zu beantworten, erhalten Sie von uns via SMS. Diese SMS enthält einen Link dem Sie bitte folgen. Dadurch startet automatisch der im Mobilgerät integrierte Browser und führt Sie zur entsprechenden Seite. Dann können Sie die Fragen beantworten. Vergessen Sie nicht, den Browser anschließend wieder zu schließen.

Für die Teilnahme an der Studie erhalten Sie eine Aufwandsentschädigung von 25,- €.

3. Technische Einschulung
Ich werde Ihnen jetzt eine Probe-SMS schicken, damit Sie ein paar Probefragen beantworten können.

Die TP sollte wissen, wie Sie mit Ihrem Mobilgerät „ins Internet kommt" (Zugangsdaten, Einstellungen, ...).
Der Testleiter öffnet auf dem Center-Mobilgerät den Browser und ruft die folgende Site auf: http://xperience.icts.sbg.ac.at/rim/questionnaire.cgi?id=7
Auf dieser Site wählt er den Namen der aktuellen TP aus. Die TP wurde hier bereits vorher eingetragen! Dadurch wird der TP eine SMS geschickt, die einen Link zu einem Probesample

Figure C.2: Interview guide in German for the individual introduction sessions as used in the pilot attachment study in Chapter 5 – page 1/3

enthält. Die TP soll nun diesem Link folgen und die Fragen beantworten. Nach Beantwortung der Fragen kann die TP den Browser wieder schließen (Mobilgerät abhängig). Sollte der Test nach mehrmaligen Versuch nicht funktionieren, muss die TP abgelehnt werden.

Haben Sie hierzu noch Fragen?

4. Fotos mit Mobilgerät (falls Mobilgerät diese Funktion unterstützt)
Ist Ihr Mobilgerät mit einer Kamera ausgestattet?
Nein → *weiter mit 5.*
Ja →
Wie bereits erwähnt wollen wir mit dieser Studie Situationen erfassen, in denen Sie Ihr Mobilgerät unterstützt oder aber nicht so verhält, wie Sie es sich wünschen. Dazu benötigen wir auch Informationen über Ihre Umgebung. Wir bitten Sie Situationen (Ihre Umgebung, Sie sich selbst) zu fotografieren, in denen Sie sich über Ihr Mobilgerät freuen oder ärgern. Wir werden uns nach der Studie diese Fotos gemeinsam ansehen und ich werde Sie zu der jeweiligen Situation befragen, um die Situation besser verstehen zu können.

5. Sensecam (falls TP daran teilnimmt)
Um Ihr Umfeld während der Benutzung des Mobilgerätes besser verstehen zu können, bitten wir Sie ein neuartiges Produkt einen Tag lang während der Studie zu testen: Die SenseCam. Die SenseCam ist eine digitale Fotokamera mit einem Weitwinkelobjektiv, die ca. jede Minute automatisch ein Foto schießt. Zusätzlich können sie über einen Auslöser selber Fotos machen Wir bitten Sie diese Kamera einen Tag lang während des Tests zu tragen.

TL erklärt der TP die Funktionsweise der SenseCam. (Einschalten / Ausschalten, Auslöser)
TL zeigt der TP die SenseCam-Probesequenz.

Wir bitten Sie die SenseCam morgen nach dem Aufstehen einzuschalten und erst vor dem zu Bett gehen wieder auszuschalten. Es ist kein Problem die Kamera in bestimmten Situationen das Objektiv zu verdecken (Kamera einfach umdrehen).

Als Belohnung erhalten sie von uns eine CD „Ein Tag in meinem Leben". Sie besitzen dann eine CD, das ihr Leben an einem bestimmten Tag im Jahr 2007 widerspiegelt.

Wollen Sie daran Teilnehmen?
Nein → *weiter mit 6.*
Ja →

- *TL überreicht TP eine Sensecam*
- *TP unterschreibt Sensecam Übergabebestätigung*
- *TL & TP vereinbaren Ort und Termin der SenseCam Rückgabe*
  Ort: _____
  Zeit: _____

6. Datenverwertungserlaubnis
Um die von Ihnen zur Verfügung gestellten Daten (Text, mit Mobilgerät aufgenommene Bilder, SenseCam Bilder) werden anonym behandelt ausschließlich für diese Studie verwendet. Ich bitte Sie dafür diese Datenverwertungserlaubnis zu unterzeichnen.

- *TP unterzeichnet Datenverwertungserlaubnis*

Figure C.3: Interview guide in German for the individual introduction sessions as used in the pilot attachment study in Chapter 5 – page 2/3

7. Pre-interview
Abschließend noch ein kurzes Interview. Ich stelle Ihnen 5 Fragen zu Ihren bisherigen Erfahrungen mit Mobilgeräten:

1. Seit wann / wie lange benutzen Sie Ihr derzeitiges Mobilgerät und was ist ihr allgemeiner Eindruck?

2. Welche Funktionen nutzen Sie am meisten mit ihrem Mobilgerät? Wie oft nutzen Sie diese Dienste?

3. Was macht Ihr Mobilgerät so speziell für Sie?

4. Best 3: Welche 3 Eigenschaften gefallen Ihnen an ihrem Mobilgerät am Besten?

5. Worst 3: Welche 3 Eigenschaften gefallen Ihnen an ihrem Mobilgerät am wenigsten?

Vielen Dank

Figure C.4: Interview guide in German for the individual introduction sessions as used in the pilot attachment study in Chapter 5 – page 3/3

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Angaben zu Ihrer Person und ihre Kontaktdaten:

Nachname: ………..…………………………....….	Titel …………………………………….…...
Vorname: ………………………………………….	Nationalität: …..…………………………...……...
Straße: ……..…………………………………...	PLZ, Ort: ……………..…………….…..……………
Land …………………………………..………	Email: ………………………….............................
Geb. Datum: ………………………….......................	Telefon: …………..……......……….….....................

Geschlecht:	☐ Weiblich	☐ Männlich

Tätigkeiten:	
☐ Berufstätig:	Beruf: …..………………………………………………………… Branche:…………………………………………………………… Tätigkeit:…..
☐ Schule/ Studium:	Studienrichtung: ………………………………………..…..……… Schultyp: ……………………………………………………………
☐ in Pension:	Zuletzt ausgeübter Beruf: ………………………………….………
☐ arbeitssuchend	
☐ Sonstiges: …………………………………………………………………………..	

Höchste abgeschlossene Ausbildung:
☐ Pflichtschule (Volks-, Hauptschule)
☐ Berufschule/abgeschlossene Lehre
☐ Handels-/Fachschule ohne Matura
☐ Höhere Schule mit Matura
☐ Hochschule, Studium
  ☐ andere: ………………………….

Sprache	Muttersprache	Ausgezeichnete Kenntnisse (Wort & Schrift)	Sehr Gute Kenntnisse (Wort & Schrift)	Gute Kenntnisse (Wort/ Schrift)	Basis- Kenntnisse (Wort/ Schrift)
Deutsch	☐	☐	☐	☐	☐
Englisch	☐	☐	☐	☐	☐

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Figure C.5: Pre-questionnaire in German including demographics as used in the pilot attachment study in Chapter 5 – page 1/3

Welchen der folgenden Medien/Dienste nutzen sie wie oft?

Diverse Medien	Täglich	Mehrmals pro Woche	Einmal pro Woche	Mehrmals pro Monat	Einmal pro Monat	seltener	nie
Fernsehen	☐	☐	☐	☐	☐	☐	☐
Radio hören	☐	☐	☐	☐	☐	☐	☐
Lesen (Buch, Zeitung, usw.)	☐	☐	☐	☐	☐	☐	☐
CDs, Musikkassetten	☐	☐	☐	☐	☐	☐	☐
DVDs/ Videos ansehen	☐	☐	☐	☐	☐	☐	☐

Computer	Täglich	Mehrmals pro Woche	Einmal pro Woche	Mehrmals pro Monat	Einmal pro Monat	seltener	nie
PC nutzen	☐	☐	☐	☐	☐	☐	☐
Notebook/Laptop nutzen	☐	☐	☐	☐	☐	☐	☐
PDA/Handheld PC nutzen	☐	☐	☐	☐	☐	☐	☐
Computerspiele spielen	☐	☐	☐	☐	☐	☐	☐
Konsolenspiele spielen	☐	☐	☐	☐	☐	☐	☐

Internet	Täglich	Mehrmals pro Woche	Einmal pro Woche	Mehrmals pro Monat	Einmal pro Monat	seltener	nie
Internet privat nutzen	☐	☐	☐	☐	☐	☐	☐
Internet beruflich nutzen	☐	☐	☐	☐	☐	☐	☐
Mobiles Internet (Datenkarten)	☐	☐	☐	☐	☐	☐	☐
E-Mails schreiben	☐	☐	☐	☐	☐	☐	☐
Online-Auktionen (Ebay…)	☐	☐	☐	☐	☐	☐	☐
Internet-Telefonie	☐	☐	☐	☐	☐	☐	☐
Webradio	☐	☐	☐	☐	☐	☐	☐
Online-Games spielen	☐	☐	☐	☐	☐	☐	☐
Chatten/an Forum teilnehmen	☐	☐	☐	☐	☐	☐	☐
Online-Brokerage	☐	☐	☐	☐	☐	☐	☐
Online-Shopping	☐	☐	☐	☐	☐	☐	☐

Festnetztelefonie/ Mobiltelefon	Täglich	Mehrmals pro Woche	Einmal pro Woche	Mehrmals pro Monat	Einmal pro Monat	seltener	nie
Festnetz-Telefon nutzen	☐	☐	☐	☐	☐	☐	☐
Mit Handy telefonieren	☐	☐	☐	☐	☐	☐	☐
Video-telefonieren	☐	☐	☐	☐	☐	☐	☐
SMS schreiben	☐	☐	☐	☐	☐	☐	☐
Spiele spielen am Handy	☐	☐	☐	☐	☐	☐	☐
Fotografieren mit Handy	☐	☐	☐	☐	☐	☐	☐
Kalender am Handy nutzen	☐	☐	☐	☐	☐	☐	☐
Wecker am Handy nutzen	☐	☐	☐	☐	☐	☐	☐
Aufgabenliste am Handy nutz.	☐	☐	☐	☐	☐	☐	☐
Rechner am Handy nutzen	☐	☐	☐	☐	☐	☐	☐

Figure C.6: Pre-questionnaire in German including demographics as used in the pilot attachment study in Chapter 5 – page 2/3

Internet-Dienste am Handy	☐	☐	☐	☐	☐	☐	☐
Musik am Handy hören	☐	☐	☐	☐	☐	☐	☐
Mit Handy bezahlen	☐	☐	☐	☐	☐	☐	☐

Portable Geräte	Täglich	Mehrmals pro Woche	Einmal pro Woche	Mehrmals pro Monat	Einmal pro Monat	seltener	nie
Digitalen Fotoapparat nutzen	☐	☐	☐	☐	☐	☐	☐
Digitale Videokamera nutzen	☐	☐	☐	☐	☐	☐	☐
MP3-Player nutzen (zB. iPod)	☐	☐	☐	☐	☐	☐	☐
DVD-portable nutzen	☐	☐	☐	☐	☐	☐	☐

Nutzen Sie Ihr Handy um Web zu surfen?	
☐ ja	☐ nein

Nutzen Sie Ihr Handy um Emails zu empfangen?	
☐ ja	☐ nein

Nutzen Sie Ihr Handy um Emails zu versenden?	
☐ ja	☐ nein

Nutzen Sie Ihr Handy als PDA?	
☐ ja	☐ nein

Welchen Standard nutzen Sie zur Datenübertragung?					
☐ GSM	☐ GPRS	☐ UMTS	☐ WLAN	☐ Weiss nicht	☐ Keine

Mobiltelefon/e:		
☐ Ja, Handy1:	Marke ……………………………	Modell ..………..………………………
	Typ: ☐ GSM/GPRS Handy ☐ UMTS Handy	
	Handy-Bindung:	☐ Ohne Bindung (vertragsfrei)
		☐ Mit Vertrag oder SIM-Lock
		☐ Wertkarte
	Hauptnutzung:	☐ Allgemein
		☐ Privat
		☐ Geschäftlich
☐ Ja, Handy2:	Marke ……………………………	Modell ..………..………………………
	Typ: ☐ GSM/GPRS Handy ☐ UMTS Handy	
	Handy-Bindung:	☐ Ohne Bindung (vertragsfrei)
		☐ Mit Vertrag oder SIM-Lock
		☐ Wertkarte
	Hauptnutzung:	☐ Allgemein
		☐ Privat
		☐ Geschäftlich

Vielen Dank!

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Figure C.7: Pre-questionnaire in German including demographics as used in the pilot attachment study in Chapter 5 – page 3/3

Datenverwertungserlaubnis/Verpflichtungserklärung
„Mobile Studie"

TP Nr.: _____

Salzburg,
Mai 2007

Liebe/r Teilnehmer/in!

Diese Studie wird vom ICT&S Center (Advanced Studies and Research in Information and Communication Technologies & Society) der Universität Salzburg durchgeführt; die verantwortliche Kontaktperson ist DI Alexander Meschtscherjakov.

Ich erkläre mich damit einverstanden, dass sämtliche Daten (Text, Bilder, Videos), die ich während der Studie zur Verfügung stelle, für Analysezwecke bzw. zur Erarbeitung der entsprechenden Untersuchungsergebnisse sowie als Grundlage für wissenschaftliche Ausarbeitungen verwendet werden dürfen.

Wir verpflichten uns, sämtliche Daten ausschliesslich für wissenschaftliche Zwecke zu verwenden und die Ergebnisse nicht an Dritte weiterzugeben. Die anonymisierten Ergebnisse der Studie werden ausschliesslich dem Auftraggeber präsentiert, der sich ebenfalls verpflichtet diese nicht an Dritte weiterzugeben.

Name in Blockbuchstaben: _____

Unterschrift: _____

Bestätigung: DI Alexander Meschtscherjakov (Kontaktperson ICT&S Center).
Rückfragen: Tel. +43-662-8044-4813, Email: alexander.meschtscherjakov@sbg.ac.at

Unterschrift: _____

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Figure C.8: Permission to use data form in German which had to be signed from each participant in the the pilot attachment study in Chapter 5

Abschlussinterview „Mobile Studie" TP: _____

Teilnehmer: _____
Datum: _____
Uhrzeit: _____
Ort: _____
Forscher _____

TP: _____
Testzeitraum: _____
Handy _____

Fotos mit Handy gemacht: Ja Nein
Sensecam: Ja Nein

Ablauf
- Begrüßung
- Dauer: ca. 1 Stunde
- TL macht Foto vom Mobiltelefon
- TL fragt, ob er das Gespräch aufzeichnen darf und startet die Aufzeichnung
- TL erklärt den Ablauf:
  - Allgemeine Fragen zur Nutzung von Mobiltelefonen
  - Studie bezogene Fragen

Allgemeine Fragen

Macht Ihr Mobiltelefon Ihr Leben einfacher oder komplizierter (Warum?)
Hilfe:
    Erreichbarkeit?
    Benutzerfreundlichkeit?
    Applikationen (Kalender, Wecker, Reminder, Internet)

Haben Sie schon Mobiltelefone von verschiedenen Herstellern verwendet? Welche? Warum?

Ergänzen sie den folgenden Satz: *Ich mag mein Mobiltelefon, weil …*

Ergänzen sie den folgenden Satz: *Ich mag mein Mobiltelefon nicht, weil …*

Was gefällt Ihnen am Design Ihres Mobilgerätes?

Wie fühlt sich Ihr Mobiltelefon in Ihrer Hand an?

Gefällt Ihnen der Bildschirmdarstellung Ihres Mobiltelefons?
Was haben Sie verändert, damit es Ihnen besser gefällt?

Figure C.9: Post interview guideline in German as used in the pilot attachment study in Chapter 5 – page 1/4

Zeigen Sie Ihr Mobiltelefon gerne anderen Leuten? (Was zeigen Sie Ihnen?)
Hilfe: Das Gerät selbst, Fotos, Applikationen …
Freuen Sie sich, wenn Sie auf Ihr Mobiltelefon angesprochen werden?

Welche Inputmöglichkeiten hat Ihr Telefon?
  1. Zifferntastatur
  2. QUERTY Tastatur
  3. Touchscreen

Verwenden Sie die Eingabemöglichkeit T9? (Warum? Warum nicht?)

Wofür (Kalender, Telefonbuch, SMS, Email, …) verwenden Sie welchen Texteingabemodus (z.B. T9) bei Ihrem Mobiltelefon?

Sind Sie mit den Eingabemöglichkeiten zufrieden? (wenn nein, warum nicht?)

Welcher Dienst fehlt Ihnen an Ihrem Mobilgerät?
Hilfe: Denken Sie an Dienste / Applikationen, die Sie beispielsweise an einem PC nutzen?
  Skype
  Welche SW wurde zusätzlich installiert?

Gibt es Zeiten, in denen Sie Ihr Mobilgerät häufiger als sonst benutzen?
Hilfe:
  Weihnachten
  Neujahr
  Geburtstage
  Urlaub
  Ausland

Welchen Service benutzen Sie in diesen Zeiten vor allem?
Hilfe:
  SMS
  MMS
  Telefon
  Email

Gibt es eine Zeitspanne / Zeiten, in der / denen Sie nicht durch Ihr Mobilgerät gestört werden wollen? (spezielles Profil?)
Hilfe:
  Morgens
  Vormittag
  Nachmittag
  Abend
  Nacht (Ausschalten?)
  Wochenende / Feiertag
  Wochentags

Fragen über Ausdrücke zur emotionalen Bindung

Mit welchen 5 (emotionalen) Begriffen würden Sie Ihr Mobiltelefon beschreiben?

Figure C.10: Post interview guideline in German as used in the pilot attachment study in Chapter 5 – page 2/4

Ergänzen Sie folgenden Satz: Ich empfinde mein Handy als:

Hässlich	Schön	weder noch
Stilvoll	Stillos	weder noch
Minderwertig	Wertvoll	weder noch
Nicht vorzeigbar	Herzeigbar	weder noch
Einfach	Kompliziert	weder noch
Praktisch	Unpraktisch	weder noch
Gut	Schlecht	weder noch
Innovativ	Konservativ	weder noch
Isolierend	Verbindend	weder noch
Leuten näher bringend	Von Leuten distanzierend	weder noch
Verwirrend	Übersichtlich	weder noch
Neuartig	Herkömmlich	weder noch
Widerspenstig	Handhabbar	weder noch
Sympathisch	Unsympathisch	weder noch
Abstoßend	Anziehend	weder noch
Lahm	Fesselnd	weder noch

Haben Sie Ihrem Mobilgerät einen Namen gegeben? Haben Sie anderen Geräten einen Namen gegeben (Auto, Computer, Laptop, Ipod, …) Warum?

Was würde Ihnen am meisten fehlen, wenn Sie Ihr Mobilgerät verlieren würden?

Fragen zur Methode

Was hat Ihnen an der Studie gefallen? (Erfahrungen)

Was hat Ihnen an der Studie nicht gefallen? (Erfahrungen)

Was würden Sie an der Studie abändern/verbessern?

Wie hoch waren Ihre tatsächlichen Kosten? (Welchen Tarif hat TP?)

Wie hoch empfinden Sie den Gesamtaufwand der Beantwortung der Fragen für Sie?
War die Dauer der Studie (eine Woche) für Sie zu lange oder wäre eine längerer Zeitraum auch möglich? Unter welchen Umständen?
Tipp: (Weniger Fragesample pro Tag, Keine Fragen am Wocheende, …)

War die Anzahl der Fragesamples pro Tag (7) zu hoch oder wären mehr Fragen pro Tag auch möglich? Unter welchen Umständen?

War die Anzahl Fragen pro Sample (4) zu hoch oder wären mehr Fragen pro Sample auch möglich? Unter welchen Umständen?

Wie lange haben Sie im Schnitt für die Beantwortung eines Samples gebraucht?

[Fragen nicht beantwortet]

Figure C.11: Post interview guideline in German as used in the pilot attachment study in Chapter 5 – page 3/4

TL sucht aus Testergebnissen diejenigen Fragesamples heraus, auf die keine Antwort gekommen ist.

Warum haben Sie auf dieses Fragesample keine Antwort gegeben?

Würden Sie noch einmal bei dieser Studie mitmachen?

Fragen zu (nicht) gemachten Fotos

Möglichkeiten:
1. TP hat kein Foto gemacht → weiter mit A
2. TP hat Fotos gemacht: (**Fotos auf PC überspielen**!)
   - TP hat ein Foto gemacht ohne Korrelation zu ESM → weiter mit B
   - TP hat ein Foto gemacht zum Zeitpunkt eines ESM Samples → weiter mit C

A: [Emotion <-> Kontext: ohne Foto]
Können Sie sich an eine Situation erinnern, in der Sie sich besonders über Ihr Mobilgerät gefreut oder geärgert haben? Beschreiben Sie diese Situation.

B: [Emotion <-> Kontext: ohne ESM Korrelation]
Fotos ansehen, die die Testperson mit Ihrer Kamera gemacht hat und nach der jeweiligen Situation fragen. Warum haben Sie sich in diesem Moment über Ihr Mobiltelefon gefreut / geärgert?

Foto: _____
Dateiname: _____
Datum / Zeit: _____

C: [Emotion <-> Kontext: mit ESM Korrelation]
Foto der TP mit demselben Zeitpunkt des ESM Samples vergleichen. TP soll Situation beschreiben. Warum haben Sie sich in diesem Moment über Ihr Mobiltelefon gefreut / geärgert?

Foto: _____
Dateiname: _____
Datum / Zeit: _____
Fragesample: _____

Abschluß

Einladung zum Workshop am Mi. 1.8. oder Do 2.8. um 17:00 Uhr
Dauer: 3 Stunden
Aufwandsentschädigung: 10.- €

TL Überreicht TP 25.- € Aufwandsentschädigung (Unterschrift).

Vielen Dank!

Figure C.12: Post interview guideline in German as used in the pilot attachment study in Chapter 5– page 4/4

Appendix BlackBerry Attachment Study

This appendix provides study material presented in the BlackBerry attachment study presented in Chapter 6. It includes:

➤ Workshop questionnaire including FeatMo regarding the own mobile device (Figure D.1-D.3) – in German

➤ AttrakDiff regarding the new BlackBerry device (Figure D.4) – in German

➤ Post interview guideline (Figure D.5-D.6) – in German

➤ FeatMo regarding the new BlackBerry device (Figure D.7) – in German

ICT&S Center

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Angaben zu Ihrer Person

Nachname (Titel)	Geb. Datum:
…………..………………………………...….	……………………………………….……..
Vorname:	Nationalität:
………………………………………………	…..………………….……….……...……..
Straße:	PLZ, Ort:
……..……………………………………....	……………..……………...………………

Geschlecht:	☐ Weiblich	☐ Männlich

Aktuelle Tätigkeiten:	
☐ Berufstätig:	Beruf: …..………………………………………………………………
	Tätigkeit:…..
☐ Schule/ Studium:	Studienrichtung: ………………………………………………...………
	Schultyp: ………………………………………………………………
☐ in Pension:	Zuletzt ausgeübter Beruf: ……………………………………………
☐ arbeitssuchend	
☐ Sonstiges: ……………………………………………………………………………..	

Höchste abgeschlossene Ausbildung:	
☐ Pflichtschule (Volks-, Hauptschule)	☐ Höhere Schule mit Matura
☐ Berufschule/abgeschlossene Lehre	☐ Hochschule, Studium
☐ Handels-/Fachschule ohne Matura	☐ andere: ………………………….

Sprache	Muttersprache	Ausgezeichnete Kenntnisse	Sehr Gute Kenntnisse	Gute Kenntnisse	Basis-Kenntnisse
Deutsch	☐	☐	☐	☐	☐
Englisch	☐	☐	☐	☐	☐

BlackBerry-Vorerfahrung: Ich habe schon einmal....
☐ .... von BlackBerry gehört.
☐ .... ein BlackBerry benutzt.
☐ .... ein BlackBerry besessen.
☐ .... überlegt ein BlackBerry zu kaufen.

Welchen der folgenden Medien/Dienste nutzen sie wie oft?

Internet	Täglich	mehrmals pro Woche	mehrmals pro Monat	seltener	nie
Internet privat nutzen	☐	☐	☐	☐	☐
Internet beruflich nutzen	☐	☐	☐	☐	☐
Internet mobil nutzen	☐	☐	☐	☐	☐
E-Mails lesen / schreiben	☐	☐	☐	☐	☐
Chatten / Forenteilnahme	☐	☐	☐	☐	☐

TP: ____   1

Figure D.1: Original questionnaire in German as used in the initial workshop of BlackBerry attachment study – socio-demographic and mobile usage data – page 1/3

Computer	täglich	mehrmals pro Woche	mehrmals pro Monat	seltener	nie
PC nutzen	☐	☐	☐	☐	☐
Notebook/Laptop nutzen	☐	☐	☐	☐	☐
PDA/Handheld PC nutzen	☐	☐	☐	☐	☐
Computerspiele spielen	☐	☐	☐	☐	☐

Festnetztelefonie/ Mobiltelefon	täglich	mehrmals pro Woche	mehrmals pro Monat	seltener	nie
Festnetz-Telefon nutzen	☐	☐	☐	☐	☐
Mit Handy telefonieren	☐	☐	☐	☐	☐
SMS schreiben	☐	☐	☐	☐	☐
Spiele spielen am Handy	☐	☐	☐	☐	☐
Fotografieren mit Handy	☐	☐	☐	☐	☐
Kalender am Handy nutzen	☐	☐	☐	☐	☐
Wecker am Handy nutzen	☐	☐	☐	☐	☐
Aufgabenliste am Handy nutzen	☐	☐	☐	☐	☐
Rechner am Handy nutzen	☐	☐	☐	☐	☐
Internet am Handy	☐	☐	☐	☐	☐
Musik am Handy hören	☐	☐	☐	☐	☐
Emails empfangen	☐	☐	☐	☐	☐
Emails versenden	☐	☐	☐	☐	☐

Aktuelle(s) Mobiltelefon/e:

☐ Ja, Handy1:	Marke	Modell
	…………………………………	..…………..………………………
Im Besitz seit:	Typ: ☐ GSM/GPRS Handy ☐ UMTS Handy	
	Handy-Bindung:	☐ Ohne Bindung (vertragsfrei)
		☐ Mit Vertrag oder SIM-Lock
_____		☐ Wertkarte
	Hauptnutzung:	☐ Beides
		☐ Privat
		☐ Geschäftlich
☐ Ja, Handy2:	Marke	Modell
	…………………………………	..…………..………………………
Im Besitz seit:	Typ: ☐ GSM/GPRS Handy ☐ UMTS Handy	
	Handy-Bindung:	☐ Ohne Bindung (vertragsfrei)
		☐ Mit Vertrag oder SIM-Lock
_____		☐ Wertkarte
	Hauptnutzung:	☐ Beides
		☐ Privat
		☐ Geschäftlich

Figure D.2: Original questionnaire in German as used in the initial workshop of BlackBerry attachment study – socio-demographic and mobile usage data – page 2/3

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Bitte bewerten Sie die folgenden Aussagen:

(es geht dabei um Ihr aktuelles [Haupt-]Handy...)

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Mein Handy ist schön.	☐	☐	☐	☐	☐
Der Wert meines Handys ist nicht mit Geld aufzuwiegen.	☐	☐	☐	☐	☐
Aussehen und Image meines Handys sind unwichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich unwohl, wenn jemand anderes mein Handy benutzt.	☐	☐	☐	☐	☐
Ich erinnere mich gerne an den Moment als ich mein Handy zum ersten Mal in der Hand hielt.	☐	☐	☐	☐	☐
Ich mag die Klingeltöne auf meinem Handy.	☐	☐	☐	☐	☐
Mein Handy ist nicht wichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich mit meinem Handy emotional verbunden.	☐	☐	☐	☐	☐
Ich investiere viel Zeit und Energie, um mein Handy einzigartig zu machen.	☐	☐	☐	☐	☐
Ich mag das Hintergrundbild bzw. Thema meines Handys.	☐	☐	☐	☐	☐
Mein Handy ist ein wichtiger Teil von mir.	☐	☐	☐	☐	☐
Mein Handy hat keine spezielle Bedeutung für mich.	☐	☐	☐	☐	☐
Ich informiere mich intensiv, um die Möglichkeiten meines Handys voll auszuschöpfen.	☐	☐	☐	☐	☐
Mein Handy passt zu meiner Persönlichkeit.	☐	☐	☐	☐	☐
Ich habe mein Handy immer bei mir.	☐	☐	☐	☐	☐
Wenn ich mein Handy verlieren würde, wäre ich traurig.	☐	☐	☐	☐	☐
Es macht mir Spaß mein Handy zu benutzen.	☐	☐	☐	☐	☐
Mein Handy ist ein Statussymbol für mich.	☐	☐	☐	☐	☐
Ohne mein Handy würde mir etwas fehlen.	☐	☐	☐	☐	☐
Mit meinem Handy verbinde ich positive Gedanken und Gefühle.	☐	☐	☐	☐	☐
Mein Alltag wäre auch ohne mein Handy möglich.	☐	☐	☐	☐	☐
Ich mag mein Handy.	☐	☐	☐	☐	☐
Ich habe meinem Handy eine individuelle Note verpasst.	☐	☐	☐	☐	☐
Für mich ist mein Handy mehr als nur ein technisches Gerät.	☐	☐	☐	☐	☐
Ich würde mein Handy an meine Freunde weiterempfehlen.	☐	☐	☐	☐	☐
Wenn ich mein Handy nicht finden kann, werde ich panisch.	☐	☐	☐	☐	☐
Ich habe mein Handy mit einem individuellen Klingelton ausgestattet.	☐	☐	☐	☐	☐
Ich könnte mir ein Leben ohne mein Handy nicht mehr vorstellen.	☐	☐	☐	☐	☐
Es ist für mich wichtig ein topaktuelles Modell zu besitzen.	☐	☐	☐	☐	☐

Vielen Dank!

TP: ____   3

Figure D.3: Original questionnaire in German as used in the initial workshop of BlackBerry attachment study – FeatMo regarding own mobile device – page 3/3

Fragebogen zum ersten Eindruck (AttrakDiff)   TP Nr.: _____
BlackBerry Studie   Salzburg, Juni/Juli 2008

Bitte geben Sie mit Hilfe der folgenden Wortpaare Ihren Eindruck zum BlackBerry wieder. Kreuzen Sie bitte die entsprechenden Kästchen ohne lang Nachzudenken an.

Ich finde das BlackBerry …

menschlich	☐	☐	☐	☐	☐	☐	technisch
isolierend	☐	☐	☐	☐	☐	☐	verbindend
angenehm	☐	☐	☐	☐	☐	☐	unangenehm
originell	☐	☐	☐	☐	☐	☐	konventionell
einfach	☐	☐	☐	☐	☐	☐	kompliziert
fachmännisch	☐	☐	☐	☐	☐	☐	laienhaft
hässlich	☐	☐	☐	☐	☐	☐	schön
praktisch	☐	☐	☐	☐	☐	☐	unpraktisch
sympathisch	☐	☐	☐	☐	☐	☐	unsympathisch
umständlich	☐	☐	☐	☐	☐	☐	direkt

stilvoll	☐	☐	☐	☐	☐	☐	stillos
voraussagbar	☐	☐	☐	☐	☐	☐	unberechenbar
minderwertig	☐	☐	☐	☐	☐	☐	wertvoll
ausgrenzend	☐	☐	☐	☐	☐	☐	einbeziehend
bringt mich Leuten näher	☐	☐	☐	☐	☐	☐	Trennt mich von Leuten
nicht vorzeigbar	☐	☐	☐	☐	☐	☐	vorzeigbar
zurückweisend	☐	☐	☐	☐	☐	☐	einladend
phantasielos	☐	☐	☐	☐	☐	☐	kreativ
gut	☐	☐	☐	☐	☐	☐	schlecht

verwirrend	☐	☐	☐	☐	☐	☐	übersichtlich
abstoßend	☐	☐	☐	☐	☐	☐	anziehend
mutig	☐	☐	☐	☐	☐	☐	vorsichtig
innovativ	☐	☐	☐	☐	☐	☐	konservativ
lahm	☐	☐	☐	☐	☐	☐	fesselnd
harmlos	☐	☐	☐	☐	☐	☐	herausfordernd
motivierend	☐	☐	☐	☐	☐	☐	entmutigend
neuartig	☐	☐	☐	☐	☐	☐	herkömmlich
widerspenstig	☐	☐	☐	☐	☐	☐	handhabbar

Figure D.4: Original AttrakDiff in German regarding the BlackBerry device as used in the initial workshop, as well as the final interview of the BlackBerry attachment study

Abschlussinterview „RIM Studie"

TP: _____   Datum / Uhrzeit :_____

Checkliste:
- o *Datenblatt aus Workshop – auf Vollständigkeit überprüft*
- o *Loggingdaten der jeweiligen TP*
- o *Laptop (Windows) um Kontaktdaten zu überspielen*
- o *Diktiergerät (aufgeladen? Freier Speicher?)*
- o *Geld und Erhaltsbestätigungen*
- o *AttrakDiff Fragebogen*
- o *FeatMo Fragebogen*
- o *BFI-10 Fragebogen*
- o *Zettel mit „Ene meine ..."*
- o *Stoppuhr*

- • Begrüßung
- • Dauer: ca. 1 – 1,5 Stunden
- • TL fragt, ob er das Gespräch aufzeichnen darf?   JA   NEIN
- • TL erklärt den Ablauf:
    - o Interview mit Fragen zum BlackBerry und zur Studie
    - o 3 Fragebögen sind auszufüllen
    - o Daten vom BB werden auf das eigene Handy überspielt und die Umleitung wird aufgehoben

Interview:
1. **TP füllt restliche Datenblatt Infos aus:**

   Wieviel darf ein neues Handy für Sie kosten?

2. **TP überreicht BB an Testleiter -> Daten auslesen**

3. **TP überreicht Tagebuch an Testleiter**

4. **AttrakDiff BB Fragebogen**

5. **EmoAtt BB Fragebogen**

6. **Diktiergerät einschalten!**

7. **Fragen zu Logging Daten -> auf Logging Sheet**

8. Wie sind sie mit der Tastatur zurechtgekommen? (SureType vs. Mehrfachtippen bzw. QWERTY) – Ab wann haben sie sich an die Tastatur gewöhnt?

9. Haben sie viel mit der Tastatur gemacht?

10. **Übung: „Ene Meine ..." (SureType vs. Mehrfachtippen?)**

11. Was fehlt Ihnen am BlackBerry?

1

Figure D.5: Original post interview guideline in German as used in the final interview of the BlackBerry attachment study – page 1/2

12. Vergleichen sie das BlackBerry mit Ihrem eigenem Handy? (z.B. Design, Funktionen, Beschäftigungsdauer, Personalisierung, ...) Warum?

13. Gab es Zeiten in denen Sie Ihr BlackBerry besonders mochten bzw. nicht mochten?

14. Gab es Zeiten in denen Ihr BlackBerry besonders wichtig für Sie war?

15. Was haben Sie an Ihrem BlackBerry verändert? (Hintergrundbild, Thema, Klingelton)

16. Ist es wichtig für Sie, dass Ihr Handy etwas Besonderes ist? Wenn ja: Was macht ein Handy für Sie zu etwas Besonderem?

17. Haben Sie Ihrem BlackBerry einen Namen gegeben? Haben Sie anderen Geräten einen Namen gegeben (Auto, Computer, Laptop, Ipod, anderes Handy?) Warum?

18. Wird Ihnen etwas fehlen, jetzt wo Sie Ihr BlackBerry zurückgeben müssen? Was?

19. Was müsste Ihr BlackBerry können, damit Sie es nur schweren Herzens wieder hergeben würden?

20. Wieviel wäre Ihr BlackBerry für Sie jetzt wert?

21. Was hat Ihnen an der Studie gefallen bzw. nicht gefallen?

22. Wie hoch empfinden sie den aufwand für die Beantwortung der Fragen:

    Dauer: 8 Wochen

    Anzahl der Fragesamples pro Tag: 3

    Anzahl Fragen pro Sample: ca 5-6

23. Würden Sie noch einmal bei dieser Studie mitmachen?

24. Tagebuch auf Verständlichkeit überprüfen

25. BFI-10 Fragebogen ausfüllen

26. Wurden Daten Übertragen? Eventuell Daten ausdrucken! Daten löschen!

27. Umleitung aufheben!

TL Überreicht TP 60.- € Aufwandsentschädigung (Unterschrift)

Sind sie damit einverstanden in die TP Datenbank aufgenommen zu werden? JA NEIN

Gibt es noch etwas von Ihrer Seite?

Vielen Dank!

Figure D.6: Original post interview guideline in German as used in the final interview of the BlackBerry attachment study – page 2/2

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Bitte bewerten Sie die folgenden Aussagen:

(es geht dabei um Ihr BlackBerry...)

	Stimme sehr zu	Stimme eher zu	Neutral	Stimme eher nicht zu	Stimme gar nicht zu
Mein BlackBerry ist schön.	☐	☐	☐	☐	☐
Der Wert meines BlackBerrys ist nicht mit Geld aufzuwiegen.	☐	☐	☐	☐	☐
Aussehen und Image meines BlackBerrys sind unwichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich unwohl, wenn jemand anderes mein BlackBerry benutzt.	☐	☐	☐	☐	☐
Ich erinnere mich gerne an den Moment als ich mein BlackBerry zum ersten Mal in der Hand hielt.	☐	☐	☐	☐	☐
Ich mag die Klingeltöne auf meinem BlackBerry.	☐	☐	☐	☐	☐
Mein BlackBerry ist nicht wichtig für mich.	☐	☐	☐	☐	☐
Ich fühle mich mit meinem BlackBerry emotional verbunden.	☐	☐	☐	☐	☐
Ich investiere viel Zeit und Energie, um mein BlackBerry einzigartig zu machen.	☐	☐	☐	☐	☐
Ich mag das Hintergrundbild bzw. Thema meines BlackBerrys.	☐	☐	☐	☐	☐
Mein BlackBerry ist ein wichtiger Teil von mir.	☐	☐	☐	☐	☐
Mein BlackBerry hat keine spezielle Bedeutung für mich.	☐	☐	☐	☐	☐
Ich informiere mich intensiv, um die Möglichkeiten meines BlackBerrys voll auszuschöpfen.	☐	☐	☐	☐	☐
Mein BlackBerry passt zu meiner Persönlichkeit.	☐	☐	☐	☐	☐
Ich habe mein BlackBerry immer bei mir.	☐	☐	☐	☐	☐
Wenn ich mein BlackBerry verlieren würde, wäre ich traurig.	☐	☐	☐	☐	☐
Es macht mir Spaß mein BlackBerry zu benutzen.	☐	☐	☐	☐	☐
Mein BlackBerry ist ein Statussymbol für mich.	☐	☐	☐	☐	☐
Ohne mein BlackBerry würde mir etwas fehlen.	☐	☐	☐	☐	☐
Mit meinem BlackBerry verbinde ich positive Gedanken und Gefühle.	☐	☐	☐	☐	☐
Mein Alltag wäre auch ohne mein BlackBerry möglich.	☐	☐	☐	☐	☐
Ich mag mein BlackBerry.	☐	☐	☐	☐	☐
Ich habe meinem BlackBerry eine individuelle Note verpasst.	☐	☐	☐	☐	☐
Für mich ist mein BlackBerry mehr als nur ein technisches Gerät.	☐	☐	☐	☐	☐
Ich würde mein BlackBerry an meine Freunde weiterempfehlen.	☐	☐	☐	☐	☐
Wenn ich mein BlackBerry nicht finden kann, werde ich panisch.	☐	☐	☐	☐	☐
Ich habe mein BlackBerry mit einem individuellen Klingelton ausgestattet.	☐	☐	☐	☐	☐
Ich könnte mir ein Leben ohne mein BlackBerry nicht mehr vorstellen.	☐	☐	☐	☐	☐
Es ist für mich wichtig ein topaktuelles BlackBerry Modell zu besitzen.	☐	☐	☐	☐	☐

Vielen Dank!

TP: _____

Figure D.7: Original FeatMo questionnaire in German regarding the BlackBerry device as used in the final interview of the BlackBerry attachment study

Appendix MP3 Player Attachment Study

This appendix provides the original MP3 FeatMo questionnaire in German as used in the MP3 player attachment study presented in Chapter 7.

Statement	1	2	3	4	5
Mein MP3 Player ist schön.[L]	O	O	O	O	O
Der Wert meines MP3 Players ist nicht mit Geld aufzuwiegen.[S]	O	O	O	O	O
Aussehen und Image meines MP3 Players sind unwichtig für mich.[S]	O	O	O	O	O
Ich fühle mich unwohl, wenn jemand anderes meinen MP3 Player benutzt.[E]	O	O	O	O	O
Ich erinnere mich gerne an den Moment als ich meinen MP3 Player zum ersten Mal in der Hand hielt.[E]	O	O	O	O	O
Ich mag die Musikauswahl auf meinem MP3 Player.[L]	O	O	O	O	O
Mein MP3 Player ist nicht wichtig für mich.[I]	O	O	O	O	O
Ich fühle mich mit meinem MP3 Player emotional verbunden.[DQ]	O	O	O	O	O
Ich investiere viel Zeit und Energie, um meinen MP3 Player einzigartig zu machen.[P]	O	O	O	O	O
Ich mag wie ich meinen MP3 Player gestaltet habe bzw. wie er gestaltet ist.[L]	O	O	O	O	O
Mein MP3 Player ist ein wichtiger Teil von mir.[I]	O	O	O	O	O
Mein MP3 Player hat keine spezielle Bedeutung für mich.[S]	O	O	O	O	O
Ich informiere mich intensiv, um die Möglichkeiten meines MP3 Players voll auszuschöpfen.[P]	O	O	O	O	O
Mein MP3 Player passt zu meiner Persönlichkeit.[P]	O	O	O	O	O
Ich habe meinen MP3 Player immer bei mir.[I]	O	O	O	O	O
Wenn ich meinen MP3 Player verlieren würde, wäre ich traurig.[E]	O	O	O	O	O
Es macht mir Spaß meinen MP3 Player zu benutzen.[L]	O	O	O	O	O
Mein MP3 Player ist ein Statussymbol für mich.[S]	O	O	O	O	O
Ohne meinen MP3 Player würde mir etwas fehlen.[I]	O	O	O	O	O
Mit meinem MP3 Player verbinde ich positive Gedanken und Gefühle.[E]	O	O	O	O	O
Mein Alltag wäre auch ohne meinen MP3 Player möglich.[I]	O	O	O	O	O
Ich mag meinen MP3 Player.[L]	O	O	O	O	O
Ich habe auf meinem MP3 Player individuelle Playlisten angelegt.[P]	O	O	O	O	O
Für mich ist mein MP3 Player mehr als nur ein technisches Gerät.[S]	O	O	O	O	O
Ich würde meinen MP3 Player an meine Freunde weiterempfehlen.[L]	O	O	O	O	O
Wenn ich meinen MP3 Player nicht finden kann, werde ich panisch.[E]	O	O	O	O	O
Ich habe meinen MP3 Player individualisiert (neue Kopfhörer, Tasche, ...).[P]	O	O	O	O	O
Ich könnte mir ein Leben ohne meinen MP3 Player nicht mehr vorstellen.[I]	O	O	O	O	O
Es ist für mich wichtig ein topaktuelles Modell zu besitzen.[S]	O	O	O	O	O

Table E.1: FeatMo questionnaire adapted to MP3 players in German

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[L]Likability; [I]Importance; [P]Personalization; [S]Symbolism; [E]Emotion; [DQ]Direct Question

Curriculum Vitae

Name		DI Alexander Meschtscherjakov
Address		Nikolaus-Lenau-Str. 1
		5020 Salzburg
		Austria
Date of birth		12. 09. 1972
Place of birth		Salzburg
Citizenship		Austrian
Education	1979-1983	Volksschule Lehen II (Elementary school)
and training	1983-1991	Bundesgymnasium Salzburg II (Grammar school)
	14.06.1991	Reifeprüfung mit ausgezeichnetem Erfolg (Final examination graduated with highest distinction)
	1991-1992	Mandatory military service
	01.04.1992	Promoted corporal
University	1992-2003	Study of mathematics (University of Salzburg)
studies	1992-2003	Study of computer science (University of Salzburg)
	19.12.2003	Master's degree in computer science, area of concentration applied computer science (University of Salzburg)
	2006-2010	Doctoral program (University of Salzburg)
Work	1989-1998	Various project collaborations (e.g., IBM Salzburg)
experience	1995-1998	Computer and network administrator at the department of Mathematics (University of Salzburg)
	1998-2001	System administrator at "Keywi Music" (Salzburg)
	2001-2008	Disc jockey at "Antenne Salzburg" radio station

	2003-2008	Founder and owner of the event and visions agency "2vision" (Salzburg)
	2007-2008	HCI Research Fellow at the ICT&S Center (University of Salzburg)
	since 2008	Research and teaching assistant (HCI & Usability Unit) at the ICT&S Center (University of Salzburg)
Project activities (selected)	2007-2008	"Emotional attachment to mobile devices & services" in cooperation with Research In Motion Limited
	2008-2009	EU funded FP6 project (IP) "Citizen Media" on UX evaluation of novel audio-visual applications
	2008-2009	"Contextual interfaces within a semi-conductor factory" in cooperation with Infineon Technologies Austria AG
	2009-2010	"BlackBerry work efficiency study" in cooperation with Mobilkom Austria AG
	2009-2010	"Contextual experience sampling" in cooperation with T-Laboratories Berlin
	since 2009	Christian Doppler Laboratory "Contextual Interface" in cooperation with Audio Mobil Elektronik GmbH and Infineon Technologies Austria AG
	2010-2011	National funded ways2go project "ELVIS" on psychosocial barriers of traffic information systems
Conference organization	2007	Local organizing team: ACE 2007 - Conference on Advances in Computer Entertainment and Technology 13.-15.6.2007, Salzburg, Austria
	2008	Local organizing team: EuroITV 2008 - European Conference on Interactive Television 3.-4.7.2008, Salzburg, Austria
	2009	Local chair: AmI2009 - European Conference on Ambient Intelligence 18.-21.11.2009, Salzburg, Austria

Scientific activities (selected)	2007-2008	Co-supervision of master thesis: "MyESTo: Entwicklung eines ESM Tools am Beispiel Research in Motion / BlackBerry" by Phllipp Losbichler.
	2009	Workshop organizer: "The Ubiquitous Persuade" Mechanisms, Applications and Ethical Dilemmas of Ambient Persuasion held at AmI 2009
	2009	Best Paper Award at PERSUASIVE 2009 for "A persuasive interactive mannequin for shop windows."
	2009	Doctoral consortium presentation at MobileHCI'09 "Mobile attachment – emotional attachment towards mobile devices and services"
	2009	Co-editor of AmI09 proceedings (Springer) and AmI09 adjunct proceedings.
	2009	Posters & Demos Chair at AmI 2009
	2009	Programme committee member at AmI 2009
	2007-2010	Reviewing activities: ACE, EuroITV, Interact, Pervasive, CHI, AmI, Journal of Ambient Intelligence and Smart Environments, etc.
Teaching (selected)		University Salzburg:
	WS 07/08	PS Einführung in die HCI (Basics in HCI)
	WS 07/08	PS User Interface Design
	SS 10	PS Usability und User Experience Engineering
	SS 10	SE HCI Studio
	SS 10	VP HCI Anwendungen (HCI applications)
	WS 10/11	VP User Interface Design
	WS 10/11	SE HCI Innovation
		Fachhochschule Salzburg (University of Applied Sciences):
	WS 10/11	Interface Cultures

Publications in conjunction with the thesis:

➣ MESCHTSCHERJAKOV, A., OBRIST, M., MIRLACHER, T., LANKES, M., AND TSCHELIGI, M. 2008. Evaluating the emotional attachment to mobile devices & services. Tech. rep., HCI & Usability Unit, ICT&S Center, University of Salzburg, 2008.

➣ MESCHTSCHERJAKOV, A., SCHERNDL, T., LOSBICHLER, P., AND TSCHELIGI, M. 2009. Emotional Attachment of Mobile Devices and Services - Usage Experience Study. Technical report, HCI-Unit-TR-2009-01, HCI & Usability Unit, ICT&S Center, University of Salzburg.

➣ MESCHTSCHERJAKOV, A. 2009. Mobile attachment Ð emotional attachment towards mobile devices and services. In MobileHCI'09: Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (supplementary proceedings).

➣ MESCHTSCHERJAKOV, A., WEISS, A., AND SCHERNDL, T. 2009. Utilizing emoticons on mobile devices within ESM studies to measure emotions in the field (workshop position paper). In MobileHCI'09: Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (supplementary proceedings).

➣ BAUMGARTNER, A., MIRLACHER, T., SCHWAIGER, D., MESCHTSCHERJAKOV, A., AND TSCHELIGI, M. 2010. Contextual Experience Sampling Protocol Definition. Technical report, HCI-Unit-TR-2010-01, HCI & Usability Unit, ICT&S Center, University of Salzburg.

➣ MESCHTSCHERJAKOV, A., REITBERGER, W., AND TSCHELIGI, M. 2010. Maestro: Orchestrating user behavior driven and context triggered experience sampling. In Measuring Behaviour 2010: Proceedings of the 7th International Conference on Methods and Techniques in Behavioral Research (Eindhoven, The Netherlands, August 24-27, 2010), A. J. Spink, F. Grieco, O. E. Krips, L. W. S. Loijens, L. P. J. J. Noldus, and P. H. Zimmermann, Eds., pp. 287–290.

➣ OBRIST, M., MESCHTSCHERJAKOV, A., AND TSCHELIGI, M. 2010. User experience evaluation in the mobile context. In Mobile TV: Customizing Content and Experience, A. Cereijo Roibas, A. Marcus, and R. Sala, Eds., Human-Computer Interaction Series. Springer, London.

➣ MESCHTSCHERJAKOV, A., MOSER, C., AND TSCHELIGI, M. 2010.

BlackBerry Efficiency Study Results. HCI-Unit-TR-2010-02. HCI & Usability Unit, ICT&S Center, University of Salzburg.

➤ MESCHTSCHERJAKOV, A., MOSER, C., AND TSCHELIGI, M. 2011. My Mobile Co-Worker: Perceived Work Efficiency Enhancement With Mobile Devices. Submitted to MobileHCI'11 – 13th international conference on human-computer interaction with mobile devices and services.

Selected other publications:

➤ MESCHTSCHERJAKOV, A., REITBERGER, W., OBERMAIR, C., AND TSCHELIGI, M. 2007. Designing user experiences in special ubiquitous contexts. In Ubicomp 2007: Proceedings of the 9th International Conference on Ubiquitous Computing (Innsbruck, September 2007), A. Bajart, H. Muller, and T. Strang, Eds., Workshop on Interaction with Ubiquitous Wellness and Healthcare Applications, pp. 233–238.

➤ REITBERGER, W., OBERMAIR, C., PLODERER, B., MESCHTSCHER-JAKOV, A., AND TSCHELIGI, M. 2007. Enhancing the shopping experience with ambient displays: A study in a retail store. In AmI 2007: Proceedings of the European Conference on Ambient Intelligence (Darmstadt, November 2007), B. Schiele, A. Dey, H. Gellersen, B. De Ruyter, M. Tscheligi, R. Wichert, E. Aarts, and A. Buchmann, Eds., Springer LNCS, pp. 314–331.

➤ MESCHTSCHERJAKOV, A., REITBERGER, W., LANKES, M., AND TSCHELIGI, M.2008. Enhanced shopping: A dynamic map in a retail store. In UbiComp 2008: Proceedings of the 10th international Conference on Ubiquitous Computing (New York, NY, USA, 2008), ACM, pp. 336–339.

➤ OBERMAIR, C., REITBERGER, W., MESCHTSCHERJAKOV, A., LANKES, M., AND TSCHELIGI, M. 2008. perframes: Persuasive picture frames for proper posture. In PERSUASIVE 2008: Proceedings of the 3rd International Conference on Persuasive Technology (Berlin, Heidelberg, 2008), Springer-Verlag, pp. 128–139.

➤ MESCHTSCHERJAKOV, A., WILFINGER, D., SCHERNDL, T., AND TSCHELIGI, M. 2009. Acceptance of Future Persuasive In-Car Interfaces Towards a More Economic Driving Behaviour. Proc. AutomotiveUI'09: 1st International Conference on Automotive User Interfaces and Interactive Vehicular Applications, 2009. pp. 81–88.

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➤ REITBERGER, W., HAM, J., WEISS, A., SPAHN, A., MESCHTSCHER-JAKOV, A., AND NICKEL, P., AND TSCHELIGI, M. 2009. Workshop on"The

Ubiquitous Persuader": Mechanisms, applications and ethical dilemmas of ambient persuasion. In AmI2009: Proceedings of 3rd European Conference on Ambient Intelligence (Berlin, Heidelberg, 2009), Springer LNCS, pp. 202–208. Adjunct Procceedings.

➤ REITBERGER, W., MESCHTSCHERJAKOV, A., MIRLACHER, T., SCHERNDL, T., HUBER, H., AND TSCHELIGI, M. 2009. A persuasive interactive mannequin for shop windows. In PERSUASIVE 2009: Proceedings of the 4th International Conference on Persuasive Technology for Human Well-Being (New York, NY, USA, 2009), ACM, pp. 1–8. Best Paper Award.

➤ GRILL, T., REITBERGER, W., MESCHTSCHERJAKOV, A., OBRIST, M., AND TSCHELIGI, M. 2010. The Christian Doppler Laboratory on contextual interfaces. In AmI 2010: Proceedings of the first International Joint Conference on Ambient Intelligence (Malaga, Spain, November 10-12, 2010), Springer LNCS, pp. 325–332.

➤ MESCHTSCHERJAKOV, A., REITBERGER, W., PÖHR, F., AND TSCHELIGI, M. 2010. The operator guide: An ambient persuasive interface in the factory. In AmI 2010: Proceedings of the first International Joint Conference on Ambient Intelligence (Malaga, Spain, November 10-12, 2010), Springer LNCS, pp. 117–126.

➤ REITBERGER, W., MESCHTSCHERJAKOV, A., PÖHR, F., AND TSCHELIGI, M. 2010. Examining an interface in the context factory through a persuasive lens. In PERSUASIVE 2010: Proceedings of the 5th International Conference on Persuasive Technology for Human Well-Being.

➤ WILFINGER, D., MESCHTSCHERJAKOV, A., MURER, M., AND TSCHELIGI, M. 2010. Influences on user acceptance: Informing the design of eco-friendly in-car interface. In Proceedings of the 2nd International Conference on Automotive User Interfaces and Interactive Vehicular Applications.

Declaration

This thesis was composed under the supervision of Prof. Dr. Manfred Tscheligi at the HCI &Usability Unit of the ICT&S Center of the University Salzburg. With these words I assure that I wrote this thesis autonomously and without illegitimate help. Aside from the indicated citations I did not use any other sources.

The following diploma thesis have been developed under my supervision and contributed to this thesis:

➣ LOSBICHLER, P., 2008. MyESTo: Entwicklung eines ESM Tools am Beispiel Research in Motion / BlackBerry. Diplomarbeit, Studiengang Digitales Fernsehen, Fachhochschule Salzburg.

➣ LEIKERMOSER, R. 2011. Entwicklung eines ESM-Tools. Diplomarbeit, Institut für Computerwissenschaften, Universit ät Salzburg. (to appear)

The following technical reports have been developed with my contribution or under my supervision and added to this thesis:

➣ MESCHTSCHERJAKOV, A., OBRIST, M., MIRLACHER, T., LANKES, M., AND TSCHELIGI, M. 2008. Evaluating the emotional attachment to mobile devices & services. Technical report, HCI-Unit-TR-2008-01, HCI & Usability Unit, ICT&S Center, University of Salzburg.

➣ MESCHTSCHERJAKOV, A., SCHERNDL, T., LOSBICHLER, P., AND TSCHELIGI, M. 2009. Emotional Attachment of Mobile Devices and Services - Usage Experience Study. Technical report, HCI-Unit-TR-2009-01, HCI & Usability Unit, ICT&S Center, University of Salzburg.

➣ BAUMGARTNER, A., MIRLACHER, T., SCHWAIGER, D., MESCHTSCHERJAKOV, A., AND TSCHELIGI, M. 2010. Contextual Experience Sampling Protocol Definition. Technical report, HCI-Unit-TR-2010-01, HCI & Usability Unit, ICT&S Center, University of Salzburg.

➤ MESCHTSCHERJAKOV, A., MOSER, C., AND TSCHELIGI, M. 2010. BlackBerry Efficiency Study Results. HCI-Unit-TR-2010-02. HCI & Usability Unit, ICT&S Center, University of Salzburg.

Parts of this thesis were already published in:

➤ MESCHTSCHERJAKOV, A. 2009. Mobile attachment – emotional attachment towards mobile devices and services. In MobileHCI'09: Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (supplementary proceedings).

➤ MESCHTSCHERJAKOV, A., WEISS, A., AND SCHERNDL, T. 2009. Utilizing emoticons on mobile devices within esm studies to measure emotions in the field (workshop position paper). In MobileHCI'09: Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (supplementary proceedings).

➤ MESCHTSCHERJAKOV, A., REITBERGER, W., AND TSCHELIGI, M. 2010. Maestro: Orchestrating user behavior driven and context triggered experience sampling. In Measuring Behaviour 2010: Proceedings of the 7th International Conference on Methods and Techniques in Behavioral Research (Eindhoven, The Netherlands, August 24-27, 2010), A. J. Spink, F. Grieco, O. E. Krips, L. W. S. Loijens, L. P. J. J. Noldus, and P. H. Zimmermann, Eds., pp. 287–290.

➤ OBRIST, M., MESCHTSCHERJAKOV, A., AND TSCHELIGI, M. 2010. User experience evaluation in the mobile context. In Mobile TV: Customizing Content and Experience, A. Cereijo Roibas, A. Marcus, and R. Sala, Eds., Human-Computer Interaction Series. Springer, London.

Salzburg, 25th May 2011

DI Alexander Meschtscherjakov