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Mobile Devices in Social Contexts

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Heidi Tscherning

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Everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it. (Martin Heidegger, 1977)

ABSTRACT - ENGLISH

The development of mobile devices has occurred with unprecedented pace since the late nineties, and the increase of generic services has proliferated in most developed countries, driven by the expanding technological capabilities and performance of mobile platforms. This dissertation investigates how consumer objectives, orientation, and behavior can aid in explaining the adoption and use of a new type of mobile devices: “app phones”. This dissertation focuses its effort on two focal influences of adoption and use; social influences and competing forces. Through a qualitative case study and field study this dissertation explores early adoption and use of iPhones. The case study is a one-shot cross-sectional case study that investigates five individuals, related through the same social network, and their decision to adopt an iPhone prior to its release in Denmark. This adoption decision engenders high switching costs as adopters lack references to imitate and need skills to unlock and jailbreak their iPhones to make them work on Danish networks. The specific purpose of the case study is to explore how social influences impact mobile users’ early adoption decisions, as it is well known in the literature that people with similar characteristics, tastes, and beliefs often associate in the same social networks and, hence, influence each other. The field study is cross-sectional with multiple snapshots and explores fifteen individuals part of the same university study, who receives an iPhone for a period of seven months short after its release in Denmark. The specific purpose of the field study is to explore how competing forces of iPhone usage influence assimilation, i.e. the degree to which the iPhone is used, over time. The dissertation, furthermore, contains a systematic literature review. The main contribution of this dissertation is reported through four articles and is directed at both academic researchers and practitioners. The study emphasizes the importance of social influences and competing forces in the investigation of adoption and use of certain mobile devices.

ABSTRACT – DANSK

Siden slutningen af halvfemserne er udviklingen af mobile enheder foregået i et hidtil uset tempo. Nye generiske mobile services har spredt sig til størstedelen af den vestlige verden, drevet af en ekspanderende teknologisk kapacitet og ydeevne. Denne Ph.d. afhandling undersøger, hvorledes forbrugeres erklærede formål med at anvende en mobil enhed, deres sociale orientering samt brugsadfærd kan bidrage til at forklare adoption og anvendelse af en ny type mobile enheder: ”app telefoner”. Afhandlingen undersøger to centrale påvirkninger i forhold til adoption og anvendelse af app telefoner: sociale påvirkninger og konkurrerende kræfter. Gennem et kvalitativt casestudie og en kvalitativ feltundersøgelse undersøger denne afhandling tidlige adoption og anvendelse af iPhones. Casestudiet undersøger fem relaterede personers beslutning om at anskaffe sig en iPhone før dens frigivelse i Danmark. Denne anskaffelsesbeslutning medfører høje omkostninger. Personerne har ikke mulighed for at henvende sig til andre i en lignende situation og lære af deres erfaringer. Desuden har denne gruppe af forbrugere brug for særlige færdigheder til at låse deres iPhone op og ”jailbriake” den så den kan fungere på danske netværk. Casestudiet undersøger hvordan sociale relationer har indflydelse på anskaffelsesbeslutningen blandt tidlige brugere. Det er velbeskrevet i litteraturen at folk med samme karaktertræk, smag og tro typisk er socialt forbundet og påvirker hinanden. Feltstudiet undersøger femten personer, relateret gennem samme universitetsstudie, som alle modtager og anvender iPhones i en periode på syv måneder, kort efter at iPhone er blevet kommercielt lanceret på det danske marked. Det specifikke formål med feltstudiet er således at undersøge, hvorledes konkurrerende kræfter i forbindelse med iPhone påvirker assimilation, dvs. i hvilken grad iPhone anvendes, over tid. Desuden indeholder afhandlingen en systematisk gennemgang af litteraturen på det område. De vigtigste bidrag i denne afhandling rapporteres gennem fire artikler og er rettet mod akademiske forskere og praktikere. Studiet understreger betydningen af sociale påvirkninger og konkurrerende kræfter for adoption og anvendelse af specifikke mobilteknologier.

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Embarking on a Ph.D. journey is the beginning of a challenging and stimulating voyage towards becoming an “educated” researcher. As with all other studies, this is not a secluded process but a process that is challenged and supported by several individuals. While I recognize that the list of people who have contributed to the development of this dissertation is extensive, any attempt to acknowledge all contributors will remain futile. I will, however, express my gratitude to a number of persons who have guided me toward the end goal of obtaining a Ph.D. degree.

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LIST OF ABBREVIATIONS

AIS	Association of Information Systems
BI	Behavioral Intention
CFF	Competing Forces Framework
CVF	Competing Values Framework
DOI	Diffusion of Innovations
ECIS	European Conference on Information Systems
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
GPRS	General Packet Radio Service
GSM	Groupe Spécial Mobile (Global System for Mobile Communications)
IFIP 8.6	International Federation for Information Processing Conference on Diffusion and Adoption
ICIS	International Conference on Information Systems
IOIS	Inter-Organizational Information Systems
IP	Internet Protocol
IS	Information Systems
IT	Information Technology
MB	Megabyte
MFTA	Multi-level Framework of Technology Adoption
MMS	Multimedia Messaging Service
PC	Personal Computer
PEU	Perceived Ease of Use
PU	Perceived Usefulness
SMS	Short Message Service
TAM	Technology Acceptance Model
TDC	Tele Danmark Communications – the largest network provider in Denmark
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
VoIP	Voice over Internet Protocol

VHF Very High Frequency
WLAN Wireless Local Area Network
UMTS Universal Mobile Telecommunications System
US United States of America
UTAUT Unified Theory of Acceptance and Use of Technology

LIST OF ORIGINAL PAPERS

- Article 1: Tscherning, H. and Damsgaard, J. (2008). "Understanding the Diffusion and Adoption of Telecommunication Innovations: What We Know and What We Don't Know," In IFIP International Federation for Information Processing (287), *Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion*, eds. León, G., Bernardos, A., Casar, J., Kautz, K., and DeGross, J. (Boston: Springer), 2008, pp. 41-62.
- Article 2: Tscherning, H. and Mathiassen, L. (2010). "The Role of Social Networks in Early Adoption of Mobile Devices," In IFIP International Federation for Information Processing (288), Pries-Heje, J., Venable, J., Bunker, D., Russo, N., and DeGross, J. (eds.) *Human Benefits Through the Diffusion of Information Systems Design Science Research*, (Boston: Springer), 2010.
- Article 3: Tscherning, H. (2011). "A Multi-Level Social Network Perspective on ICT Adoption," in Dwivedi, Y. K., Wade, M. R. and Schneberger, S. L. (eds.) *Information Systems Theory: Explaining and Predicting Our Digital Society* (2011, forthcoming).
- Article 4: Tscherning, H. and Mathiassen, L. (2011). "Competing Forces Model of Technology Adoption and Assimilation: Explaining Behaviors in a Group of Mobile Device Users". Submitted to *Journal of the Association of Information Systems* with a revise and resubmit decision. An earlier version of the paper will be published in the proceedings of ECIS 2011.

CHAPTER ONE: INTRODUCTION

This dissertation argues that individual adoption of mobile technologies in voluntary settings is influenced by the social context and competing forces pulling consumers in different directions. This chapter aims to motivate the dissertation, present the context of the study, and outline the statement of problem and purpose. First, the mobile revolution, which has occurred over the past two decades and has led to an increase in research on mobile technologies, is introduced. The research question is formulated, followed by an elaboration into two research sub-questions. Finally, the objectives and contribution are presented and the general structure of the dissertation is presented and discussed.

1.1 A MOBILE REVOLUTION

The diffusion, adoption, and use of mobile technologies (i.e. devices, platforms, applications, services, and infrastructure) has increased with unprecedented pace since the late nineties, and generic services have proliferated in most developed countries, driven by the expanding technological capabilities and performance of mobile platforms. Today, mobile technologies are evolving systems made up of interdependent components that can be innovated upon, with an increasing interdependence between physical product and service and an increasing potential for various actors to innovate upon them (Gawer and Cusamo, 2002; Wei, 2008). Mobile technologies are able to detect their environment and exploit contextual information such as the consumer's location, people nearby, the time of day, light and noise levels (Chun and Maniatis, 2009; Dey and Abowd, 2000; Hong and Tam, 2006). Internet access with these new technologies has become so omnipresent that mobile internet usage has been referred to as the “*real world's internet*” (Katz, 2008, p. 434).

During the early phases of this study, established and conventional mobile device¹ players faced fierce competition from new progressive players in the field of mobile

¹ A mobile device here refers to conventional types of mobile phones as well as contemporary smart phones that have become popular within the past decade; mobile phones offering advanced capabilities with Internet enabled functionality.

device development. Apple introduced the iPhone to the US market in July 2007, while the first Google Android phone, the HTC Dream, was introduced by T-Mobile in October 2008. Apple and Android sales increased immediately, and during the first six months Apple sold 3.7 million iPhones² and T-mobile sold 1 million Android phones³ in the US. Apple and Android phones have, through the introduction of third party applications, transformed current expectations of mobile devices, and consumers have embraced this revolution by adopting these new “app phones⁴” (Pogue, 2009). The rapid advances of mobile technology, along with the recent emergence of Web 2.0 services, creates situations in which the context is dynamic, bringing fundamental changes to the ways consumers interact with mobile technology. Based upon this, “*we can only expect that the integration of digital capabilities into these products [will become] increasingly feasible, both technologically and economically*” (Yoo, 2010, p. 216).

The emergence of thousands of third party applications available for app phones is, however, challenging the level of value for consumers; the positive and negative impacts of mobile technologies are conceptually inseparable and grow in strength with new releases (Jaarvenpaa and Lang, 2005). While app phones provide users with freedom, control, and resource efficiencies, they can also create feelings of enslavement, chaos, and inefficiency (Mick and Fournier, 1998). App phones are used for utilitarian work-related purposes, but they are also used for hedonic personal purposes (van der Heijden, 2004). It is, furthermore, well known from social psychology that individuals are subject to social influences that can induce behavioral changes (Bovard, 1951; Deutsch and Gerard, 1955). As app phones continue to facilitate different usage behaviors in different contexts, they yield unexpected consequences and limitations (Arnold, 2003). Consumers

² Apple Q1: 1.389.000 iPhones: <http://www.apple.com/pr/library/2007/10/22results.html>
Apple Q2: 2.315.000 iPhones: <http://www.apple.com/pr/library/2008/01/22results.html>

³ <http://www.deutschetelekom.com/dtag/cms/content/dt/en/596270?archivArticleID=654792>

⁴ New York Times gadget reviewer David Pogue suggested the name “App phone” as the name “Smartphone” is too limited. He suggests that a smartphone is a cell phone with e-mail, and that the App phone is a new category somewhere between cell phones and laptops, or even beyond them and therefore deserves a name of its own. “*Since Apps distinguish iPhonish phones from mere smartphones, so ‘app phones’ it is.*” Pogue (2009). I will likewise use the term “app phones” in this dissertation.

thus experience conflicting situations in which they are prompted “*to take actions whose consequences clash with their original intentions or expectations*” (Lang and Jarvenpaa, 2005, p. 9), which is ultimately reflected in their adoption and usage decisions.

Generally, research on the adoption of information technologies (IT) has been investigated as a means to provide value and meet objectives (e.g. Agarwal and Karahanna, 2000; Davis et al., 1992; Gefen and Straub, 2000; van der Heijden, 2004). As a user’s overall experience of interacting with a technology is based on both its usefulness and provision of enjoyment and fun (Holbrook, 1986), value is assumed to be an important determinant of adoption and usage behavior (Babin et al., 1994; Holbrook, 1986; Sheth, 1991). The consumer behavior literature has provided value-based classifications (e.g. Babin et al., 1994; Hirschman and Holbrook, 1982, Holbrook and Hirschman, 1982) used to differentiate between utilitarian and hedonic information systems (van der Heijden, 2004). While several researchers presume that value conceptualizations may vary depending on a study's context (Dodds, Monroe, and Grewal 1991; Holbrook and Corfman 1985), the value of IT is often instigated by its intrinsic and extrinsic attributes, resulting in a particular adoption choice (Agarwal and Karahanna, 2000; Davis et al., 1992; Venkatesh, 2000). Though limited in volume, the mobile adoption literature similarly confirms that extrinsic and intrinsic motivations (as articulated by Deci, 1971; 1972) also drive mobile service adoption (Kim et al., 2007; Kwon and Chidambaram, 2000; Sarker and Wells, 2003).

It can therefore be anticipated that consumers’ objectives can contribute to explaining their mobile adoption and usage decisions.

In the social sciences in general it is well known that the consumers’ social contexts can significantly impact individual decision-making, including their technology adoption and usage decisions. Individual and social orientation has been a research interest in social psychology for decades, since researchers found that individual psychological processes are subject to social influences (Bovard, 1951; Deutsch and Gerard, 1955). While the role of social influences has been studied broadly to understand social behavior (Bovard,

1951, Deutsch and Gerard, 1955; Eagly, 1983; Kahan, 1997; van den Bulte and Lilien, 2001), and is increasingly being applied in IS practices (Fulk et al., 1990; Malhotra, 1998; Venkatesh and Morris, 2000), only limited focused research on the role of the social context in mobile adoption decisions has been conducted (e.g. Cambell and Russo, 2003; Dickinger et al., 2008; Lu et al. 2005). This is despite the fact that it has been illustrated that the telephone medium impacts the social networks of individuals by adding communication that otherwise would not occur (Cox and Leonard, 1990; Geser, 2004). App phones create a holistic experience for users, who no longer focus mainly on device functionality, and new standards emerge, while social influences increasingly impact individual consumers.

It can, hence, be expected that consumers' orientation can contribute to explaining their adoption and usage decisions.

Learning how to use a new IT can be an impediment to adopting and using an IT. As consumers discover a need that an IT can help fulfill, they must discover novel ways of meeting objectives that create new value or solve old problems, and a learning process takes place (e.g. Subramani, 2004). In the case of app phone adoption, continued learning can be expected to take place for a longer time than with conventional feature phones, as a consequence of the numerous possibilities they offer.

It can therefore be expected that consumers' usage behavior can contribute to explaining their mobile adoption and usage decisions.

Adoption research has largely addressed factors that drive users to *initially adopt a new IT*, i.e., acquire and use an IT for the first time (e.g. Agarwal, 2000; Leonard-Barton and Deschamps, 1988; Moore and Benbasat, 1991). Less attention has been paid to factors that influence users to *continue to use an IT* after they have adopted it (e.g. Bhattacharjee, 2001; Karahanna et al., 1999; Parthasarathy and Bhattacharjee, 1998). Hence, IT adoption research generally adopts a variance approach, in which specified independent variables are tested to determine whether they can predict adoption decisions (e.g. Agarwal and Karahanna, 2000; Moore and Benbasat, 1991; Venkatesh et al., 2003),

while only a little research focuses on the more inclusive adoption and use process (e.g. DeSanctis and Poole, 1994; Orlikowski et al., 1995). Adoption of mobile phones, however, differs from other types of adoption observed in the IS adoption field. It has been argued that as availability of IT increases and the cost decreases, and as IT becomes ubiquitous, it also becomes a commodity. From a strategic standpoint, IT becomes invisible and thus no longer matters (Carr, 2003). The availability of mobile phones has increased exponentially over the past decade to a current figure of 5.6 billion mobile connections⁵. The cost of acquiring a mobile phone has decreased and it is now possible to acquire mobile phones at zero initial cost and with a cheap subscription rate. However, at this introductory stage of the app phones there seems to be a different pattern. The price of a new app phone amounts to at least 300 USD with a flat rate subscription plan of at least 60 USD per month⁶. App phones represent a paradigm shift by allowing users to download thousands of add-on programs - “apps” – free of charge or at low cost and become GPS units, musical instruments, medical equipment, and more. During the early phases of this study, app phones had not yet become commodities, but it can now be argued that they are increasingly approaching a commodity state. App phone sales have exploded since their introduction in 2007 and will most likely continue to increase at the same pace for another year or two⁷. The app phone denotes an entirely new mobile technology, which is no longer solely a mobile phone, but a technology between a mobile phone and a laptop. An app phone, therefore, represents a so-called “really new product” (Lehmann, 1994), which is an innovation that defies straightforward classification in terms of existing product concepts (Gregan-Paxton and Roedder John, 1997) and thus “creates, or at least substantially expands, a category rather than reallocate shares” (Marketing Science Institute 1994, p. 6). Prior research suggests that consumers use information already contained in existing product categories to learn about new products (Gregan-Paxton, 1999; Gregan-Paxton and Roedder John, 1997; Markman et al., 2000),

⁵ <http://www.gsmamobileinfolink.com>

⁶ <http://www.mobilpriser.dk>

⁷ http://borsen.dk/nyheder/it/artikel/1/196058/salget_af_smartphones_eksploderer_i_danmark.html

which implies that early app phone adopters will compare the app phone to their previous mobile phone in an adoption situation. Consequently, app phone adopters will adopt the app phone based on their existing knowledge of a similar device even though the app phone offers new usage opportunities and fundamentally changes the way people interact with the mobile phone and the Internet (Yoo, 2010).

As a result, the switch from a feature phone or a smartphone to an app phone represents an *early adoption decision* for consumers as opposed to a *repeat adoption decision*. While almost every person in Denmark possesses a mobile phone and on average makes a repeat adoption decision to acquire a new mobile phone every 18 months (Nielsen, 2011), the decision to adopt an app phone signifies an important - and novel - adoption decision because consumers must invest considerable resources into this new technology.

As the current mobile device revolution takes place, questions arise: how do consumers decide which mobile phone meets their objectives, considering the many possibilities they face? How do they obtain and sort contradictory information from their environment in the adoption and use process? To what extent do consumers use a new device and the new opportunities it offers? How do consumers change their usage behaviors over time? And how do consumers' social contexts influence these decision-making processes?

Yoo (2010) calls for a study of emerging, pervasive, IT-enabled phenomena. Research of mobile technologies must be combined with elements of contextual and behavioral nature to further our understanding of how individual choices evolve. To accommodate the need for more research on the consequences of the mobile revolution, this dissertation addresses the following research question:

To what extent can an understanding of social influences, and more generally, a set of competing forces, assist in explaining the early adoption and use of app phones?

1.2 RESEARCH QUESTION ELABORATION

In order to approach the research question the dissertation will also investigate two sub-questions that will help lay the groundwork for the larger inquiry.

1.2.1 Sub-question One

Contextual factors, such as one's social environment, generally have a significant impact on IT adoption and usage behaviors (e.g. Lewis et al. 2003; Magni et al. 2008; Malhotra, 1998; Venkatesh and Morris, 2000), the idea being that consumers turn to people in their social environment for information that can help them make an adoption or use decision. While research into adoption of mobile devices is somewhat established, research into consumer orientation in relation to the adoption and use decision-making is still a rather new research domain and only limited contributions have sought to illuminate how social structures can influence the use of technology (Klein and Kleinman, 2002). This dissertation aims to contribute to this emerging field by specifically focusing on consumer orientation and the following sub- question:

1) How can social influences contribute to explaining the adoption and use of app phones?

This sub-question aids the identification of a theoretical standpoint from which to approach consumer orientation in app phone adoption research in a way that allows for the emergence of both its richness and complexity, together with the aspects that most relate to explaining adoption and use of app phones. This sub-question concerns how social contexts influence app phone adopters in their decision making process, and accordingly foregrounds the assumption that a relationship between identified social influence constructs and adoption can be determined. The social influence approach is widespread in quantitative studies on consumer behavior (Mathieson, 1991; van den Bulte and Lilien, 2001) and has also been applied in IT adoption studies (Malhotra and Galetta, 1999; Venkatesh and Morris, 2000) and mobile studies (Dickinger et al. 2008; Lu et al. 2005). However, the nature of the research question allows for a qualitative approach, which will provide complementary insights into *how* social influences impact mobile adoption decisions and how these influences change individual behavior. It allows existing social influence constructs to be applied to a new mobile adoption phenomenon to provide in-depth descriptions and explanations. Furthermore, considering both the

individual and elements in the surrounding environment can provide additional knowledge. Most adoption situations involve phenomena occurring at a minimum of two levels, e.g. the individual and the social network or the individual and the organizational, yet most adoption research applies a single level of analysis. In consumer adoption situations, individual consumers make adoption decisions, however, often with implicit impacts from the surrounding environment, such as family and friends who have acquired a certain technology, informational reviews of products in the media, or a sales person promoting a product. The social influence approach, therefore, by applying factors from two levels of analysis, can determine how social contexts impact these different levels of analysis.

1.2.2 Sub-question Two

In addition to consumer orientation, diverse consumer objectives and inconsistent consumer behavior may further influence adoption and use decisions, leading to a second sub-question:

- 2) *How can the competing forces of app phones contribute to explaining their adoption and use?*

This sub-question aids in identifying a second theoretical position for exploring additional tensions and influences that may also help to explain the adoption and use of app phones. As mobile users experience contradictory impacts when using mobile devices (Arnold, 2003; Mick and Fournier, 1998), and as social influences may change individual behavior, it is to be expected that a competing forces approach may provide additional insight into the adoption and use of app phones. Although such an approach has proven useful and robust in understanding a wide variety of organizational and individual phenomena, including organizational effectiveness (Quinn and Rohrbaugh, 1983) and leadership competencies (Yukl, 1989), it has only been applied sparingly in IT adoption and use studies (e.g. Lang and Jarvenpaa, 2005; Mick and Fournier, 1998). The

approach, however, allows for the study of tensions observed in relation to consumer objectives, consumer orientation, and consumer behavior in app phone adoption and use.

1.2.3 Two approaches

The application of two plausible theoretical standpoints, i.e. a social influence approach and a competing forces approach, addresses the research question and sets the stage for designing operational empirical models to examine key aspects of the theory (van de Ven, 2007). The two approaches are related but different. The social influence approach focuses on the interplay between a consumer and the surrounding environment, and how this environment may influence or even alter the decisions being made by the consumer. The competing forces approach investigates how tensions in consumer orientation, objectives, and behavior influences consumer decision-making and includes tensions that may exist between a consumer's initial adoption and use evaluation and their final decision – including the consumer's orientation. As the main research question requires an in-depth study of human behavior in an understudied research context, these different investigatory approaches are essential for developing reliable scientific knowledge (van de Ven, 2007). Following these insights, and as multiple frames of reference can improve the understanding of this new phenomenon, it is assumed that the social influence approach and the more inclusive competing forces approach can help in the study of how mobile adopters make adoption decisions when new devices are introduced, and how the use of app phones changes over time.

1.3 RESEARCH OBJECTIVES AND CONTRIBUTION

In order to answer the main research question and the sub-questions proposed, this dissertation applies qualitative methods of analysis to explore the adoption and use of app phones, and to what extent an understanding of social influences and competing forces can add to explanations of their adoption and use. This approach has been selected based on the exploratory nature of the research question, requiring that the complexity and richness of mobile user behavior be elicited. A case study and a field study emphasizing

the adoption and use processes related to Apple's newly introduced iPhone are conducted. The case study describes the relation between social influences and early adoption of iPhones and the field study investigates early use of newly acquired iPhones in a cross-sectional study with multiple snapshots. The main contribution of this dissertation is to investigate the connection between social influences and competing forces on one side and the adoption and use of new and advanced app phones on the other, and in addition to suggest frameworks that reflect the work already being done within mobile adoption and use, by applying two different, but related, theoretical approaches.

The association of social influences with mobile device adoption and use serves as a basis for investigating the research question, and is intended to produce knowledge, primarily for the research community, and to support the initial phases of the research design process in the subsequent study that concerns understanding app phone usage. The studies take place using mainly qualitative methods, such as interviews, focus groups, archival data and so forth, and the data will be obtained from mobile users, as the researcher intervenes in the social system being investigated.

1.4 FOCUS OF THE STUDY

Table 1 provides an overview of the stages-of-adoption model prevalent in the consumer behavior literature adapted from Kotler and Armstrong (1996). The aim is to show which parts of the process will be investigated in this dissertation. According to Kotler and Armstrong (1996), the consumer adoption process consists of five stages: awareness, interest, evaluation, trial, and adoption.

The *awareness* stage is entered as information about an app phone's existence and its unique characteristics become readily available to the consumer who at this stage lacks detailed information about it. If the consumer's *interest* is awakened and they are motivated to actively seek information about the app phone, knowledge and an ability to appreciate the relevance of attributes and benefits of the app phone emerges, and the

consumer *evaluates* whether or not to *trial* it. Often, new ITs such as app phones possess new and complex features, which do not communicate obvious credible advantages over older ITs, such as existing feature phones and smartphones. Thus, the consumer may not know what a particular attribute means or what the optimal level of the attribute might be. Trial of app phones can occur in real time in a store-front or it can occur via imagined use of the app phone. The four stages leading to the consumer making an adoption decision can be triggered by extrinsic or intrinsic motivations (Deci, 1971, 1972; Venkatesh, 2000), the characteristics of the consumer (Constantiou et al., 2007; Rogers, 2003), as well as characteristics of the technology in relation to the objectives of the consumer (Davis et al., 1989; Rogers, 2003). Based on these pre-adoption criteria, the consumer makes a decision to either adopt or reject the app phone. This is a point-in-time event. If the consumer decides to reject the app phone, this does not mean that a different decision cannot be taken at some later point in time. If the consumer decides to adopt the app phone, the use process follows, ideally meeting the consumer's objectives and providing value. Part of the use process concerns app phone assimilation. *Technology assimilation* is a learning and adaptation process that involves gaining knowledge about how to deploy the app phone in opportunities beyond the initial, evaluative uses (Hayen et al., 2004). At some point the app phone is incorporated into the existing cognitive structures of the consumer and becomes an integrated part of the consumer's everyday life and requires less conscious attention. After the app phone has been assimilated to the extent necessary to fulfill the consumer's needs, the consumer usually *continues to use* the IT until a new, better substitute is encountered.

The focus of this dissertation is to investigate how social influences and competing forces influence app phone adoption and use. Implicit within these approaches are different triggers of adoption, such as the aforementioned extrinsic and intrinsic motivations, consumer characteristics, and technology characteristics. While these will not be investigated directly in the study, they will to some extent be part of the articles in Appendices A-D.

Table 1: Overview of Stages-of-Adoption and Use of App Phone

	<i>Pre-adoption process</i>				<i>Point in time decision</i>	<i>Use process</i>	
<i>Stage</i>	<i>Awareness</i>	<i>Interest</i>	<i>Evaluation</i>	<i>Trial</i>	<i>Adoption/ Rejection</i>	<i>Assimilation</i>	<i>Continued use</i>
<i>Description</i>	Awareness of the app phone but lack of further information about it.	Motivation to seek information about the app phone.	Determination of whether or not to try the app phone.	Trial of the app phone to test its efficacy in meeting needs.	Decision to acquire the app phone and make use of it on a regular basis or to reject it.	Incorporation and absorption of new uses of the app phone into existing cognitive structures.	Application of the app phone until made aware of new substitute technology
<i>Investigation strategy</i>	Will be incorporated empirically in the two studies to the extent they are incorporated in the two theoretical perspectives.				Case study investigation	Field study investigation	
<i>Approaches</i>	<u>Implicit triggers of adoption and use</u>				<u>Theoretical approaches</u>		
	Extrinsic and Intrinsic motivation (Deci, 1971, 1972) (Venkatesh, 2000).	User characteristics (Rogers, 2003) (Constantiou et al., 2007).	Technology characteristics (Rogers, 2003) (Davis et al., 1989)		Social influences: Focus on consumer orientation	Competing forces: Focus on consumer objectives, orientation and behavior	

Source: Own creation. Adapted from Kotler and Armstrong (1996), p. 167.

1.5 DISSERTATION OVERVIEW AND STRUCTURE

In order to show how the dissertation approaches the research question and sub-questions and will generate the previously mentioned contributions, this section outlines how the dissertation itself is structured and how its results will be presented.

The dissertation includes this cover paper and an attached collection of four articles (Appendices A-D). The aim of the cover paper is to synthesize the research documented in the four articles, while also providing detailed discussions expanding on them. The

overall structure of the cover paper consists of five parts organized around the articles. Part One provides a foundation for the research problem; Part Two frames the research problem; Part Three presents the methodology; Part Four presents the results; and Part Five discusses personal reflections and concludes the dissertation. While the dissertation is organized around the four articles, this structure allows for presenting a coherent narrative, and hence, the five parts will be presented as above, drawing on content from each article, while also seeking to minimize redundancy.

Part One provides a foundation for the problem of investigation and contains Chapters 2 and 3. Chapter 2 provides an overview of mobile communication. A brief look at the state of mobile communication worldwide is provided, followed by a description of the specific mobile device context used for the case study and field study: the adoption and use of the iPhone. Next, the mobile ecosystem is presented, followed by an explanation of the Danish telecom market and the notion of mobility. Chapter 3 reviews the existing literature, taking as its point of departure *Article 1* (Tscherning and Damsgaard, 2008). The chapter first defines the broad notion of telecommunication innovations. Next, it provides an overview of the outcome of *Article 1* (Tscherning and Damsgaard, 2008), which takes a broad diffusion and adoption approach and clarifies how the adoption and use of mobile technologies has been identified as the specific domain of interest. The chapter provides a focused literature survey of consumer adoption and use of mobile devices with the aim of highlighting the limitations of current research. The chapter concludes with an explicit outline of the research opportunities this dissertation seeks to contribute to.

Part Two, consisting of Chapter 4, frames the two theoretical standpoints for approaching the research question. According to Azevedo (1997) and van de Ven (2007), multiple perspectives may reveal the robust features of reality by identifying those features that appear invariant or convergent across at least two independent theories (Van de Ven, 2007). More complex, and often more insightful, explanations emerge when different data sources yield consistent or contradictory information about a phenomenon. Hence, the social influence approach is introduced and discussed as it establishes a relationship

between social influences on early mobile adoption decisions, in order to begin answering the first sub-question of the dissertation. The chapter discusses the social influence frame applied to a single level of analysis: the individual consumer. It further investigates influences from two levels of analysis: the individual consumer and the influence from the social network level. *Article 2* (Tscherning and Mathiassen, 2010) and *Article 3* (Tscherning, 2011) draw on this perspective. Individual and social orientation is presented in order to establish that a tension may exist when consumers need to make adoption and use decisions. Next, the competing forces approach is introduced and discussed to begin answering the second sub-question of the dissertation and as seen in *Article 4* (Tscherning and Mathiassen, 2011). Specific competing forces from the established literature that have impacted consumer behaviors are identified. The overall purpose of the chapter is to first introduce the social influence perspective and then to present social orientation as opposed to individual orientation as part of the competing forces perspective.

Part Three presents the research methodology chosen to study how consumer objectives, orientation, and behavior can contribute to an explanation of app phone adoption and use. Chapter 5 begins by describing the relationship between the mobile users and the mobile devices and argues for a critical realism ontology and a social constructionism epistemology. The chapter further argues that an interpretive approach for conducting the empirical study is consistent with the integrated theoretical perspective put forward in Part Two. Chapter 6 presents the detailed research design of the study, consisting of a case study and a field study. While the two studies are conducted in the same domain, they are distinct from one another with regard to theoretical framing, data collection, and procedure for data analysis. The case study “Early Adoption of App Phones” will aid in answering research sub-question 1 and the field study “Early Use of App phones” will aid in answering research sub-question 2.

Part Four reviews the results from the empirical data collection and discusses the empirical results from the four articles in relation to each research sub-question and the main research question. Chapter 7 presents each research question, the method applied to

answer the question, the findings, and the contribution. Chapter 8 synthesizes the results by discussing the main findings in relation to existing literature and by discussing different approaches to finding a solution to the research questions; i.e. how this dissertation could have been approached differently.

Part Five discusses personal reflections on the Ph.D. process and concludes the dissertation by summarizing the main points covered, providing a discussion of its main contributions, and suggesting opportunities for further research on the topic.

The collection of articles follows directly after this cover paper in Appendices A to D. *Article 1* (Tscherning and Damsgaard, 2008) and *Article 2* have been accepted and published, *Article 3* (Tscherning, 2011) has been accepted and will be published in July 2011, and *Article 4* (Tscherning and Mathiassen, 2011) has been submitted but no decision has been made yet regarding acceptance. Appendices E to H contain additional information about published articles during the doctoral program and details regarding data collected in the case study and the field study. The four articles forming part of this dissertation are listed and briefly summarized below. Appendix E contains a list including all published papers during the Ph.D.

- 1 Tscherning, H. and Damsgaard, J. (2008). Understanding the Diffusion and Adoption of Telecommunication Innovations: What We Know and What We Don't Know. In IFIP International Federation for Information Processing, Volume 287, *Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion*, León, G., Bernardos, A., Casar, J., Kautz, K., and DeGross, J. (eds.), Boston: Springer, pp. 41-62.

Article 1 provides a systematic account of selected literature within diffusion and adoption of the broad notion of telecommunication innovations to examine what aspects of diffusion and adoption are either accentuated or overlooked in the IS field. As theoretical point of departure a holistic framework that comprises innovation, unit of adoption, and their interaction as captured by demand-pull and supply-push forces is presented. The framework furthermore takes the diffusion and adoption context and theoretical perspective into account. The overall research method applied is a literature survey, and the sample consists of research papers from the International Conference on Information Systems (ICIS), the European Conference on Information Systems (ECIS), and the International Federation for Information Processing conference on diffusion and adoption (IFIP 8.6) including the years 1998-2007. The results show there are a number of gaps within the field that need to be addressed to provide a more comprehensive view of adoption and diffusion of telecommunication technologies. Most research has been conducted on the voluntary use of technologies targeting the individual, and there is a near total absence of papers investigating the group and the inter-organizational level of adoption. Furthermore, there is no real synthesis of theories applied to explain diffusion and adoption of telecommunication innovations, although the Technology Acceptance Model (TAM) is a widely used theory. Finally, most papers provide a variance instead of a process view on the diffusion and adoption process, and interpretive and positivistic approaches to the studies in these conferences are equally distributed.

- 2 Tscherning, H. and Mathiassen, L. (2010). Early Adoption of Mobile Devices: A Social Network Perspective. *Journal of Information Technology Theory and Application*, (11:1), pp. 23-42.

Article 2 presents detailed insights into why and how five closely related individuals made the decision to adopt the iPhone before it was available through traditional supply chains. Taking a social influence approach, the paper analyzes how adoption threshold, opinion leaders, social contagion, and social learning shaped adoption behaviors and outcomes for the users. Based on purposive sampling, the paper presents a case study of an unusual early adoption phenomenon. The results confirm that network structures impact the early decision to adopt the iPhone. When facing uncertainty, the users' adoption decisions emerged as a combined result of individual adoption reflections and major influences from their social network as well as behaviors observed within the network.

- 3 Tscherning, H. (2011). A Multi-Level Social Network Perspective on ICT. In Dwivedi, Y. K., Wade, M. R. and Schneberger, S. L. (eds.) *Information Systems Theory: Explaining and Predicting Our Digital Society*, Boston: Springer, Forthcoming.

Article 3 provides a conceptual framing of how social network influences at the individual and social network level can help to explain adoption of IT. The paper addresses factors at two levels of analysis and adapts the well-known Coleman diagram into the Multi-level Framework of Technology Adoption. The result of the paper is the Multi-level Framework for Technology Adoption that explores how social network analysis, homophily-driven theories, theories of self-interest and collective action, and contagion theories can be applied in adoption research to explain the dynamics of individual and network level adoption behavior. The framework suggests that the degree to which adoption occurs can be explained based on the interaction of individual and network level phenomena.

- 4 Tscherning, H. and Mathiassen, L. (2011). Competing Forces Framework of Technology Assimilation: An Investigation into a Group of Mobile Device Users. Submitted to *Journal of the Association of Information Systems*.
Revise and resubmit decision has been provided.

Article 4 identifies three dimensions of competing forces and posits that these play key roles in shaping IT assimilation, leading to the development of the Competing Forces Framework of IT assimilation. The theoretical point of departure is competing forces identified in the literature: utilitarian versus hedonic objectives, exploration versus exploitation behavior, and individual versus social orientation. Based on a field study consisting of interviews, focus groups, surveys, diaries, and actual usage data from the network provider, the paper presents how fifteen iPhone users assimilated the iPhone and services over a seven month period. The findings provide evidence for how the three dimensions of competing forces shaped assimilation of the iPhone over time and how users adapted four types of assimilation processes (investigating, interacting, improving, and integrating) into different patterns to reap the benefits of the iPhone.

Table 2 provides an outline of the dissertation, which consists of three phases: a preliminary study, an *early adoption of app phone* study, and a *use of app phone* study. In the preliminary study, a broad literature survey was conducted with the purpose of uncovering what we do and do not know about the diffusion and adoption of telecommunication innovations from a holistic perspective. A literature review of articles published at three conferences was conducted and the outcome of the study was *Article 1* (Tscherning and Damsgaard, 2008).

The second phase studied the early adoption of iPhones to describe the relation between social influences and early adoption and to suggest a framework that considers factors of individuals and their social context in the adoption process. A qualitative case study of five early adopters in the same social network was conducted based on semi-structured interviews, archival data, and data from online social networks. The outcome of the

second phase was *Article 2* (Tscherning and Mathiassen, 2010), based on the collected empirical data, and *Article 3* (Tscherning, 2011), a conceptual contribution.

The third phase studied the use of iPhones to determine a relation between contradictory forces and the early use of iPhones, and suggests a framework that considers how such impacts can contribute to explaining app phone usage. A qualitative field study of the use of iPhones was conducted based on semi-structured interviews, focus groups, surveys, diaries, and network-provided usage data. The outcome of the third phase was *Article 4* (Tscherning and Mathiassen, 2011).

Table 2: Outline of Dissertation

<i>Phase</i>	Preliminary study	Adoption of app phones	Use of app phones
<i>Purpose</i>	<ul style="list-style-type: none"> Literature study of diffusion and adoption research of telecommunication innovations. 	<ul style="list-style-type: none"> To describe the relation between social influences and early adoption of iPhones. To suggest a framework that considers factors of individuals and the surrounding environment in the adoption process. 	<ul style="list-style-type: none"> To determine a relation between contradictory forces and use of iPhones. To suggest a framework that considers how contradictory impacts of app phones contribute to explaining early app phone usage.
<i>Perspective</i>	General holistic perspective	Social influence perspective	Competing forces perspective
<i>Method</i>	Literature review	Qualitative Case study	Qualitative Field study
<i>Data</i>	<u>3 conferences over 10 years</u> <ul style="list-style-type: none"> International Conference on Information Systems European Conference on Information Systems IFIP 8.6 (Diffusion & Adoption) 	<u>5 subjects</u> <ul style="list-style-type: none"> 5 semi-structured interviews Archival data Data from online social networks 	<u>15 subjects*</u> <ul style="list-style-type: none"> 30 semi-structured interviews 3 focus groups 15 diaries Network provided usage
<i>Outcome</i>	Article 1	Article 2 Article 3	Article 4

* The data collection in the field study was conducted as a collaboration of four researchers.

PART ONE: FOUNDATION

Chapter 1 identified the current state of the mobile revolution in which new app phones have transformed the ways consumers interact with mobile technologies, while motivating the research question. Mobile adoption and usage decisions seem to be influenced by the social context of consumers as well as the contradictory possibilities of mobile devices. Thus, this dissertation seeks to answer to what extent social influences and competing can aid in explaining the early adoption and use of app phones.

The purpose of Part One is to provide a foundation for engaging with this research topic and consists of two chapters. Chapter 2: “Mobile Communication” provides background information on mobile communication in Denmark. The chapter first imparts a view of the current state of mobile communication worldwide and positions Denmark’s estimated readiness in the ICT landscape. Next, Apple and the iPhone are discussed to provide contextual background information about the transformation of the mobile ecosystem. The mobile ecosystem surrounding Apple is described and visualized with the aim of limiting the scope of this dissertation, and, finally, the telecom market in Denmark is presented. Chapter 3: “Adoption and Use of Mobile Devices” reviews the existing body of literature on the adoption and use of mobile devices by taking as its point of departure the more extensive diffusion and adoption literature. First, basic concepts within the field are presented based on the findings of Article 1 (Tscherning and Damsgaard, 2008). Second, prior research on the adoption and use of mobile devices is reviewed, followed by the identification of a number of research opportunities; namely the study of social influence and competing forces in relation to mobile device adoption and use. Finally, the chapter discusses how a qualitative approach using the identified theoretical perspectives can benefit research into the adoption and use of mobile devices.

CHAPTER TWO: MOBILE COMMUNICATION

2.1 INTRODUCTION

Despite the recent economic downturn, the use of ICT, such as mobile devices with Internet-enabled communication, continues to grow worldwide. By April 2011, there were an estimated 5.6 billion mobile connections globally and the mobile industry will most likely capture more voice services from fixed networks for the foreseeable future, as the mobile phone is now by far the preferred telephone choice for most consumers. Growth rates continue to be strongest in those regions where penetration is relatively low, and, “*the digital divide for mobiles is far less severe than it is for the Internet*” (Katz et al., 2008, p. 434). Hence, the mobile device divide is expected to lessen further over time⁸. According to the International Telecommunication Union’s⁹ 2008 ICT Development Index (IDI), Denmark was the fourth most ICT-ready country in the world, after Sweden, Luxembourg, and Korea and it remains toward the top of the list. The IDI measures the development and progress of ICT, the level of advancement and development potential per country, and the digital divide between countries. Denmark is, therefore, an appropriate venue for investigating app phone adoption and use.

2.2 APPLE – THE NEW PROGRESSIVE PLAYER

Apple’s iPhone was introduced in July 2007 to the US market and in July 2008 to the Danish market¹⁰. At the time, the iPhone was the latest addition to Apple’s portfolio of innovative products since co-founder and CEO Steve Jobs returned in 1996. The product portfolio includes the iMac from 1998, the iPod, including the iTunes store, from 2001,

⁸ The ITU ICT Development Index (IDI) 2008: <http://www.itu.int/ITU-D/ict/publications/idi/2009/index.html>

⁹ Telecommunications and broadcasting worldwide are overseen by the International Telecommunication Union (ITU), which is an agency of the United Nations.

¹⁰ <http://www.iphonefreak.com/2008/06/denmark-carrier-telia-announces-iphone-3g-pricing-mms-support-included.html>

and the more recent iOS units¹¹: the iPod Touch from 2007, the Apple TV from 2007, and the iPad from 2010 among others.

As early as 2003 at the “D – All Things Digital” conference¹², Steve Jobs showed interest in the possibilities of the mobile phone, and in 2005 Apple and Motorola launched “ROKR E1”, the first mobile phone to be integrated with Apple’s iTunes software¹³. The collaboration ended in 2006, just five months prior to the announcement of the iPhone in January 2007 at the Macworld Conference and Expo. Even before the initial announcement of the iPhone, there was considerable speculation on what the “rumored Apple mobile phone” would look like (see Figure 1). Writing for The Mac Observer¹⁴ on November 9th 2006, John Martellaro stated:

“For several years now, we’ve all been swooning over the possibility of an Apple product we all believe will be called the ‘iPhone’. Why is this? I believe it’s because, deep down, we suspect, based on Apple’s track record, that the Apple iPhone will be a very desirable product. It will blow away the competition. It will make us look cool just using it. It will be a work of design art. And we’ll want one.”

The hype of the iPhone took off when Apple CEO Steve Jobs unveiled it at the annual Macworld Conference and Expo. The dramatic introduction, accompanied by applause and a standing ovation from thousands of Apple enthusiasts, was followed up by a public relations attack and a large number of articles in blogs, publications, and the mainstream media.

¹¹ Apple units that run on Apple’s updated operating software iOS.

¹² <http://d8.allthingsd.com/speakers/steve-jobs/>

¹³ <http://direct.motorola.com/hellomoto/rokr/>

¹⁴ <http://www.macobserver.com/columns/hiddendimensions/2006/11/09.1.shtml>

Figure 1: Examples of the Rumored Apple Mobile Phone



The Mac Observer, 9 November 2006



iPhoneFreak¹⁵, 20 October 2006

Apple claimed that the iPhone would be easier to use than other smart phones because of its unique touch screen display and intuitive software that allowed for such user-friendly features as scrolling visually through voice mail messages and easy access to the Internet, video, music, and third party application libraries.

Figure 2: Launch of the First iPhone in New York City, 2007, and Copenhagen, 2008



iPhone Edge launch, New York City 11 July 2007



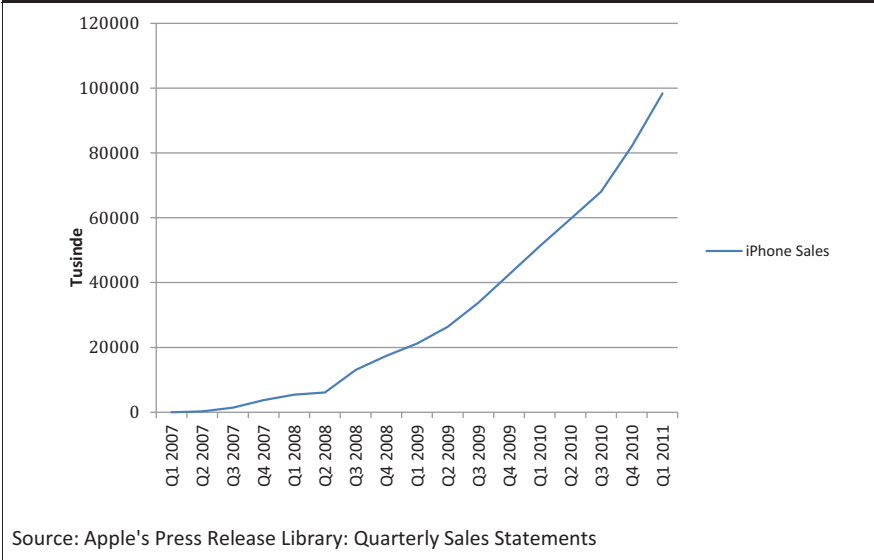
iPhone 3G launch, Copenhagen 10 July 2008

¹⁵ http://www.iphonefreak.com/2006/10/iphone_fake_pic.html

Apple aficionados elevated the status of the iPhone to unprecedented proportions. John Martellaro's prediction proved to be very accurate and as the launch date approached people all over the US waited in line for days to secure an iPhone. The launch itself, which took place over a weekend, was an event with live music, performances, and distribution of related samples. In Denmark an event leading up to the launch was held at midnight the year after (see Figure 2). While Apple began selling the iPhone, skeptics were questioning the hype surrounding it. The iPhone was less capable than existing competitive devices in many ways. The first release did not have 3G, using the older 2G technology from Edge; it did not allow synchronization with popular software programs, such as Microsoft Office including Exchange; and the camera was a mere two megapixels compared to the standard five megapixels in competing smartphones. Alongside the less competitive functionality, users were tied to a single network provider: AT&T in the US and Telia in Denmark. Finally, the monthly subscription plan for using the iPhone was one of the most expensive plans to date. Despite these apparent shortcomings, Apple sold 270,000 iPhones in the US in the first thirty hours of the launch weekend¹⁶ and the accumulated sales worldwide have since escalated (see Figure 3). The explanation for the escalated sales can, at least to some extent, be attributed the ecosystem surrounding the iPhone. It is not just a competitive mobile device, but rather it is a multipurpose information appliance (Hong and Tam, 2006) that complements the personal computer, and can be carried everywhere.

¹⁶ <http://www.apple.com/pr/library/2007/06/28iphone.html>

Figure 3: Accumulated iPhone Sales Worldwide, 2007-2011



The announcement of the iPhone and the statement that Apple would be entering a “multi-year partnership” with AT&T (at the time Cingular) meant an exclusive mobile voice and data service plan for iPhone users. According to Apple, AT&T was the “*best and most popular carrier in the US*”¹⁷. The media, however, noted that the large US competitor Verizon Wireless earlier declined the offer to enter a partnership¹⁸, and that while AT&T now had a multi-year exclusive contract with Apple to sell the iPhone¹⁹, Apple was, and still is, responsible for defining the iPhone's specifications, setting the price, building the user interface, deciding which 3rd party applications are allowed to be installed on the device, as well as the decision not to include 3G data support in the initial iPhone. Furthermore, AT&T only has on-screen branding and no brand name on the exterior of the iPhone. While Apple has confirmed that a payment agreement exists, the

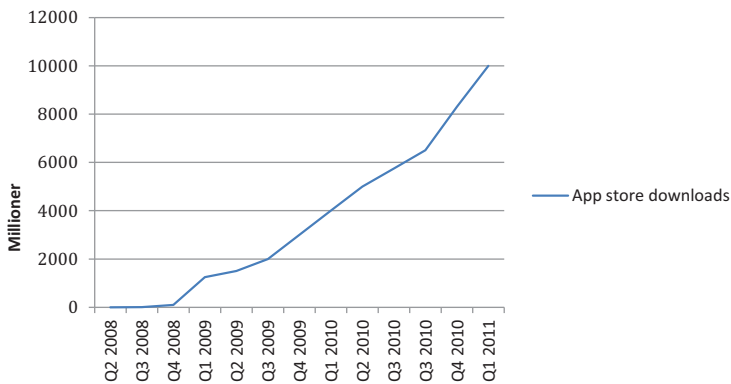
¹⁷ <http://www.apple.com/pr/library/2007/01/09cingular.html>

¹⁸ http://www.usatoday.com/tech/news/2007-01-28-verizon-iphone_x.htm?POE=TECISVA

¹⁹ Recently, Apple entered a partnership with Verizon in the US and a partnership with 3 in Denmark.

exact details have never been disclosed. It has, however, been estimated that Apple receives 18 USD per customer per month from AT&T, which amounts to 432 USD per subscriber over a two year contract period²⁰. The power relations between the actors of the mobile ecosystem have thus undergone a tremendous change. Whereas network operators traditionally were the powerful players within the mobile industry, able to price mobile phones and subscriptions based on competition, Apple, the mobile platform provider, has now become the powerful industry player that charges the network provider for selling its products. This revenue sharing model has set a new industry standard. Prior to the partnership between Apple and AT&T, a mobile device producer enforcing a new market structure had never before been observed. The popularity surrounding the Apple brand, along with the hype created at the yearly Macworld Conference and Expo, is continually being satisfied, and the expectations of Apple's innovative designs continues to live on.

Figure 4: Accumulated Application Downloads Worldwide, 2008-2011



Source: Apple Timeline: <http://www.apple.com/pr/products/ipodhistory/>

²⁰ http://news.cnet.com/8301-13579_3-9803657-37.html

By January 2011, Apple had sold almost one hundred million iPhones worldwide and consumers had downloaded ten billion applications from the App Store (see Figure 4). Upon its introduction, optimism that the iPhone would be available “unlocked” (open to other networks) through gray market channels in the US was met from AT&T with a promise of retaliation against those who unlock the iPhone²¹. A week after the US release, hackers at the “iPhone Dev Wiki” managed to partially unlock the iPhone and released a program for others to do so as well. Other hackers subsequently managed to completely unlock the iPhone and within two months the original “iPhone Dev Wiki” team released free software to facilitate this²². In response, Apple released software updates that disabled unlocked iPhones, starting the inevitable arms race: each software update was followed by a program to unlock the updated iPhone. Consumers did not just unlock the iPhone in order to use it on other networks other than Apple’s exclusive partners, they also started to “jailbreak” the devices to remove any limitations imposed upon the iPhone by Apple, such as the design and third party application limitations mentioned above.

2.3 THE MOBILE ECOSYSTEM

The mobile communications market involves a number of players, most importantly device manufacturers, platform providers, network operators, application and service providers, and infrastructure providers. The market is thus composed of a large and complex network of companies interacting with each other to provide a broad array of mobile products and services to consumers. Such a network can be thought of as an *ecosystem*, an operating logic in which actors actively collaborate with and are dependent on each other (Moore, 1993). The analogy of an ecosystem, borrowed from the natural sciences, has proven useful in understanding networks in an organizational context

²¹ <http://bits.blogs.nytimes.com/2007/01/10/more-iphone-fun-facts/>

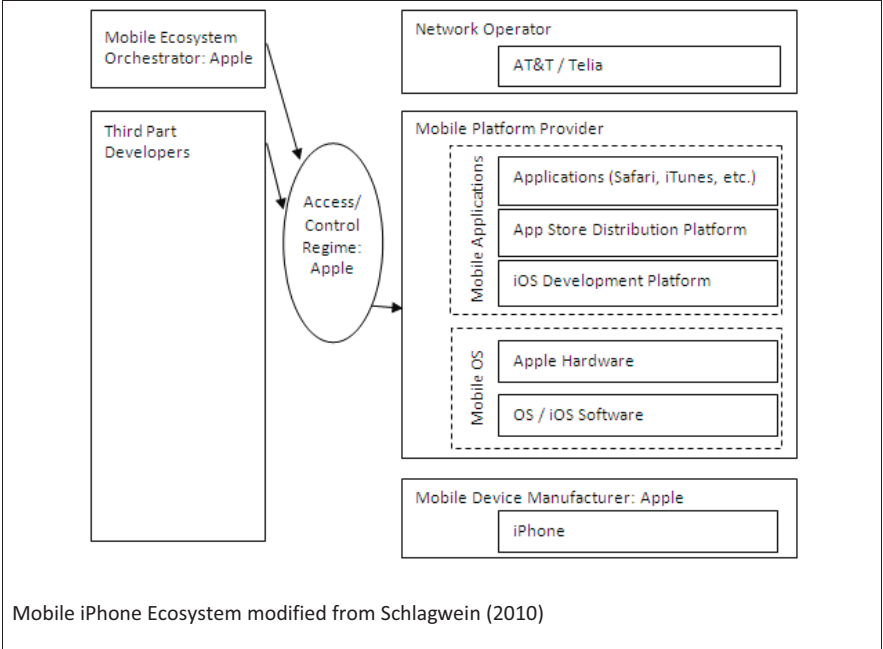
²² <http://gizmodo.com/gadgets/breaking/iphone-partially-unlocked-calls-without-att-contract-279606.php>

(Hannan and Freeman, 1977, Hannan and Freeman, 1989), and is also used more specifically to describe mobile contexts (Basole, 2009; Schlagwein et al., 2010).

The complexity of the mobile ecosystem is increasing with the convergence of enabling technologies: new actors emerge, new relations are formed, and the traditional distribution of power has shifted (Basole, 2009). Companies from different industries are entering the mobile market offering integrated and complementary products and services. This development has led to new forms of competition, as companies face changed consumer expectations, technological evolution, and regulatory influences, all on a local and global scale. Mobile usage patterns and purposes increasingly deviate from original intentions of use (e.g. Scheepers et al., 2006; Sørensen and Pica, 2005) as consumers construct new objectives and usage patterns. Furthermore, new players have entered the market, and new partnerships are being formed. Basole (2009, p.1) notes that previous research suggests that companies in complex networks “*need to orchestrate inter-organizational relationships, maintain and develop core competencies and develop business models that take network position and network value creation and delivery into account*”. These are some of the challenges that today’s players in the mobile ecosystem face.

Companies in central positions of such ecosystems are referred to as platform leaders (Gawer and Cusumano, 2002) or ecosystem orchestrators (Hinterhuber, 2002). Mobile ecosystem orchestrators strive to orchestrate the ecosystem to improve overall value creation. Traditionally, network operators have predominantly controlled the mobile ecosystem in most countries. However, at present mobile platform providers are gaining increased power. Figure 5 shows an overview of the Apple iPhone mobile ecosystem. On all levels, companies compete with peers in their respective markets.

Figure 5: iPhone Ecosystem



Mobile iPhone Ecosystem modified from Schlagwein (2010)

The mobile ecosystem surrounding the iPhone consists of five levels: the mobile device manufacturer, the mobile platform provider, the network operator, the third party application developer, and the mobile orchestrator. At the *mobile device manufacturer* level Apple, as the app phone manufacturer, produces and assembles the handset on which the mobile platform runs. As described in section 2.1: “Apple – The New Progressive Player”, Apple has established itself as being progressive in their product development, taking into account the whole user experience. While Apple is a relatively new player in the mobile market, the company has demonstrated that it is among the leading mobile device manufacturers, holding a 3.2% market share²³. Figure 6 provides

²³ <http://www.gartner.com/it/page.jsp?id=1466313>

an overview of the models of iPhone released along with specifications and enhancements.

Figure 6: Overview of iPhone Releases and Specifications

iPhone	iPhone 3GS	iPhone 4
		
<p>Announced: January 2007 Released: June 2007 Release in DK: June 2008 (3G)</p>	<p>Announced: June 2009 Released: June 2009</p>	<p>Announced: June 2010 Released: June 2010</p>
<i>Features</i>	<i>Features</i>	<i>Features</i>
<p>2G Network/3G from June 2008 Display</p> <ul style="list-style-type: none"> • 480-by-320 resolution • TFT capacitive touchscreen <p>Battery life (standby/talk/music):</p> <ul style="list-style-type: none"> • 250/8/24 <p>2 megapixel camera iTunes App Store (500 Apps) Status: discontinued</p>	<p>3G Network Display</p> <ul style="list-style-type: none"> • 480-by-320 resolution • TFT capacitive touchscreen <p>Battery life (standby/talk/music):</p> <ul style="list-style-type: none"> • 300/12/30 <p>3 megapixel camera VGA video recording iTunes App Store (50,000 Apps) Status: available</p>	<p>3G Network Display</p> <ul style="list-style-type: none"> • 960-by-640 resolution • TFT capacitive touchscreen <p>Battery life (standby/talk/music):</p> <ul style="list-style-type: none"> • 300/14/40 <p>5 megapixel camera HD video recording FaceTime video calling iTunes App Store (225,000 Apps) Status: available</p>
<p>Source: GSM Arena: http://www.gsmarena.com</p>		

The *mobile platform provider* level consists of two sub-levels: the *mobile operating system* level and the *mobile application* level. The operating system used on the iPhone was iPhone OS in the first three iPhone versions; iPhone, iPhone 3G, and iPhone 3GS; and iOS in the latest version; the iPhone 4. iOS has become increasingly popular along with Apple's mobile devices, including iPhone, iPod Touch, and iPad, and these iOS units now has a 16.7% market share²⁴. At the mobile application level, Apple provides a number of standard applications on the iPhone, such as calling, text messaging, the Safari browser, iTunes, and others. Third party applications can be accessed via Apple's App Store distribution platform, which is also a standard application on the iPhone. The App Store can be accessed on both Mac OS and iOS and allows users to browse and download applications that are developed with the iPhone software development kit (SDK) and are published through Apple. Depending on the application, apps are available either at no or some cost, and can be downloaded directly to the iPhone or other target devices, or onto a computer via iTunes. Apple controls the App Store and allows 70% of revenues to instantly go to the seller of the application, while Apple receives 30%. Furthermore, third party application developers can use the iOS development platform and the SDK supplied by Apple for application development purposes.

At the *network operator* level, AT&T and Telia, among others, provide access to communication networks. Although communication networks consist of several technological sub-elements, such as network and infrastructure, they are usually provided as an integrated package by the network operator. The network operators have joined in partnership with Apple to become sole initial suppliers of the iPhone as described in section 2.1: "Apple – the New Progressive Player".

The *third party application development* level consists of independent contributors who develop third party applications made available through the App store according to Apple's rules and revenue sharing model. As such, it is evident that Apple is also the mobile ecosystem orchestrator, who organizes web services, applications, and business

²⁴ <http://www.gartner.com/it/page.jsp?id=1466313>

processes and ties them together into a coherent workflow. The term “app phone” in this dissertation refers to the physical handset provided by the platform provider as well as the mobile operating system, applications, and services, but does not refer to infrastructure technologies.

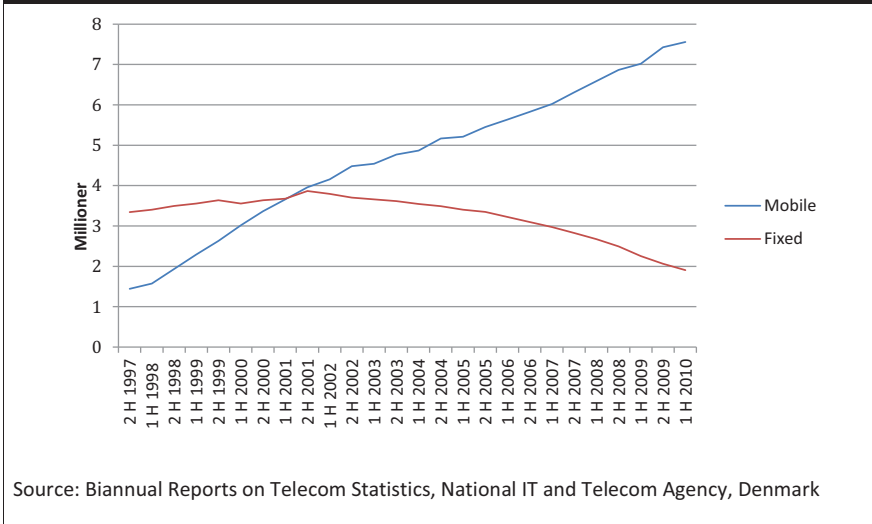
As new app phones and new applications have become available, network providers have provided affordable access to avoid continued jailbreaking of the system. Historically, the mobile voice market has followed the lead of the fixed voice market, basing itself on a monopoly rather than on competitive price setting. Today, however, the mobile industry has adopted more competitive price models for their mobile data services, and price models are moving towards flat mobile data pricing, which effectively relegates mobile operators to being infrastructure rather than service players.

2.4 THE DANISH TELECOM MARKET

As with the global telecom market, the Danish telecom market has experienced a significant increase in mobile subscriptions. Mobile penetration in Denmark is currently nearly one hundred percent, with several consumers owning more than one mobile phone and only a few consumers who have not yet obtained a mobile phone. Mobile services are provided by four major infrastructure providers, and a number of smaller, virtual mobile network operators. In Denmark, the infrastructure providers are forced by regulation to open their networks for other mobile network operators, and can only charge a certain amount to provide a fair return on investments for opening up the network.

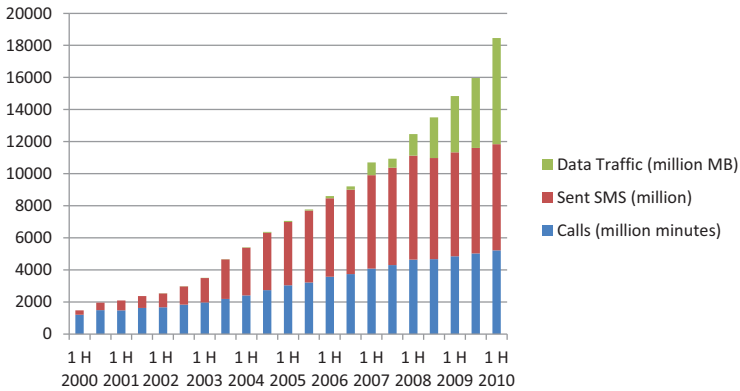
By the end of 2010, there were almost four times the number of mobile phone subscriptions than fixed telephone lines, and the number of mobile subscriptions is approaching eight million (see Figure 7). In contrast to the growth of the mobile sector, fixed telephony has experienced a decrease in the last decade.

Figure 7: Number of Fixed and Mobile Subscriptions in Denmark, 1997-2010



Mobile phone usage has increased immensely since 1997. While mobile calls have increased as fixed landline calls have decreased, the number of Short Message Service (SMS) messages sent has increased from 752 million in 2000 to 13 billion in 2009. The number of Multimedia Messaging Service (MMS) messages sent has increased from 2.7 million in 2003 to 75 million in 2010, and, finally, data traffic has increased from 551 TB in the second half of 2007 to 6,618 TB in the first half of 2010. Figure 8 shows mobile usage in Denmark between 1999 and 2009 as reported by the National IT and Telecom Agency in Denmark.

Figure 8: Mobile Usage in Denmark, 2000-2010

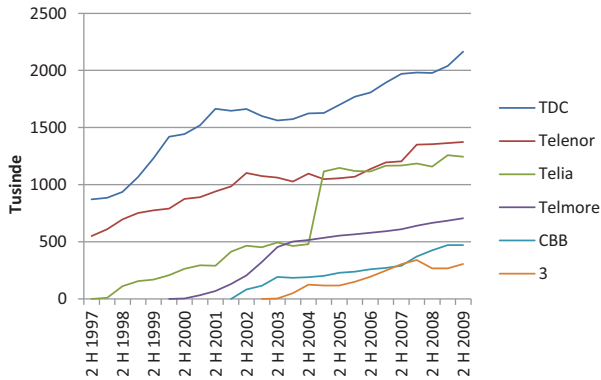


Source: Biannual Reports on Telecom Statistics, National IT and Telecom Agency, Denmark

The largest network operator in Denmark, TDC, is a former public telecom monopoly in Denmark and has recently relisted on the Stock Exchange after being a privately held company since 1998. TDC is the largest network provider in Denmark in all aspects of telecommunication, including fixed landlines, mobile, Internet, VHF maritime borderline-radio, etc.

Other competing network providers in the Danish market are Telenor, the large Norwegian operator, Telia, the large Swedish operator, and Telmore, which TDC owns a stock majority in. Finally, CBB and 3 are also fairly competitive in the Danish Telecom market. Telia was Apple's Danish partner when launching the iPhone in Denmark in 2008. Figure 9 shows the number of mobile subscriptions per network operator the past twelve years.

Figure 9: Number of Mobile Subscriptions per Network Operator, 1997-2009



Source: Biannual Reports on Telecom Statistics, National IT and Telecom Agency, Denmark

2.5 MOBILE COMPUTING

Advances in the mobile communications ecosystem have provided the foundation for the current mobile revolution, and mobile computing has emerged as a pervasive technology that is now crucial to consumers on the move. ICT is the broad term used to refer to any communication device or application that makes communication possible, encompassing radio, television, mobile phones, computer and network hardware and software, satellite systems, etc., as well as the various services associated with them, such as videoconferencing and distance learning. Mobile technologies, as a sub-group of ICT, are technologies related to the use of mobile devices and include devices, platforms, applications, services, and infrastructure.

From a business perspective, mobile computing provides applications, such as e-commerce, national defense, emergency and disaster management, real-time control systems, and remote operation of appliances (Varshney and Vetter, 2000). From a user perspective, mobile devices combine communication and computing into a multipurpose gadget that provides multiple services (Bergman, 2000), has a one-to-one binding with

the user, offers ubiquitous access, and provides both utilitarian and hedonic functions (Hong and Tam, 2006). Mobile devices can be further distinguished through the use of the terms feature phones, smartphones, and app phones. Smartphones offer Internet access, whereas app phones offer more advanced computing and connectivity and can be thought of as small handheld computers integrated with a mobile telephone.

2.6 SUMMARY OF CHAPTER

There are a limited number of mobile device studies, despite the widespread use of information technologies supporting and allowing for mobility. Although research into mobile devices is increasing, there are three related concerns that motivate the need for more work:

First, we are experiencing a mobile revolution. App phones, such as Apple's iPhone and Android phones, have led to a transformation of current mobile technology that is new and understudied. Mobile technologies have become pertinent to society at large and this study seeks to provide a better understanding of how adoption and use of app phones takes place in a lattice of competing forces and influences.

Second, research on the adoption and use of app phones is an emerging research domain, which needs further research emphasis. This dissertation seeks to contribute to the specific research domain of mobile adoption and use by applying a theoretical pluralist approach to understanding the complexity of reality, which is essential for developing reliable scientific knowledge (Van de Ven, 2007).

Finally, mobile adoption and use has to a large extent been studied by applying quantitative measures to uncover the complexities of the phenomenon by explaining correlations and other statistical measures between identified constructs. This study seeks to complement these studies by qualitatively investigating the complexity of the research phenomenon through rich and detailed analysis of the phenomenon.

CHAPTER THREE: ADOPTION AND USE OF MOBILE DEVICES

3.1 INTRODUCTION

The previous chapter provided background information on the current state of mobile communication with the aim of positioning Denmark in the ICT landscape. While the mobile ecosystem involves various business actors, this dissertation revolves around the users of app phones. This chapter thus reviews the existing body of literature that has focused on the adoption and use of mobile devices, including services taking their point of departure in the broader diffusion and adoption literature involving telecommunication innovations in general. The review defines the field to which this dissertation contributes to and seeks to expand. In particular, this dissertation will be positioned as a contribution to the field of adoption and use of mobile devices, utilizing a social influence and a competing forces approach to explore app phone adoption and use in social contexts. The chapter will begin by defining general telecommunication technologies along with the subset, mobile technologies, that is addressed by this dissertation. First, the findings of *Article 1* (Tscherning and Damsgaard, 2008) are discussed to clarify the field of interest. Second, the chapter reviews current research on the adoption and use of mobile devices. Third, the chapter identifies a number of research opportunities, specifically the application of a social influence approach and competing forces approach in relation to mobile device adoption and use. Finally, the chapter discusses how a qualitative study applying these approaches can benefit research into the adoption and use of mobile devices.

3.2 MOBILE ADOPTION AND USE - BASIC CONCEPTS

In order to answer the research question, it is of interest to investigate how mobile devices have been approached for the purpose of explaining adoption and use, and how such approaches might be improved. *Article 1* (Tscherning and Damsgaard, 2008) takes a broad perspective and investigates the diffusion and adoption of telecommunication

innovations in selected outlets. Telecommunication refers here to the transmission of information over significant distances by electronic means for the purpose of communication²⁵. While the diffusion and adoption of some telecommunication innovations has increased to unexpected proportions, the diffusion and adoption of others have not (Anil et al., 2003; Carlsson et al., 2006; Constantiou et al., 2006), making it of interest to examine the state of telecommunication diffusion and adoption research. *Article 1* (Tscherning and Damsgaard, 2008) examines the aspects that are either accentuated or overlooked in diffusion and adoption research as reported in the literature. Specifically, the article reviews research presented between 1998 and 2007 from three outlets: the International Conference on Information Systems (ICIS), the European Conference on Information Systems (ECIS), and the IFIP International Federation for Information Processing conference on diffusion and adoption (IFIP 8.6). The literature study, presented through a holistic framework, investigates the types of telecommunication technology being studied, the adopting unit studied, whether researchers took a variance or a process view, the division between positivistic and interpretive approaches, and, finally, whether one or more theories dominated the diffusion and adoption literature. Through analysis, the literature study reveals that the majority of telecommunication research relates to mobile devices and services, such as mobile TV services (Lin and Chiasson, 2007) and mobile video streaming (Stanoevska-Slabeva and Hoegg, 2005), as opposed to, for example, broadband technologies (e.g. Choudrie and Dwivedi, 2005; Damsgaard and Gao, 2004). A majority of the research has been conducted on the voluntary use of these technologies at the individual level, while the group/social network and inter-organizational levels of research are nearly absent. Furthermore, the variance research perspective dominates in preference to the process perspective, while it seems that there is an almost equal distribution of positivist and interpretive research in the three outlets during the investigated ten years. There is no real synthesis in regard to theoretical approach, and while the TAM is widely used, many

²⁵ http://searchtelecom.techtarget.com/sDefinition/0,,sid103_gci1262258,00.html

studies employ theories from related fields, such as marketing (Dahlberg and Mallat, 2002; Haghirian and Madlberger, 2005) and economics (Choudrie et al., 2003).

While the literature study does not claim to be comprehensive, it does reveal some interesting trends. Whereas the majority of the research is conducted at the individual level, some diffusion and adoption research seem to involve multiple levels in selected studies; e.g. adoption of mobile virtual healthcare communities involving individuals and communities (Leimeister et al. (2002) and adoption of mobile communication technology involving individuals and organizations (Sell et al., 2004). Furthermore, while it has been established that contextual factors, such as a consumer's social environment, generally have significant impact on IT adoption and usage behaviors (Lewis et al. 2003; Magni et al. 2008), the literature review revealed little effort put toward trying to understand how social influences impact diffusion as well as adoption decisions.

The telecommunication literature review in *Article 1* (Tscherning and Damsgaard, 2008) involves several types of telecommunication technologies, but the focus of this dissertation is on mobile technologies. Mobile technologies refer to a subset of telecommunication technologies comprising mobile devices, platforms, applications, services, and infrastructure that enable transmission of information for the purpose of communication. Mobile technology adoption has been a key area of interest for researchers for the past decade, and the field is often referred to as one field although it encompasses several broad research streams: diffusion, adoption, uses and gratification, and domestication (Pedersen and Ling, 2003). *Diffusion research* examines the process and the rate with which a new technology spreads through a culture (Rogers, 2003; Tarde et al., 2008) and, hence, the IS field studies the aggregate diffusion or adoption of a technology or service in an industry, a community, or in society in general. Adoption is the result of a decision-making process in which an individual, group, or organization considers using a particular innovation (Rogers, 2003). *Adoption research* studies the adoption and use of technologies in general and their use in organizations in particular. It focuses on the adoption process and use of a wide variety of technologies and

applications. The technologies being adopted have previously most often been applications, systems or services rather than technological artifacts or devices (Benbasat and Barki 2007; Orlikowski and Iacono, 2001; Pedersen and Ling, 2003). *Uses and gratifications research* places more focus on the consumer instead of the actual message of the medium itself (Katz, 1959) and studies the gratifications sought by the adopters of different kinds of media. Finally, *domestication research* studies the adoption, use, and domestication of technology in society with a particular focus on its societal consequences (Pedersen and Ling, 2003). These four streams of research have their origins in different fields, which explains their differing focal points: diffusion research is founded in marketing and economics, adoption research in IS, uses and gratifications in the media and communication field, and domestication research is founded in sociology.

Article 1 (Tscherning and Damsgaard, 2008) lays the groundwork for defining the area of concern for the present research. The main research question “*To what extent can an understanding of social influences and, more generally, a set of competing forces, assist in explaining the early adoption and use of app phones?*” identifies adoption and use research as the primary area of concern for this dissertation. Thus, the following section reviews and assesses the emerging literature on mobile device adoption and use, and does not address diffusion research, uses and gratifications research, or domestication research. Research on mobile device adoption and use has been conducted at multiple levels of analysis: individual (Al-Natour and Benbasat, 2009; Bruner and Kumar, 2005; van der Heijden, 2004), group (Sarker et al., 2005, Sarker, 2006), organizational (Nippert-Eng 1996; Palen et al. (2001), and inter-organizational (Hripcsak et al., 1999). This dissertation investigates mobile adoption and use solely at the individual consumer level, however, and the following literature study therefore concerns consumer adoption and use of mobile technologies. Finally, the literature study primarily draws on previous research within IS, although research published in related areas, such as marketing, digital media, and psychology is also included.

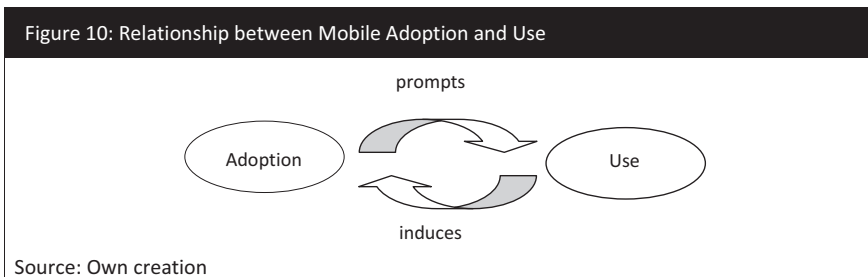
3.3 ADOPTION AND USE OF MOBILE DEVICES

While the technological innovations of mobile devices trace back to the 1940s, it wasn't until the 1990s that adoption took off (Lacohée et al., 2003). Since then, research on mobile devices has received a great deal of attention from both academics and practitioners seeking to understand the implications of mobile devices. Several journals have been dedicated to mobile technologies with varying points of focus, such as the consumer, *Consumer Use of the Internet and Mobile Web*, mobile marketing, *International Journal of Mobile Marketing*, and mobile communication, *International Journal of Mobile Communication*, among others. Furthermore, special issues of several journals have been dedicated to the topic, such as the *European Journal on Information Systems* in 2006, *Communications of the ACM* in 2003 and 2005, the *International Journal of Electronic Commerce* in 2003 and 2004, and *Decision Support Systems* in 2003. Finally, researchers have recently been talking about a mobilities paradigm that would re-evaluate the world via a mobile lens, one that “connects the analysis of different forms of travel, transport, and communications” (Urry, 2007, p. 6). Interestingly, while research in mobile technologies has increased immensely, only limited research on the topic has been published in the “basket of eight” IS journals²⁶. Landau (2010) found that out of 2001 total articles published in the “basket of eight” journals between 2000 and 2010, only 76, equivalent to 3.8%, concerned mobile ICT, ranging from 0.8% in *Management Information Systems Quarterly* (MISQ) to 7.5% in the *European Journal of Information Systems* (EJIS). Only one article, from *Information Systems Research* (ISR), concerned the adoption and use of mobile devices (Hong and Tam, 2006). One explanation may be that IS researchers seek to engage with practice and with the latest developments in the field. A publication vehicle with a more rapid response rate than the existing one might enable IS researchers to publish on current research topics of interest

²⁶ The “basket of eight” IS journals are the following in order of impact factor: *Management Information Systems Quarterly* (MISQ), *Information Systems Research* (ISR), *Journal of Management Information Systems* (JMIS), *Journal of the Association of Information Systems* (JAIS), *Journal of Information Systems* (JIS), *Journal of Strategic Information Systems* (JSIS), *Information Systems Journal* (ISJ), and *European Journal of Information Systems* (EJIS).

(Baskerville and Myers, 2009). Since such a vehicle does not exist in the very best journals at this point, the following literature study draws primarily on other IS journals and conferences.

The adoption and use of mobile technologies has long been at the core of mobile research in the IS field. Although closely linked conceptually, research on the adoption and use of mobile devices is typically pursued independently with only a few exceptions studying both (e.g. Al-Natour and Benbazat, 2009; Cambell and Russo, 2003; Sarker and Wells, 2003). However, in practice, the two concepts are continuous: once a decision has been made to adopt a mobile device, the user is naturally prompted to use the services offered. After using the device for a period of time, most users decide to upgrade their current device to a newer model that fits their needs better. Figure 10 portrays the reciprocal relationship between the two research streams.



In the following, research in the field of mobile adoption and use is reviewed, focusing on studies that investigate the decision to adopt mobile devices in a consumer context and studies that investigate consumer usage behavior in relation to mobile devices. Driving this inquiry is the realization that mobile services yield disappointing adoption levels especially frequently (Anil, 2003; Constantiou et al., 2006). While the two research streams are investigated separately, the same factors seem to influence the streams, and hence the two streams are discussed jointly.

The Role of the Artifact

It is by now a common assumption that in IS research the IT artifact has tended to be taken for granted (Orlikowski and Iacono, 2001). It has been either “black-boxed” or treated as being a stable element without researchers taking notice of it (Latour, 1987). In traditional models of IT adoption, such as the TAM (Davis 1989), artifacts have furthermore commonly been viewed as productivity-oriented tools. Recently, however, Benbasat and Zmud (2003, p. 186) conceptualized the IT artifact more broadly to be “*the application of IT to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s)*” and proposed that factors and phenomena closely associated with the IT artifact should come into play as central elements of an IS study.

In mobile adoption research, Hong and Tam (2006) refer to multipurpose information appliances such as mobile devices as IT artifacts that have a one-to-one binding with the user, offer ubiquitous services and access, and provide a number of utilitarian and hedonic functions. They develop and empirically test an adoption model that incorporates technology-specific perceptions of the device. Their results show that users’ technology-specific perception are important determinants of adoption, including service availability, which is the extent to which an information appliance is perceived as being able to provide pervasive and timely connections, and perceived value for money, which is a cognitive trade-off between perceptions of quality and sacrifice that results in a balanced perception of monetary value (Hong and Tam, 2006, p. 166). Similarly, Bruner and Kumar (2005) find that when accessing the mobile Internet, the fun of using a specific device should not come at the expense of the device being easy to use. Their basic notion is that a specific device used to access the Internet may provide greater intrinsic motivation to consumers. Finally, Al-Natour and Benbasat (2009), who investigate both adoption and use, propose that understanding a user’s relationship with an IT artifact is essential to understanding whether the user will decide to reuse the same artifact, the nature of such usage, and the choice to switch to another artifact. Their results support findings in previous literature that users not only view their interactions with IT artifacts

as social and interpersonal, but also attribute to them human-like behaviors and personalities. Thus, depending on how an IT artifact is appropriated, the cues manifested and perceived will be different as, in social relationships, behavioral and relationship beliefs affect choices made in future interactions. In mobile use research, Cambell and Russo (2003) investigate factors that affect perceptions and use of mobile devices and include the degree to which the device is perceived as being an artifact of personal display, and they find support for the argument that perceptions and uses of mobile devices are socially constructed.

While the artifact is gaining increased attention in recent mobile adoption and use research, the new types of devices that continually evolve and offer new services and applications constantly add new considerations. Carr's (2003) claim that IT systems and services, along with becoming ubiquitous, have also become commodities and are no longer differentiable from each other (Carr, 2003, p. 6) is being challenged. As Hong and Tam (2006) state, "*there is an intrinsic force from the demand side to intensify the extent and nature of personalization of information appliances and their supporting services*". Traditional adoption and use models that "black-box" the artifact are not able to entirely explain adoption and use of the new type of app phones.

The Role of User Psychographics

Demographics are the typical characteristics of users, such as gender (Nysveen et al., 2005; Riquelme and Rios, 2010) and age (Carroll et al., 2002), that have been applied to qualify effects in studies, both as moderators as well as general demographics as main empirical evidence of mobile adoption (Rice and Katz, 2001). By contrast, psychographics, which originates from marketing, is the study of personality, values, attitudes, interests, and lifestyles (Demby, 1971).

Identifying pre-adoption criteria remains a critical issue, and several researchers have either applied or emphasized psychographics in their mobile adoption studies. *User characteristics* that go beyond simple demographics may help categorize mobile users, and Constantiou et al. (2007) conduct statistical analyses of empirical data on mobile

service users to segment mobile adopters. The authors suggest that core characteristics among different adopter types should be supplemented with user behavior and variations in user requirements and attitudes. Several studies apply general demographics and psychographics for different purposes. Haghirian and Madlberger (2005) investigate antecedents of attitude toward advertising via mobile devices and Al-Natour and Benbazat (2005) seek to determine final intention to adopt artifacts. In mobile use studies, Constantiou et al. (2006) examine how basic mobile users can become advanced mobile users, and Bina and Giaglis (2005) identify early adopters' profiles based on gender, age, education, and income.

Since Rogers' (2003) classification of individual's into adopter categories, *innovativeness* has been a prevalent psychographic attribute in adoption research. As innovators are willing to take risks, have high social status, great financial lucidity, and interact frequently with other innovators, they are more willing to adopt new technologies that may or may not ultimately succeed (Rogers, p. 282). For early adoption, decision-making is exposed to variables other than those incurred by the technology itself and users may possibly be more influenced by those variables (e.g. Ajzen and Fishbein, 1980; Karahanna and Straub, 1999; Rogers, 1983). Lu et al. (2008) apply social influence and personal innovativeness to TAM to explain intention to adopt wireless Internet services via mobile technology, and Yang (2010) similarly applies self-efficacy and innovativeness to TAM to explain intention to adopt mobile data services in the US and in Korea respectively. Lu et al.'s (2008) study reveals strong causal relationships between social influences, personal innovativeness, and perceptual beliefs such as usefulness and ease of use, which in turn impact adoption intentions. Providing a cultural perspective, Yang's (2010) results indicate that the effect of technology self-efficacy on perceived ease of use of mobile data services was stronger for American consumers than Korean consumers, and that the effect of innovativeness on behavioral intention to use mobile data services was stronger for Korean consumers than American consumers. Finally, Bauer et al. (2005) find that innovativeness increases knowledge about mobile

communication, which in turn positively influences users' attitude towards mobile marketing.

Other examples of studies showing that psychographic attributes influence adoption behavior include studies on social influence, where the focus shifts from individual choice to socially constructed patterns of adoption and usage decisions (Bauer et al., 2005; Dickinger et al., 2008; Lu et al., 2008; Nysveen et al., 2005), trust-based constructs in the context of mobile commerce (Lin and Wang, 2005; Luarn and Lin, 2005), and broad attitudinal, social, and perceived behavior control factors (Teo and Pok, 2003). Pedersen and Nysveen (2003) apply self-expressiveness to TAM to explain intention to adopt mobile parking services. They find that self-expressiveness contributes considerably to the explanatory power of the extended TAM. Finally, a number of studies on value-based adoption of mobile services have been conducted. Yang and Jolly (2009) apply perceived value, such as functional, social, monetary, and emotional, to attitude toward adopting mobile data services in the US and Korea, and find that emotional value has the most significant effect on using mobile data services for consumers in the two countries. Kim et al. (2005) develop the Value-based Adoption Model to explain mobile Internet adoption and demonstrate that consumers' perception of the value of mobile Internet is a principal determinant of adoption intention.

The Role of Usage Objectives

Though several research studies apply user psychographics, usage objectives have played an increasingly important role in mobile adoption and use studies. While different qualities provided by mobile systems have been applied to studies, such as system and content quality (Cheong and Park, 2005; Haghirian and Madlberger, 2005), quality of service (Andrews et al., 2001), and aesthetic qualities (Cyr et al., 2006), mobile adoption and use objectives have been increasingly referred to as productivity-oriented/ utilitarian or pleasure-oriented/hedonic (Van der Heijden, 2004), terms tracing back to the motivational studies of the 1950s (Deci, 1975; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982). Van der Heijden (2004) emphasizes the hedonic usage objectives

of IT, which he maintains provide self-fulfilling rather than instrumental value to the user, are strongly connected to home and leisure activities, focus on the fun-aspect of using devices, encourage prolonged rather than productive use, and are intrinsically motivated. In contrast, utilitarian usage of IT, which has been emphasized previously, provides instrumental value to the user, implying that there is an objective external to the interaction between user and device such as increasing task performance, and is extrinsically motivated (Van der Heijden, 2004, p. 695).

In mobile adoption research, there has been considerable work on the utilitarian-based TAM to predict whether individuals will adopt and voluntarily use a technology. TAM has consistently outperformed other theories, such as the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1973; Fishbein and Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991) in terms of explained variance (e.g., Davis et al., 1989; Venkatesh et al., 2003). Several mobile studies therefore adopt TAM and employ perceived ease of use and perceived usefulness as key independent variables while adding other variables to increase explanatory power of adoption and use (e.g. Cheong and Park, 2005, Carlsson et al., 2006; Riquelme and Rios, 2010). Several studies also extend the model with hedonic measures, such as perceived enjoyment (Dickinger et al., 2008, Hill and Troshani, 2010; Hong and Tam, 2006; Van der Heijden, 2004, 2005), fun (Bruner and Kumar, 2005), and playfulness (Cheong and Park, 2005).

In mobile use studies, Lee et al. (2009) adopt utilitarian and hedonic benefits as two key objectives for mobile data service usage and find that information quality has a stronger influence on usage increase when the main motive is utilitarian rather than hedonic. Nysveen et al.'s (2005) study, however, suggests that social norms and hedonic, intrinsic motives are important determinants of intention to use among female users, whereas utilitarian, extrinsic motives are key drivers among men. Finally Wu and Du (2010) suggest that mobile devices can also be dual-purposed, possessing co-existing utilitarian and hedonic purposes.

The Role of Assimilation:

While research on the adoption and use of mobile devices indicates considerable impact, it has been established that the long term innovative effects and benefits occur when users subsequently assimilate technologies, make them their own, and embed them within their lives (Bar et al., 2007). Technology assimilation refers to the process of incorporating and absorbing uses of IT into an existing cognitive structure. The term is inspired by Piaget's (1972) notion of intelligent adaptation and learning referred to by Piaget (1972) as assimilation and accommodation. Piaget (1972) states that assimilation is the process of using or transforming the environment so that it can be placed within preexisting cognitive structures, while accommodation is the process of changing cognitive structures in order to accept something from the environment. Technology assimilation, therefore, assumes that when a technology has been adopted, it will be incorporated into the adopter's cognitive structures. However, Fichman and Kemerer (1997) found that an assimilation gap may exist and developed a measure for the difference between cumulative acquisition and deployment patterns, as technologies are not always fully assimilated. High assimilation is desirable, as assimilation and the continued usage of mobile devices may prevent undesirable costs or induce users to re-configure the device (Bar et al., 2007; Bhattacharjee, 2001).

3.4 RESEARCH OPPORTUNITIES

Table 3 provides an overview of research conducted on the adoption and use of mobile devices and services. Overall, there is agreement that research on adoption and use of mobile devices is an important field to study and some researchers go beyond mere adoption studies and investigate assimilation. However, certain research opportunities in the field can be identified. First, while the mobile device, the artifact, has gained attention as a consequence of Orlikowski and Iacono's (2001) call for its emphasis, research in this area is still limited. Most studies taking the artifact into account only do so peripherally, and the implications of specific mobile devices are often not investigated. An exception is Hong and Tam (2006) who focus primarily on multipurpose information appliance devices. As app phones are qualitatively different from previous types of mobile devices,

considering the artifact is critical. Second, while studies considering user psychographics as antecedents to mobile adoption and usage behaviors are manifold, the number of studies taking social influences into account is limited. Dickinger et al. (2008) and Lu et al. (2008) explicitly investigate social influences through Structural Equation Modeling (SEM) and find strong causal relationships between social influences and mobile adoption, indicating that more research in the area is needed.

Table 3: Research on the Adoption and Use of Mobile Devices and Services				
	Definition	Constructs	Adoption References	Use References
The Artifact	The application of IT to enable or support some task(s) embedded within a structure(s) that is itself embedded within a context(s) (Banbazat and Zmud, 2003).	<ul style="list-style-type: none"> - Mobile device - Multipurpose information appliances 	Al-Natour and Benbazat, 2009; Bruner and Kumar, 2003; Hong and Tam, 2006; Sarker and Wells, 2003	Al-Natour and Benbazat, 2009; Cambell and Russo, 2003; Sarker and Wells, 2003
Psychographics	The study of personality, values, attitudes, interests, and lifestyles (Demby, 1971).	<ul style="list-style-type: none"> - User characteristics - Innovativeness - Social norm - Values - Attitude 	Al-Natour and Benbazat, 2009; Bauer et al., 2005; Constantiou et al., 2007; Dickinger et al., 2008; Haghirian and Madlberger, 2005; Lu et al., 2008; Pedersen and Nysveen, 2003; Teo and Pok, 2003; Kim et al., 2005; Yang, 2010; Yang and Jolly, 2009	Al-Natour and Benbazat, 2009; Bina and Giaglis, 2005; Carroll et al., 2002; Constantiou et al., 2006; Lin and Wang, 2005; Luarn and Lin, 2005; Nysveen et al., 2005; Rice and Katz, 2003
Objectives	Utilitarian objectives provide instrumental value to the user, are external to the interaction between user and device, and are extrinsically motivated.	<ul style="list-style-type: none"> - Perceived ease of use - Perceived usefulness - Utility 	Bauer et al., 2005; Cheong and Park, 2005; Carlsson et al., 2006; Riquelme and Rios, 2010	Lee et al., 2009; Nysveen et al., 2005; Wu and Du, 2010

	Hedonic objectives provide self-fulfilling value to the user, are connected to home and leisure activities, focus on the fun aspect, encourage prolonged use of devices, and are intrinsically motivated.	<ul style="list-style-type: none"> - Perceived enjoyment - Fun - Playfulness 	Cheong and Park, 2005; Dickinger et al., 2008, Hill and Troshani, 2010; Hong and Tam, 2006; Van der Heijden, 2004, 2005; Bruner and Kumar, 2003	Lee et al., 2009; Nysveen et al., 2005; Wu and Du, 2010
Assimilation	The process of incorporating and absorbing new ideas and IT into an existing cognitive structure (Fichman and Kemerer, 1997; Fichmann, 2000)	-	-	Bar et al., 2007; Bhattacharjee, 2001

Third, recent research shows a need for distinguishing between utilitarian and hedonic objectives of mobile devices. While researchers seem to agree that utilitarian or hedonic objectives guide mobile users in their adoption and use decisions, they do not seem to agree on which of these objectives has the highest explanatory power or when. As proposed by Wu and Du (2010), mobile devices are also dual-purposed and the conflicting nature of the mobile device should be investigated further. Fourth, only very limited research has been conducted into the assimilation of mobile devices, though it is now widely recognized that IT assimilation gaps often occur and long term innovative effects fail to appear. This implies a need for understanding how mobile devices are assimilated. While a large share of the investigated studies seek causal explanations of the adoption and use of mobile devices, the dependent variable of these studies is most often users' intention to adopt a mobile device or service, and few studies investigate whether behavioral intention can in fact predict actual behavior. The linkage between behavioral intention and actual behavior may be attributed to Ajzen and Fishbein (1980) who determine that an appropriate measure of behavioral intention is an immediate determinant of actual behavior and will provide the most accurate prediction. In contrast, Bagozzi (2007, p. 245) states that "*the intention-behavior linkage is probably the most uncritically accepted assumption in social science research in general and IS research in particular*". He argues that adoption and use are most often not the ultimate goal but

merely a means to an end. He, furthermore, believes that there is a gap in time between the time intentions are formed and the time a user conducts actual behavior, and thus that unanticipated obstacles may occur. Bagozzi (2007) therefore argues that it is important to consider various psychological and instrumental steps that occur between behavioral intention and actual behavior. The predictive validity of the intention-behavior linkage of, for example, TAM has, however, been established (Szajna, 1994), which might explain why much of the existing literature on mobile device adoption and use seem to support Ajzen and Fishbein's (1980) assumption that behavioral intention is the most appropriate measure of adoption (e.g. Bruner and Kumar, 2005; Lin and Wang, 2005; Luarn and Lin, 2005; Nysveen et al., 2005; Pedersen and Nysveen, 2003; Sarker et al., 2003).

3.5 ALTERNATIVE FRAMING OF ADOPTION AND USE OF MOBILE DEVICES

Based on the previous literature study, it is apparent that research in the area of mobile device adoption and use is becoming an established field, and that much relevant research has already been conducted. However, several opportunities for further research have been identified. The distinction between utilitarian and hedonic objectives of mobile users in existing research seems to show divergent results, suggesting that more research should be conducted on these potentially contradictory usage objectives. Also, previous research implies that social influences have significant impact on individual adoption and usage decisions, suggesting that conflicts exist between individual consumer intentions and social influences imposed by an individual's environment. It has, furthermore, become a general assumption that behavioral intention can reliably predict actual mobile adoption and usage behavior, though this linkage has been questioned and it has been argued that the psychological and instrumental steps that occur between intention and behavior should be investigated. Finally, while it has been argued in Chapter 2: "Mobile Communication" that the new types of mobile devices have changed the mobile ecosystem and are no longer just tools but multi-purpose devices, the artifact itself has significant importance in the study of the adoption and use of mobile devices. Traditional

utilitarian models are based on viewing users as rational consumers who select the best possible technology available (Simon, 1955), but these models do not explain why users choose to adopt and use inferior mobile devices, such as the initial version of the iPhone. As such, there is a need for the application of different perspectives to the field of mobile device adoption and use.

This dissertation consequently takes a qualitative approach to studying mobile device adoption and seeks to contribute to existing research by applying a social influence approach and a competing forces approach. Social influence can be referred to as the “*change in an individual’s thoughts, feelings, attitudes, or behaviors that results from interaction with another individual or a group*” (Rashotte 2007, p.1). While earlier definitions included norms and roles (French and Raven 1959), it is expected that individuals make genuine changes to their feelings and behaviors as a result of interaction with others who are perceived to be similar to them, desirable, or experts (Rashotte 2007). A social influence approach can contribute to explaining how individual mobile users are affected in their adoption and use decisions. A social influence approach implicitly takes two adoption levels into account, the individual and the social contexts, and may thus also provide insight into the dynamics that occur between these two levels. A competing forces approach focuses on the tensions within mobile device experiences. As Jaarvenpaa and Lang (2005) and Mick and Fournier (1998) propose, and as the literature study shows, mobile users experience conflicting forces when making adoption and usage decisions. The approach encompasses a pressure that is not easily reconciled between individual intentions and social influences, but also examines the broader tensions of mobile adoption and use.

The recent developments in mobile phone technology means that these devices are no longer just portable phones carried by users, but instead have become small-scale information appliances containing personal information and pervasive access possibilities. Prior research on mobile device adoption and use shows evidence that a new paradigm that increases the need to include the social aspects of mobile device adoption

and use is emerging. On these grounds, this research was designed to contribute to mobile device adoption and use research with the dual objective of 1) increasing our knowledge of social influences on the adoption and use of mobile devices in particular, and 2) increasing our knowledge on how competing forces shape adoption and use behaviors more generally.

3.6 SUMMARY OF CHAPTER

This chapter has positioned the dissertation as core research within the field of IS, drawing on reference disciplines to investigate how social influences can explain the adoption and use of mobile devices. Specifically, the chapter started by defining the basic concepts of telecommunication technologies in general, also addressed in *Article 1* (Tscherning and Damsgaard, 2008), and mobile technologies specifically. The article reveals a number of specific patterns in broad telecommunication research in view of the holistic model used in conduct the literature study. Reflecting on the results, however, other interesting notions are revealed. While some of the research studies involve multiple levels of analysis (Leimeister et al., 2002; Sell et al., 2004), most diffusion and adoption research is conducted at the individual level. Further, while it is well-known that contextual factors, such as a technology user's environment (Lewis et al., 2003; Magni et al., 2008), influences individual adoption decisions, limited research takes social influences into account.

Focusing on mobile device adoption and usage, the literature review reveals four areas considered in research: the role of the artifact, the role of user psychographics, the role of usage objectives, and the role of assimilation. Since Orlikowski and Iacono's (1991) call for theorizing the artifact, a substantial number of the mobile adoption and use studies have attempted to take the artifact into account. While this effort seeks to accommodate previous requests, there is still very limited research emphasizing the role of the artifact (Al-Natour and Benbazat, 2009; Hong and Tam, 2006). Furthermore, while several studies apply a socially-related independent variable to explain social influences in their

predictive adoption and use studies, only few studies explicitly investigate social influences as a key driver of adoption and use (Dickinger et al., 2008; Lu et al., 2008). The literature review, furthermore, revealed a need for distinguishing between utilitarian and hedonic objectives of mobile device adoption and use, as users are faced with tensions in their everyday lives concerning when to use the mobile device and for what purpose. Finally, very limited research has been conducted on assimilation of mobile devices, and the introduction of the new app phones adds to the importance of exploring to what extent users actually utilize the possibilities their app phone offers.

Having shown how mobile devices have been approached for the purpose of explaining adoption and use, this literature review concludes by suggesting that further work needs to be done to explore how social influences impact mobile adoption and usage decisions. It also emphasizes that researchers should engage with how users make decisions in the context of the competing forces of individual versus social influences and utilitarian versus hedonic objectives that they face.

PART TWO: FRAMING

Part Two provides the theoretical framing through which the research question will be answered. This dissertation applies an integrative theoretical perspective to partly address the two research sub-questions, and thus contains only one chapter on theoretical framing. First, the chapter addresses the social influence approach in framing the adoption and use of app phones. The purpose is to create a foundation for addressing research sub-question 1. Second, individual and social orientations are situated in the wider competing forces approach along with two additional dimensions of competing forces: behavior and objective. The purpose is then to take a wider theoretical approach to provide additional knowledge and address research sub-question 2.

CHAPTER FOUR: FRAMING APP PHONE ADOPTION AND USE

4.1 INTRODUCTION

The social influence approach has been widely employed in social and behavioral sciences such as sociology (Clawson et al. 1986; Emirbayer and Goodwin 1994), anthropology (Wellmann 1999), epidemiology (Rothenberg et al. 1998; Potterat et al. 1999), economics (Bala and Goyal 1998; Manski 2000; Chwe, 2000), and diffusion of innovations theory (Coleman et al. 1957; Coleman et al. 1966; Burt 1986; Young 1999), but has so far seen limited application in the field of IS. There are some contributions that attempt to conceptualize the adoption and use of IT through this perspective (e.g., Mathieson, 1991; van den Bulte and Lilien, 2001) or to investigate how IT products and services spread in a network (Anderson, 2006; Oh et al. 2006; Oestreicher-Singer and Sundararajan, 2008), but only few studies directly target mobile device adoption and use (Dickinger et al., 2008; Lu et al., 2008).

Similarly, the competing forces perspective has been widely employed in the study of organizational phenomena such as organizational effectiveness (Quinn and Rohrbaugh, 1983) and organizational culture (Cameron and Quinn, 1999), and management phenomena such as leadership competencies (Yukl, 1989) and leadership in self-managed teams (Yang and Shao, 1996), but this perspective has likewise received limited attention in the field of IS (Cho et al., 2007; Carlsson and Widmeyer, 1990; Cooper and Quinn, 1993; Ngewenyam and Nielsen, 2003; Robey, 1995). The purpose of the following section is twofold. First, the section explores how the social influence perspective can explain app phone adoption and use and why it is relevant. Second, the section situates individual and social orientation in the wider competing forces perspective and explains how such a perspective can inform research into mobile device adoption and use.

4.2 THE SOCIAL INFLUENCE APPROACH

The social influence perspective originates from social psychology, the scientific study of how people's thoughts, feelings, and behaviors are influenced by the actual, imagined, or implied presence of others (Allport, 1985). Cialdini and Trost (1998) argue that in order to fully understand the process of personal change, such as the decision to adopt and use a new technology, it is necessary to understand just as fully the process of interpersonal or social influence.

4.2.1 Social Influences at the Individual Level

Monge and Contractor (1998) have conducted a comprehensive literature review of the emergence of social network perspectives on communication, which maintains that social networks are valuable, and that the relations among actors affect the behavior of individuals, groups, and organizations. Monge and Contractor identify ten groups of theories and their respective theoretical mechanisms that have been used to explain the emergence, maintenance, and dissolution of communication networks in organizational research (Monge and Contractor, 1998, p.1). These include a number of theories previously applied in IS research, such as theories of self-interest and collective action (social capital, strength of weak ties, and adoption threshold), theories of homophily (social comparison and social identity), and contagion theories (social influence and cognitive theory), among others. Theories of self-interest assume that people make what they believe are rational choices in order to obtain personal benefits (Monge and Contractor, 1998, p.5), while theories of collective action focus on mutual interests and possible benefits through coordinated action (Marwell and Oliver, 1993). Theories of homophily are based on the assumption that similarity between individuals eases communication, increases predictability of behavior, and promotes trust and reciprocity (Brass, 1995). Finally, theories of contagion assume that communication networks serve as a mechanism that exposes individuals, groups, and organizations to information, attitudinal messages, and the behavior of others (Burt, 1980; Contractor and Eisenberg, 1990), and that this exposure increases the likelihood that members of the group will

develop beliefs, assumptions, and attitudes that are similar to those of others in their group (Monge and Contractor, 1998). This section centers on social influence alone as opposed to the broader social network perspective in order to clarify its prospects in IT adoption and use research.

Originally, social influence was mainly focused on *social norms*. Social norms are jointly negotiated rules for social behavior: “*customs, traditions, standards, rules, values, fashions, and all other criteria of conduct, which are standardized as a consequence of contact of individuals*” (Sherif, 1936, p.3). That is, social norms are understood by members of a group and they guide as well as constrain social behavior. French (1956) has even applied mathematical models to measure the process of social influence, and has developed a two-stage weighted averaging of influential opinions. In this approach, individuals start out with their own initial opinions on a specific matter and at each stage they form a “norm-opinion”, which is a weighted average of the other opinions in the group. The individuals then modify their own opinion in response to this norm, forming a new opinion, which is a weighted average of their initial opinion and the network norm. While this mathematical approach is cited often, the most well known theory in the field of IS applying this construct is the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975). According to TRA, individual behavior can be predicted from attitude toward a behavioral action and social norms that influence the probability of performing the behavior. TRA has been widely applied in IS research, most often to studies in organizational settings (e.g. Bagchi et al., 2003; Davis et al., 1989; Venkatesh et al., 2003). This makes sense, as the original research of French and Raven (1959) on social norms was concerned with situations in which supervisors influence workers in a work setting. However, current research indicates that in non-work settings individuals’ make genuine changes to their feelings and behaviors as a result of interaction with others, who are perceived to be similar, desirable, or experts (Rashotte 2007).

Another type of social influence is *conformity*. Conformity is the act of matching attitudes, beliefs, and behaviors to what individuals perceive is the norm of their social

group or society. This influence may result from subtle unconscious influences, or direct and overt social learning or pressure. Conformity is distinguished from social norms because individuals move from their own position to a contradictory position as the individual's first position was contrary to that expressed by the majority in the group (Asch, 1952). Deutsch and Gerard (1955) distinguish between two different motivations for conformity: informational influence and normative influence. Informational influence concerns an individual's intention to make accurate and valid judgments and normative influence concerns an individual seeking social approval from others. These two motivations are also considered to be causal mechanisms of social contagion. Additional types of mechanisms that are socially contagious are competitive behaviors (Burt 1995), which may be observed when individuals, based on their beliefs, act competitively to impress others, and performance network effects (Katz and Shapiro, 1999), which concerns the benefits of use that increase with the number of prior adopters of an innovation. Social learning is another causal mechanism for conformity and occurs when individuals face substantial uncertainty in the trial of new innovations and, through a conscious process, observe other individual's choices to "learn" what to do (Tarde et al., 2008). Finally, opinion leaders transfer information across social boundaries between groups (Burt 1999; Valente and Davis 1999) and may do so either through contagion by cohesion, which takes place when opinion leaders diffuse information across groups, or contagion by equivalence, which takes place when opinion leaders stimulate adoption within a group. These six mechanisms represent the current state of research into individual conformity.

A third type of social influence is *compliance*. Compliance refers to the agreement to an explicit or implicit request by others, where the targeted individual is aware that a certain response is expected. Compliance may occur because of six types of tendencies. *Reciprocation* occurs when an individual receives a favor that creates an obligation to accept any reasonable requests the other person might make in return (Carlsmith and Gross, 1969). *Credibility* refers to the source of the request: if a source is credible,

individuals are more likely to comply with a request (Cialdini and Trost, 1998). Individuals are also more likely to comply with *friends*, as individuals apply subjective cost-benefit analyses of the context to compare alternatives (Homans, 1958). *Scarcity* is the influence of perceived scarcity of an object that occurs when individuals attribute value to products that have limited availability (Cialdini, 1993). *Social validation* is a phenomenon in which people are more willing to follow a recommendation if they see evidence that many others, especially similar others, have also followed it (Kenrick et al., 2004). Finally, the inclination to be *consistent* with prior commitments to a company, induced by e.g. bonuses, may also bring compliance (Cialdini and Trost, 1998). Table 4 provides an overview of the three types of social influence described above in the context of the broader social network perspective.

Table 4: Social influences from a Social Network Perspective

	<i>Description</i>	<i>Constructs</i>	<i>References</i>
<i>Self-interest and collective action</i>	Individuals make rational choices in order to acquire personal benefits or they forego the tendency to free ride.	Social capital The strength of weak ties Adoption thresholds	Coleman, 1990; Granovetter, 1973; Granovetter, 1978; Marwell and Oliver, 1993; Putnam, 1993, 1995; Valente, 1995
<i>Homophily</i>	An individual's tendency to engage with others who are alike, as similarity is thought to ease communication, increase predictability of behavior, and promote trust and reciprocity.	Social comparison Social identity	Brass, 1995; Monge and Contractor, 2003; Lazarsfeld and Merton, 1964
<i>Contagion</i>	Social norm Jointly negotiated rules for social behavior that are understood by members of a group and guide and constrain social behavior.	Social norm	Fishbein and Ajzen, 1975; French, 1956; French and Raven, 1959; Sherif, 1936

Conformity	The act of matching attitudes, beliefs, and behaviors to what individuals perceive as the norm of their social group or society.	Informational influence Normative influence Competitive influence Performance network effects Social learning Opinion leaders	Asch, 1952; Burt 1995; Deutsch and Gerard, 1955; Katz and Shapiro, 1999; Tarde et al., 2008; Valente and Davis, 1999
Compliance	The agreement to an explicit or implicit request by others, where the targeted individual is aware that a certain response is expected.	Reciprocation Credibility Liking/friendship Scarcity Social validation Commitment	Carlsmith and Gross, 1969; Cialdini, 1993; Cialdini and Trost, 1998; Homans, 1958; Kenrick et al., 2004

While it is important to consider social motives of individuals, social influence attempts are very much affected by the situational context of the influence. In voluntary mobile device adoption and use, there is often no social norm to consider, as individuals generally need not adhere to a specific cultural norm in order not to be excluded by a group. Furthermore, mobile device adopters will usually not feel an obligation to comply with others to return a favor or request from friends. Hence, the type of social influence that will most likely be observed in a mobile device adoption and use situation is conformity. As argued, this type of social influence is a contagion theory and includes informational influence, normative influence, competitive influence, and performance network effects, social learning, and opinion leaders.

4.2.2 Individual and Group Level Dynamics

As shown in the previous section, researchers interested in social networks and social influences have identified a number of mechanisms that influence individuals in their decision-making processes. IS researchers have embraced these mechanisms from social psychology and have thus been interested in the attributes, beliefs, intentions, and behaviors of individuals and organizations that could explain adoption. Currently, however, there are only a few frameworks seeking to provide explanations of IT adoption

in groups (Valente, 1996; Rice et al., 1990; Sarker, 2006). Prior studies have provided explanations of group-level adoption by computing the arithmetic mean of individual-level adoption of the same IT, assuming that individual members' behavior can be aggregated to explain group behavior (e.g. Jung and Sosik 2003; Lapointe and Rivard 2005). Sarker (2006) found that aggregation of individual-level measures might, however, not be suitable for understanding behavior in a group or social network, and it is now widely accepted that findings at one level of analysis do not generalize well to other levels of analysis, except under very restrictive circumstances (Firebaugh, 1979). While it is less complicated to understand adoption of IT at the individual level, it is evident that social networks influence individual adoption decisions, and so emphasizing the dynamics at the individual and the social network levels can provide additional insight into IT adoption. Multi-level research addresses the levels of theory, measurement, and analysis required to fully examine research questions. It describes some combination of individuals, groups, organizations, industries, and societies by integrating the micro-domain's focus on individuals with the macro-domain's broader focus, resulting in a richer depiction of the dynamics (Klein et al., 1999). Furthermore, it is well known that relationships that hold at one level of analysis may be stronger or weaker at a different level of analysis or may even reverse direction (Ostroff, 1993). Following these insights, and as adoption studies in the IS field matures, the assumption is that a solitary individual- or group-level analysis provides an understanding of behaviors occurring at either level only to some extent (Porter, 1996). Taking a multi-level approach may provide additional knowledge in understanding the IT adoption decision made by individuals, social networks, and other units of adoption.

4.3 THE COMPETING FORCES APPROACH

Taking the individual intention versus social influence dilemma as a point of departure and drawing on Quinn and Rohrbaugh's Competing Values Framework (CVF) (1981, 1983), three sets of competing forces have been identified that influence mobile adoption and use. The original CVF was developed for the purpose of increasing organizational

learning, and it operates with three dimensions of competing values. The first dimension relates to organizational focus and differentiates between an internal emphasis on the well-being and development of people in an organization, and an external emphasis on the well-being and development of the organization itself. The second dimension relates to organizational structure and represents the contrast between stability and control as opposed to flexibility and adaptation. The third dimension relates to organizational means and ends with an emphasis on processes and final outcomes. As argued above, evidence in the IS literature suggests that an individual versus social orientation reflects a set of competing forces that are similar to organizational focus. Furthermore, organizational structure can be adapted to IT usage behavior, distinguishing between exploration and exploitation, and the values related to means and ends can be adapted to the objectives of using IT, with a distinction between hedonic and utilitarian objectives. In the following the three identified dilemmas of adoption and use will be described.

4.3.1 Individual and Social Orientation

Contagion studies have established that individuals receptive to social contagion have great influence on the IT diffusion and adoption process (Van den Bulte and Lilien 2001; Dodds and Watts, 2004) and that the number of relationships an individual has directly affects their opportunities to receive and disseminate information. As described above, individual psychological processes are subject to social influences, and when individuals receive vast amounts of information, conformity may occur. Individuals move from their original cognitive position to a contradictory position (Asch, 1952; Bovard, 1951).

There are several examples in IS of how individual and social influences can shape use of IT in, for example, the individual's use context (Scheepers and Scheepers, 2004) or within smaller networks (Cambell and Russo, 2003). In general, research on social influence suggests that when social influence is maximized, an individual's intention to behave independently may be reduced, and when individual intentions to behave are maximized, the emphasis may shift away from the attitudes, beliefs, and behaviors of the group.

Individual adopters are faced with such contradictory cognitive processes when they must make decisions about what information they will react to when adopting and using IT. Based on the attitudes, beliefs, and behaviors of other people in their social group as well as the media, they are exposed to informational, normative, and competitive influences and thoughts about performance network effects in their adoption decision. There might furthermore be certain individuals with a large knowledge base and a favorable position in the network that transfer knowledge about IT within and between groups and who the majority of the group follow. Finally, individuals need to consider their skills in relation to the use of specific mobile devices and identify other individuals they may observe and learn from. As a mobile device is so personal, most individuals already have a predetermined idea of their needs and wants. In the mobile literature it has been established that individual and social orientation shape adoption and use of mobile technologies. Lu et al. (2008) find that social influences and personal traits, such as individual innovativeness, are potentially important forces in the adoption and use of mobile technology.

4.3.2 Exploration and Exploitation Behavior

Exploration and exploitation behavior has been identified through the organizational behavior literature, where March (1991) was concerned with investigating how individuals balance exploration of new possibilities and exploitation of old certainties. He suggests that exploration involves search, risk taking, experimentation, play, flexibility, discovery, and innovation; whereas exploitation is incremental and involves refinement, choice, production, efficiency, selection, implementation, and execution. The dilemma of balancing exploration and exploitation is revealed in distinctions made between learning about new technologies or refining usage of those that are already known. Exploration is a long-term process, with a risky, uncertain outcome, and exploitation by contrast is short-term, with immediate, relatively certain benefits. Organizations and their members face the problem of allocating resources between exploration and exploitation of IT (Baum et al., 2000, Gupta et al., 2007). The same holds true for consumers possessing

new IT, as they constantly face the choice of exploiting current technologies and services or exploring new technologies and services. Giving too high a priority to exploitation over exploration will cause users to stagnate in technological capability, while overly emphasizing exploration will likely lead to high learning costs with little benefit for practical IT use.

The literature reveals several examples of how exploration and exploitation of IT are conducive to organizational growth. Lee et al. (2003) examine under which conditions exploration of a new, incompatible IT drives growth and find that exploration of new IT is more likely to increase growth when there are a significant number of power users or when a new technology emerges before demand for an established technology escalates. Kane and Alavi (2007) investigate the effects on exploration and exploitation in organizational learning when introducing IT enabled mechanisms, such as email, knowledge repositories of best practices, and groupware. They find that each of these IT-enabled learning mechanisms enable capabilities that have a distinct effect on the exploration and exploitation learning dynamics in the organization.

4.3.3 Utilitarian and Hedonic Objectives

When investigating the adoption and use of IT, it is necessary to take into consideration the objectives of users and the means through which they sustain themselves and attain their objectives (Georgopoulos and Tannenbaum, 1957). In consumer behavior research a dominant theoretical assumption is based on the Information Processing Model (Bettman, 1979), which regards consumers as logical thinkers who processes the information they receive, rather than merely responding to stimuli, and thus equates the mind to a computer responsible for analyzing information from the environment. In the late 1970's researchers, however, started questioning the dominance of the Information Processing Model on the grounds that it may neglect important consumption phenomena (e.g. Olshavsky and Granbois 1979; Sheth 1979), such as playful leisure activities, sensory pleasures, daydreams, aesthetic enjoyment, and emotional responses (Holbrook and Hirschman, 1982). As discussed in Chapter 3: "Adoption and Use of Mobile Devices"

recent research similarly shows a need for distinguishing between utilitarian, productivity-oriented objectives and hedonic, pleasure-oriented objectives (van der Heijden, 2004). Venkatesh and Brown (2001) observe that decisions driving adoption and non-adoption of personal computers are significantly different: adopters are driven by utilitarian, hedonic, and social outcomes while non-adopters are influenced by changes in technology and fear of obsolescence of the adopted technology. Similarly, in mobile studies a correlation between utilitarian and hedonic objectives and mobile adoption and usage increases has been established (e.g. Kim et al., 2002; Lee et al., 2009; Nysveen et al., 2005; Whakefield and Whitten, 2006).

4.3.4 The Integrative Theoretical Perspective

The integrative theoretical approach presented in this chapter lays the groundwork for answering research sub-questions 1 and 2 concerning how a social influence and a competing forces approach can contribute to explaining the adoption and use of app phones.

The aim of presenting the social influence perspective was to place it in the established social network context, as social influences is merely a small part of the social network perspective. This dissertation focuses its research effort in a way that allows for the emergence of the richness and complexity of the social influence approach at the individual and group levels to explain the adoption and use of app phones.

Though the competing forces approach may seem disconnected from the social influence perspective, it provides a different theoretical approach, while simultaneously integrating the main principle of the social influence approach: the question of how people's thoughts, feelings, and behaviors are influenced by the actual, imagined, or implied presence of others. It therefore seems clear that a social influence approach at the individual and group levels as well as a competing forces approach can contribute to explaining mobile device adoption and use.

4.4 SUMMARY OF CHAPTER

The integrative theoretical perspective presented in this chapter lays the groundwork for investigating the second and the third research sub-questions concerning how a social influence and a competing forces approach can contribute to explaining the adoption and use of app phones.

In order to begin answering the first sub-question, the chapter first presented the social influence approach as part of the broader social network approach, focusing on social network theories that have proven useful in studying IS-related phenomena. While three types of social influence identified (social norms, conformity, and compliance), conformity seems to be the most relevant area for researching mobile adoption and use. Conformity refers to the tendency of individuals to match attitudes, beliefs, and behaviors to what they perceive are the norm in their social group or society. They move from their own initial position to a contradictory position as their first position was contrary to that expressed by others. This mechanism shows how individuals change their behavior as a consequence of competing forces pulling in different directions. It is also apparent that individuals take actions themselves in their adoption and use decisions, though individual and group level dynamics intertwine. Applying a social influence approach may therefore provide insight into these dynamics and ultimately contribute to explaining app phone adoption and use.

As shown, the decision-making dilemma of individual versus social orientation is not the only dilemma individuals face. Exploration versus exploitation behaviors and utilitarian versus hedonic objectives also impact mobile adoption and use decisions. Hence, the application of a competing forces perspective may contribute further to explaining app phone adoption and use and will also begin to answer the second sub-question.

PART THREE: METHODOLOGY

Part Three describes the research methodology to study how an understanding of social influences and competing forces can assist in explaining the adoption and use of app phones. Part Two laid the theoretical foundations of this dissertation, motivating the adoption of an integrated theoretical approach comprising a social influence and a competing forces perspective. Building on this theoretical framing, Part Three will begin by describing the relationship between mobile users and mobile devices, and on this basis discuss the philosophical underpinning of this dissertation. It will then demonstrate that adopting an interpretive approach to the empirical study is consistent with the integrated theoretical perspective laid forward in the previous chapter. Part Three consists of Chapter 5, which lays out philosophical and methodological considerations, and Chapter 6, which presents the detailed research design of this study.

CHAPTER FIVE: PHILOSOPHY OF SCIENCE

5.1 INTRODUCTION

It has been argued in this dissertation that mobile devices, such as app phones, are no longer just tools serving the instrumental purposes of their users. They have instead developed into small-sized information appliances, containing personal information and pervasive access possibilities, while being used for hedonic as well as utilitarian purposes. The convergence of technologies and the distribution of power in the supplier network have increased the complexity of the mobile ecosystem and have consequently changed consumers' expectations of their devices. Furthermore, mobile usage patterns and purposes continuously deviate from designed intentions (e.g. Scheepers et al., 2006; Sørensen and Pica, 2005) as consumers construct new objectives and usage patterns. Users expect the same immersive experiences using app phones that they experience on their laptop, and Apple and Android devices are becoming immensely successful by allowing decentralized development of applications, which allow very fast reactions to current trends and needs. Hence, today, our relationship with app phones have become practical and ontological, meaning we do not tend to encounter app phones "as app phones", but we rather tend to encounter app phones as affordances (Ciborra, 1999; Gibson, 1977), or fundamental objects of perception. That is, app phones provide possibilities, such as calling, texting, accessing email, using the internet, playing games, and so forth. Heidegger (1962) calls the way in which objects provide such potentials "in-order-to". The adoption and use of technologies has proven not to entail straightforward causal relationships because such use is fundamentally shaped by the practices of everyday human life, such as drift, tinkering, and improvisation (Ciborra, 1999, 2002). Something deeper and more complex than a direct empirical conjunction of events between people, technology, and intended outcomes is transpiring.

5.2 *PHILOSOPHICAL UNDERPINNINGS*

5.2.1 *Ontological Assumptions*

The research question of this dissertation is approached with the *critical realist ontology* most commonly associated with the work of Bhaskar (1978). His starting point was to argue specifically against positivism by claiming that science is not merely matter of noting down frequent combinations of observable causal events but is instead about objects, entities, and structures that exist and generate events we may observe (Mingers, 2004). From the critical realist perspective, reality is “out there” and can be discovered and understood. Social phenomena can be ascertained even though they are imperfect and only probabilistically comprehensible because of imperfect intellectual mechanisms (Easton, 1995; Guba and Lincoln 1994). Critical realism entails that knowledge must be evaluated and tested critically in order to determine to what extent it represents or corresponds to the actual world (Hunt, 1990). Table 5 shows my ontological assumptions in answering the research question of *to what extent an understanding of social influences and competing forces can assist in explaining the early adoption and use of app phones*. At an ontological level, reality is assumed to exist and to be discoverable and understood not just as a human construction. App phone users and app phones are two carefully separated entities in the world that do not exist as one entity and are viewed as such.

Several researchers (Bygstad, 2008; Carlsson, 2003, 2004, 2005; Dobson, 2002; Longshore Smith, 2006; Volkoff et al., 2007) have suggested that critical realism can be useful as an underpinning philosophy for IS research as it allows for a more consistent approach to research.

Second, critical realism attempts to comprehend the “*generative mechanisms and causal powers, which account in all their complex and multiple determinations for the concrete phenomena of human history*” (Bhaskar, 1998, p. xvi). That is, the concern is not just to find a relation between constructs, but to understand why or how the relation occurs. Generative mechanisms are located in the intransitive dimension and comprise three hierarchical domains (Bhaskar, 1978): the *empirical*, the domain of experience; the *actual*, the domain of events as well as experiences; and the *real*, the domain including mechanisms in addition to events and experiences. Generative mechanisms are retroduced: they undergo a process of working out what could have caused the phenomena that are of immediate interest and are subsequently subjected to empirical examination and reasoning in relation to competing explanations. Critical realism, however, does not claim to be able to uncover the real, but rather seeks the most accurate possible description and understanding of the world (Hunt, 1990). While theories are fallible and changeable and there will always be a number of competing theories (Danemark et al., 2001, p. 117), critical realists believe in inductive realism, that the long-term success of a scientific theory “*gives us reason to believe that ‘something like’ the entities contained in the theories actually exist*” (Hunt, 1990, p. 10). That is, it might not be possible to uncover the complexity involved in adoption and use of app phones; however, a social influence and a competing forces approach may provide insight and explanations to how mobile users are influenced in their adoption and use decisions for the moment.

Third, critical realism argues that one cannot concentrate solely on a single level investigation of a society, group, or individual; it argues for a relational perspective, viewing society as “*an ensemble of structures, practices and conventions that individuals reproduce or transform*” (Bhaskar, 1991, p. 76). Critical realism states that interactions between each level cannot be ignored. As this dissertation takes a social influence approach and therefore assumes a relationship between social influences and adoption

and use of app phones, critical realism is therefore appropriate for studying app phones in social contexts.

So far only limited research has been published within IS directly related to critical realism, though researchers have pointed out its potential significance (Bygstad, 2008; Carlsson, 2003, 2004, 2005; Dobson, 2002; Mingers, 2002, 2004; Mutch, 2002). Among others, Mingers (2004, p. 393) argues that “*critical realism enables us to take a basically realist stance... while accepting the major critiques of naïve realism; it addresses both natural and social science and thus encompasses both hard and soft (and critical) approaches; and it does potentially fit well with the reality of IS as an applied discipline.*” The aim of critical realism is to go beneath the surface to understand and explain *how* and *why* things are as they are. As critical realism recognizes the existence of different types of objects of knowledge, all of which require the use of different methods to understand them, it does not commit the researcher to a single method but favors pluralism.

5.2.2 Epistemological Considerations

At the *epistemological level*, the study of the adoption and use of app phones allows for the combination of ontological realism with an epistemological constructionism. As argued by Longshore Smith (2006), critical realism views the process of science and scientific knowledge as historically emergent, political, and incomplete. These limitations imply that our theories are imperfect or fallible and that knowledge is never absolute, though some theories may approximate objective reality better than others. Critical realism is, therefore, characterized as ontologically bold, but epistemologically cautious (Bhaskar, 1998, p. 176). Heidegger (1962) argues that a subject and object cannot be separated, and must be considered in terms of being-in-the-world. That is, an app phone user can only be considered as being a contextual, situated, and historically placed existent in the middle of a world amongst other things. Table 6 shows my epistemological considerations as I seek knowledge about the studied phenomenon. Though critical realism is most often associated with epistemological *realism*, this

dissertation, based on the above consideration, supports the view of epistemological *realism* and *constructionism*.

Table 6: Epistemological Considerations	
<p><i>Realism</i></p> <p>Reality can only be conceived by means of scientific methods. Reality only consists of those affordances attached to it, such as providing “the possibility of” doing something. As we cannot know anything about the independent reality with certainty, we must use our constructed concept to make qualified situated conjectures.</p>	<p><i>Constructionism</i></p> <p>Constructionism rejects any direct verification of knowledge by comparing our constructed concepts with the outside world. Humans can only perceive their own constructions, and, hence, the most important issue is how the subject can choose between different constructions to select appropriate ones.</p>
<p>←————→</p> <p>Our knowledge of the world, including our scientific knowledge, is a construction shaped by social processes.</p>	
<p>Source: Own creation inspired by discussions with Morten Hjelholt.</p>	

Epistemologically, the critical realism perspective is often associated with realism and an objective worldview. Realism argues that meaning, and therefore meaningful reality, exists apart from the operation of any consciousness. In the realist view, there is a predominance of technological determinism, which involves two key ideas: technological development is seen as autonomous and societal development is determined by technology (Bijker, 1995). This positions technology as an autonomous entity, with an “inner logic” that develops by itself and consequently determines social relationships (Williams and Edge, 1996). Society is, therefore, merely responsive to and shaped by the needs of technology. Technological determinism assumes that technology is the primary reason for change while simultaneously assuming that technology is beyond the realm of human values and beliefs. Researchers, such as Howcroft et al. (2004, p. 333), however,

argue that this perception is misleading, since it separates technology from the social world within which it resides, while at the same time it is argued that it is the one mechanism for bringing about social change.

An opposed view, constructionism, reflects a subjective world view and holds that meaning is imposed on an object by the subject without the object making any contribution to the generation of meaning. Constructionism emphasizes a kind of subjective determinism that ascribes absolute power to the individual mind, or subject, and its sensations. The subjectivism represented in Descartes' (1985) "cogito ergo sum" (I think, therefore I am) holds that the immaterial mind and the material body are two entirely different substances that interact with each other. This is also referred to as *Cartesian Dualism*. Berkeley (1975) formulated a theory that contends that individuals can only know sensations and ideas of objects, not abstractions such as "matter", and therefore that ideas depend on perceiving minds for their very existence. This belief later became commemorated as the subjectivist principle "esse est percipi" (to be is to be perceived). Berkeley (1975) argues that the world does not exist independently of being perceived and all that is known is relative to the mind that knows it.

Although realism and constructionism are generally seen as a "*bipolar hierarchy*" (van Maanen, 1998, p. 153), several critical realism researchers advocate epistemological constructionism (Al-Amoudi and Willmott, 2011; Lawson, 2003). Constructionism rejects both objectivist and subjectivist views, and maintains that meaning comes into existence through our understanding of the realities of the world. Meaning is constructed locally and within different contexts and different people may construct meaning in different ways in relation to the same phenomena. Constructionism argues that individuals are born into a world of meaning and enter a social milieu, and that we inherit a system of significant symbols and view the world through lenses bestowed upon us by our culture (Bourdieu, 1977; Crotty, 2009).

Hence, depending on our cultural heritage, app phones may make sense to us in different ways. Knowledge of the adoption and use of app phones can thus best be approached

from the point of view of the mobile user, as an “I-situation” in which the “I” of the mobile user cannot be distinguished from the “situation” of app phone adoption and use, and where the “I” and the “situation” co-evolve over time (Heidegger, 2001, [1919], p. 206). App phones evoke different usage behaviors in different contexts, which may yield unexpected consequences or limitations (Arnold, 2003). Social action embedded in different social contexts stimulates app phone usage in different ways. At the same time, such usage behaviors have become intrinsic to everyday activities and relations (Orlikowski and Scott, 2008) and app phones are “ready-to-hand” as they are “always already there” (Heidegger, 1962). Heidegger (1977) argues that technology constitutes a type of cultural system that restructures the entire social world as an object of control, is characterized by an expansive dynamic, and which ultimately shapes the whole of social life. This applies no less to app phones.

Researchers (e.g. Lee, 1999; Mingers, 2004; Orlikowski and Baroudi, 1991; Walsham, 1993; 1995a, 1995b) have argued that, historically, most empirical IS research has been underpinned by an objectivist philosophy. Burrell and Morgan (1979) argue that there are distinctively different paradigms based on either objectivism or subjectivism within a discipline, including the IS discipline, and that these are generally incommensurable; i.e. they cannot be directly compared with each other as they are based on radically different assumptions. However, both objectivist and subjectivist approaches to the study of knowledge neglect to consider how social phenomena develop in combination with and within social contexts. Obviously, the development of app phones has not solely determined societal development though it has had immense impact on people’s everyday lives. Similarly, app phones have not emerged solely in response to the market demands of conscious subjects suddenly finding a need for them. App phones have co-evolved as a social construction of prior objects, such as the fixed telephone, the laptop computer, and wireless technologies, in unison with human ideas, beliefs, and experiences. The mobile phone that consumers carried in 1995 resembled a portable phone that allowed users to make phone calls and send text messages, while the mobile phone in 2011 is a mini-

computer with a vastly greater set of affordances. This development did not happen at once, but is the result of existing technology co-evolving with people's creative ideas and experiences. As these constructions are not given by nature, they must be constantly maintained and reaffirmed in order to persist, and this process introduces the possibility of further change and development. The production of knowledge is thus contingent on human practices being constructed in social practices between mobile users and their world, as well as the researcher's ability to develop and transmit this knowledge within a social context (Crotty, 2009).

The above explicit reflections constitute the considered philosophical and methodological underpinnings of this dissertation and serve to direct the choice of research methods and to clarify philosophical limitations related to the interpretations of the research results and their reliability. Such clarifications can only be made after the philosophical stance of the researcher has been made explicit (Alvesson and Skjöldberg, 2004; van de Ven, 2007). In the following I will bridge the philosophical underpinnings with the research design of the empirical case studies.

5.3 BRIDGING PHILOSOPHY OF SCIENCE WITH RESEARCH DESIGN

Having argued for a realist and constructionist epistemology, this dissertation applies interpretive methods. The interpretive approach can be understood as consisting of an ontological base sustained by the assumption that access to reality can be obtained through social constructions such as consciousness, shared meanings, and language (Klein and Myers, 1999; Walsham, 2002). It has been pointed out by Ciborra (2001, 2006) that IS studies often lack an understanding of the social process attached to the use of technology. Where humans are involved there is space for improvisation, emotions, and other non-deterministic factors that influence IS research objects. Therefore, interpretive methods are appropriate for understanding and managing the interaction between app phone users and app phones.

IS research increasingly encompasses interpretive studies including a range of case studies (Orlikowski and Baroudi, 1991; Orr, 1996; Suchman, 1987; Walsham, 1993) and field studies (Clemons and Row, 1993; Curtis et al., 1988). For this dissertation the chosen form of research design is one case study (Eisenhardt, 1989; Yin, 2003) and one field study. Sayer (2000) argues that critical realism is relatively liberal with respect to pluralism in the use of research methods: “*Compared to positivism and interpretivism, critical realism endorses or is compatible with a relatively wide range of research methods, but it implies that the particular choices should depend on the nature of the object of study and what one wants to learn about it.*” (Sayer, 2000, p. 19). Two broad types of research methods exist: extensive methods and intensive methods. *Extensive methods* employ large-scale surveys, formal questionnaires, and statistical analyses. The researcher looks for regularities, patterns, and similarities, but has only a restricted ability to generalize to other populations and thus has limited explanatory power. *Intensive methods* focus on individuals in a specific context and employ interviews, ethnography, and qualitative analysis, while asking the question: what produces change? Such research produces causal explanations, which are limited to the situation studied. It should be emphasized that these methods are, however, not mutually exclusive and researchers (e.g. Mingers, 2002, 2003; Stoop and Berg, 2003) suggest that research results will be richer and more reliable if different research methods are combined together. Case study and field study research are intensive research methods and are fully consistent with critical realism ontology.

The case study approach is particularly well suited to relatively well defined but complex phenomena such as the study of groups, social networks, organizations, and inter-organizational relationships. The boundaries of the phenomena, e.g. mobile adoption in the group, must be determined, though it is not uncommon for these boundaries to change during the course of research (Easton, 2010; Miles and Huberman, 1994; Yin, 2003). While there are many similarities between interpretive case studies and field studies, the difference between the two is that while a case study seeks to understand a bounded

phenomenon, the boundaries are less strict in field study research. Further, a field study is conducted “in the field” over a period of time. In both case studies and field studies, a researcher may either stay detached outside the studied phenomenon or may intervene in the study. A number of considerations have been made in the decision to apply a case/field study approach.

First, the main research question in Chapter 1: “Introduction” concerns to what extent an understanding of social influences and competing forces assists in explaining the early adoption and use of app phones. Understanding the adoption and use of app phones is possible through recording and analyzing the events that take place as a result of app phone users’ actions.

Second, as will be described in detail in Chapter 6: “Research Design”, a research opportunity arose, leading to the identification of a case study that characterized the phenomenon to be investigated. It had come to my attention that a great number of mobile users had imported the iPhone from abroad and had “unlocked” and “jailbroken” the device though this is a rather complicated process. Identifying a group of five related individuals opened an opportunity to study this phenomenon and to investigate how social influences impacted their adoption decisions. The field study emerged as part of collaboration between researchers in the DREAMS-project (see Chapter 6: “Research Design”) in my department. The field study consisted of a group of 15 individuals related through their university studies, and focused on iPhone usage instead of iPhone adoption.

The third consideration relates to the collection of data. While case and field study research is essentially open to the kinds of data that might be collected, it is often equated with qualitative data collected through the use of semi-structured interviews. The strength of this method is that it is highly flexible. However, other forms of data collection, such as focus groups, diaries, surveys, etc., can also work well in particular situations and can provide additional non-obvious insights. The case study in this dissertation primarily makes use of semi-structured interviews, but also archival data and discussion group data, while the field study makes use of multiple data collection methods. The choice of

methods in each study was governed by what was expected to be required to establish a plausible causal mechanism, constrained by what data could actually be collected in the research context.

The fourth consideration concerns the issue of data interpretation. Critical realism accepts that data are collected from mobile users as well as from and about material things, such as the app phone. As a result it is accepted that any resulting explanation is necessarily interpretivist in character. In particular, when analyzing respondent-based data, the researcher faces the problem of the “*double hermeneutic*” (Woodside et al., 2005): not only is knowledge a social product, but also the *object* of social knowledge is a social product (Giddens, 1974). Social actors are reflexive and monitor the ongoing flow of activities and conditions, adapting their actions to their evolving understandings. As a result, emerging social scientific knowledge will change the actions of the subjects, adding another layer of complexity to the interpretation process since researchers are then required to include their own understanding of the subjects' understandings. This is, however, also the reason that interpretivist research approaches offer detailed and rich insight into studied phenomena.

5.4 SUMMARY OF CHAPTER

This chapter argued for a critical realism ontology perspective on app phone users and app phones. As the adoption and use of app phones are a social construction between users and app phones, knowledge and meaning comes into existence in our engagement with the realities of the world. The realist and constructionist epistemologies direct the study of the research question as they recognize a transitive as well as an intransitive dimension to reality that enables a bridging of the dualism between subjective and objective views of reality. As this approach demands a relational perspective of study, interpretive methods have been chosen.

CHAPTER SIX: RESEARCH DESIGN

6.1 INTRODUCTION

Chapter 5: “Philosophy of Science” laid the philosophical foundations for answering the main research question. It was argued that taking a critical realism ontology along with a constructionism epistemology in relation to the adoption and use of mobile devices is a suitable approach to move forward the investigation.

This section discusses the case study and field study that make up the empirical work of this dissertation. The two studies are conducted in the same domain, but differ in terms of their theoretical framing, data collection, and procedure for analyses. First, the case study and the field study methods are described with a focus on their benefits and the weaknesses. Then the research context is described, presenting the overall research design for this Ph.D. project, and, finally, the two studies are introduced. The case study, “Early Adoption of App Phones”, seeks to answer sub-question 1 by presenting the case study details the background, method, data collection, and analysis procedures. The outcomes of the case study are *Article 2* (Tscherning and Mathiassen, 2010) and *Article 3* (Tscherning, 2011). While *Article 2* is based upon the empirical data collected in the case study, *Article 3* is an entirely conceptual paper that applies the same theoretical constructs used in the empirical work to emphasize the study of multiple levels in social influence studies.

The field study, “Use of App Phones”, seeks to answer sub-question 2. The presentation of the field study similarly includes the background, method, data collection, and analysis procedures. The outcome of the field study is *Article 4* (Tscherning and Mathiassen, 2011).

6.2 THE CASE STUDY AND THE FIELD STUDY METHOD

In addition to the philosophical discussion in the previous chapter, the decision to use the case study and field study methods rests upon the aim of this dissertation to obtain a

comprehensive and in-depth understanding of mobile users' decision to adopt and use app phones and how they are influenced in this decision. A case is a sample of one, and I, therefore, do not seek statistical representativeness. Rather, I seek to identify and explain a relationship between social influences and competing forces on one side, and app phone adoption and use on the other-. Case studies are well suited to exploring 'how' or 'why' questions, which can be explanatory in nature. "*This is because such questions deal with operational links needing to be traced over time, rather than mere frequency or incidence*" (Yin, 2003, p. 6).

The case study as a research method is an empirical inquiry that investigates a contemporary phenomenon within its real-life context. It involves investigating one or a small number of social entities or situations by collecting data using multiple methods and by developing a holistic description through an iterative research process (Easton, 1995; Yin, 2003). The investigation of app phone adoption and use is indeed a contemporary phenomenon, and the two studies in this dissertation involve an early iPhone adoption study and an iPhone use study.

Case studies and field studies are often used interchangeably. The main distinction between the case study and the field study in this dissertation is notion of boundaries and the role of the researcher. A case study has clear boundaries, whereas a field study does not need to have an identified boundary. A case study can also be conducted by interviewing participants of the case, while a field study usually is conducted in situ to explore a phenomenon while it is occurring.

While the two most widely applied criteria for measuring trustworthiness of a study are validity and reliability, it has been suggested that these traditional measures are not applicable in qualitative research because of the nature of the methods and the epistemological assumptions of such research. In particular, the promotion of the uniqueness of such research means that the focus is on the particular rather than the general, indicating a conflict with validity and reliability (Lincoln and Guba, 1985; Maxwell, 1992). Several reserachers have sought to improve the trustworthiness of

interpretive research; Klein and Myers (1999) developed a set of principles for conducting and evaluating interpretive field studies and Lincoln and Guba (1985) developed the concepts of credibility, transferability, dependability, and confirmability to be used within interpretative research. This dissertation follows Lincoln and Guba's (1999) trustworthiness criteria while acknowledging that the principles by Klein and Myers (1999) could have been applied equally. *Credibility* is the level of confidence that the findings, from the respondent's perspective, have some 'truth' to them. Credibility can be improved through prolonged engagement, persistent observation, triangulation, peer debriefing, and member checks. *Transferability* is the extent to which the findings are applicable and can be translated or transferred to other settings or cases. Transferability compares to statistical generalizability, as both measures relate to how findings from one study can be applied in other related contexts. Stake (1995) argues that while it is not possible to generalize statistically on the basis of one or few individual cases, one way to generalize from a case study is through 'naturalistic generalization'. Naturalistic generalization advocates a realignment of the responsibility to generalize away from the researcher and towards the reader. Ruddin (2006, p. 804) states of naturalistic generalization that "*the researcher's liability is to afford sufficient contextual information to facilitate the reader's judgment as to whether a particular case can be generalized to a specific field of practice. We could regard such views of generalization as empowering or democratizing.*" Flyvbjerg (2006, p. 238) adds that "*the goal is not to make the case study be all things to all people. The goal is to allow the study to be different things to different people*". *Dependability* is the extent of trustworthiness the material can demonstrate in terms of minimizing researcher idiosyncrasies. This means that the findings should be consistent and repeatable. In qualitative research, this becomes important since both the interpretation of individual respondent accounts of a setting and the interpretation of a setting in its totality are essentially subjective. Lincoln and Guba (1985) argue that the relationship between dependability and credibility is similar to the relationship between validity and reliability; that is, there can be no validity in a study without an acceptable degree of reliability. A way to reach dependability is to use an

external auditor to authenticate the progress and the process of a research project. Finally, *confirmability* refers to the degree of neutrality or the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest. In section 6.4: “Case Study: Early Adoption of App Phones” and section 6.5: “Field Study: Use of App Phones” I will describe how I address these four measures of trustworthiness.

6.3 THE RESEARCH PROJECT

This dissertation is part of the DREAMS (Development, Realization, and Exploitation of Advanced Mobile Services) research project conducted at the Center for Applied ICT. The overall scope of the DREAMS project is to develop advanced mobile services and to test them in a set of experiments, ranging from small to large scale. In particular, the project intends to develop and test the use of primarily content-based services through different mobile communication platforms in order to identify emerging trajectories that will enable businesses to commercially exploit advanced mobile services and create new revenue streams.

The DREAMS project was begun in 2006 and is scheduled to complete in 2011. It has been funded by the Danish Agency of Science and Technology (grant number 2106-04-0007) and by the Copenhagen Business School. The project is managed by Professor Jan Damsgaard and consists of researchers from the Center for Applied ICT and the Law Department. DREAMS also involves a collaboration with four industry partners, who all have an interest in mobile phones and services. The partners are Dagbladet Børsen (the Financial Daily of Denmark), Danmarks Radio (the Danish Broadcast Corporation), Forbrugerstyrelsen (the Danish Consumer Agency), and Euman (a software developer in pervasive computing). Two large research studies have been undertaken in the DREAMS project. The first, Mobiconomy, had the goal of describing and analyzing the design and implementation on location-, situation- and time-sensitive services in order to offer practical guidelines. The second study, iUSE, involved investigating the adoption and use of app phones. The iUSE field study is the field study referred to in this dissertation. The

iUSE field study consisted of four researchers: Associate Professor Jonas Hedman, Assistant Professor Mads Bødker, and Doctoral students Greg Gimpel and Heidi Tscherning. The field study was conducted as a joint effort in which all four researchers developed the research design and collected data. While each researcher had his or her own research agenda, the collected data was shared among the project members. Appendix F provides an overview of the collected data of the iUSE study and the persons responsible for collecting the data. Within the DREAMS project the joint field study was carried out along with smaller studies conducted by each individual researcher. Table 7 provides a chronological overview of this Ph.D. project, including the preliminary literature study, research planning, data collection for the case study and field study, and the writing of articles as well as coursework, teaching activities, and a fourteen month research visit to Polytechnic Institute of New York University.

Table 7: Research Planning and Conduction								
Activity	Aug 07- Dec 07	Jan 08 – Jun 08	Jul 08 – Dec 08	Jan 09 – Jun 09	Jul 09 – Dec 09	Jan 10 – Jun 10	Jul 10 – Dec 10	Jan 11- Jun 11
Literature Study		Presented at IFIP 8.6						
RQ								
Article 1		Tscherning and Damsgaard, 2008						
Case Study 1: Early Adoption of Mobile Devices								
Planning		DREAMS project planning						
Data Collection		Semi-structured interviews						
Analysis		Qualitative data analysis						
Article 2						Published in JITTA		
Article 3							Accepted as book chapter	
Case Study 2: Use of Mobile Devices								

Planning			DREAMS project planning					
Data Collection			From Sep 08 – Mar 09	Surveys, semi-structured interviews, focus groups, diaries	Actual usage data from network provider			
Analysis					Qualitative data analysis			
Article 4								Submitted to JAIS
Cover paper							Write-up	Cover paper
Other activities								
PhD Courses	ICT Course Philosophy of Science	ECIS DC Social Network Analysis	Magleas DC Anchoring PhD thesis in IS	Qualitative Methods IT Economics Magleas DC	ICIS DC	Engaged Scholarship Technology Enhanced Learning		
Teaching	E-business course	E-business course	E-business course Supervision of master students					
Research visit NYU Poly				Visit at Polytechnic Institute of NYU	Jan 09 – Feb 10			

6.4 CASE STUDY: EARLY ADOPTION OF APP PHONES

In January 2008, BBC News revealed that “*more than a quarter of iPhones sold in the US have been ‘unlocked’ to work on network providers other than Apple’s exclusive partner AT&T*”²⁷. As several people in my social network were among the mobile users who had imported an iPhone from the US, the idea for a case study emerged. Through purposive sampling, five individuals related through the same social network, who had all adopted an iPhone prior to its official release in Denmark, were identified. The way in

²⁷ <http://news.bbc.co.uk/2/hi/business/7214873.stm>

which these early adopters surmounted the uncertainties related to adoption was particularly interesting since they experienced high switching costs because of a lack of existing reference points or expert users to consult when attempting to unlock and jailbreak their iPhones. Given these challenges, it was of interest to me to study whether social influences impacted their early adoption decisions. In order for me to study social influences, it was necessary to explore adoption decisions in a “bounded system” (Easton, 2010; Miles and Huberman, 1994; Yin, 2003), and so the decision to use a case study approach emerged along with this research opportunity. The case study is an intrinsic case study (Stake, 1995; Yin, 2003) because of its uniqueness: a large number of mobile users acquiring a device abroad and unlocking and jailbreaking it in order to use it in Denmark is not a pre-existing phenomenon.

6.4.1 Research Method

The case study was a one-shot cross-sectional study that collected semi-structured interview data at a single point in time (Orlikowski and Baroudi, 1991). The reason for conducting semi-structured interviews was to increase the likelihood of capturing the mobile adopters’ interpretations and their constructed reality. A further objective of the interviews was to uncover what these early mobile adopters gave status and meaning and why. Appendix G contains an overview of the content of the case study interviews, and Appendix H contains a list of data collected. The semi-structured interview data was supplemented with archival data and discussion-group data from an online forum in which the subjects were active, as well as relationship data extracted in collaboration with the subject and with explicit consent from their online social networking profiles.

6.4.2 Data Collection

Sampling

Purposive sampling provided direct access to rich data about the five individuals, their mutual relationships, and their interactions with other people and information sources. Purposive sampling techniques are primarily used in qualitative studies when the aim is to select individuals based on a specific purpose associated with answering the research

question (Teddlie and Yu, 2007) and extending emergent theory (Eisenhardt, 1989). It is, furthermore, a type of sampling in which “*particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices*” (Maxwell 1997, p. 87). As the purpose of the case study was to explore how social influences impacted mobile users’ early adoption decisions, and as it is well known in the social influence literature that people with similar characteristics, tastes, and beliefs may associate in the same social networks (Manski, 2000) the sampling criteria were that the group of individuals be rather homogenous, with similar characteristics and interests, and that they should be part of the same social network. Homogenous sampling was chosen, as the goal was to understand the decision to adopt an iPhone in a *particular* group of early adopters. The participants were similar with respect to several variables, such as demographics and experience with mobile phones.

Data Collection

The data collection took place from April 2008 to July 2008. It involved semi-structured interviews, archival records, and data collected from a discussion forum on the Internet and the participants’ social network profiles. The triangulation of data collection methods provides stronger support in the exploration of the research question (Eisenhardt, 1989). All semi-structured interviews were tape-recorded with permission from the respondents and were then transcribed. Interviews lasted from one hour to one hour and twenty minutes. The interview-guide consisted of five main parts: demographics, the user’s mobile device history, the user’s iPhone history, the closed social network consisting of the five individuals their extended networks, and finally the adoption decision. Table 8 shows the five main themes the interview-guide was based on.

Table 8: Semi-structured Interview Guide – Case Study 1

<i>Theme</i>	<i>Description</i>
Demographics	Demographic data.
Mobile device history	Experience with mobile devices; purpose of the device; experience with related products.
iPhone history	Experience with the iPhone prior to adoption and after adoption; thoughts on future technological acquisitions.
Social network	The network of the five individuals; the extended network of each individual.
Adoption decision	Information gathering; thoughts prior to adoption of device; the actual decision; after receiving the device.

Framing

As described in Chapter 4: “Framing of App Phone Adoption and Use” a social influence perspective was applied in order to study sub-question two. The social influence approach applies central constructs in the analysis of social network structure and interdependency between actors. Four constructs were explored in the case study: *adoption threshold*, *opinion leaders*, *social contagion*, and *social learning*.

6.4.3 Procedure for Data Analyses

Data were analyzed using *ATLAS.ti*. Specific coding principles were adopted to establish common ground before coding began: quotes had to be specific for the chosen code and consistency in the coding was required. A coding scheme, illustrated in Table 9, was then developed and was used as the basis for analyzing the data. The coding scheme was developed based on existing social network constructs identified in the literature.

Table 9: Coding Scheme – The Case Study

Code	Description	References	Coding examples
Adoption threshold	Thresholds are the proportion of adopters in a social system needed for an individual to adopt an innovation.	Granovetter, 1978; Valente, 1996.	<i>"I wanted to get the iPhone early on – before everybody else did. When everybody has it, it's just another mobile phone."</i>
Opinion leaders	Opinion leaders carry information across the social boundaries between groups.	Burt, 1999; Oh et al., 2006; Valente and Davis, 1999; Watts and Dodds, 2007.	<i>"I always wanted the iPhone. It has been talked about for quite a long time before it was released... The turning point was one evening I met somebody who showed it to me, and I got home that night and ordered it through the Internet."</i>
Social contagion	An actor's decision to adopt an innovation depending on other actors' attitudes, knowledge, or behaviors concerning the innovation.	Dodds and Watts, 2004; Van den Bulte and Lilien, 2001.	<i>"Apple is fantastic at creating a hype surrounding their products, and the media provide analyses, descriptions, images, and videos of these products, so you feel you know and want the products before you can have them."</i>
Social learning	Social learning occurs through the observation of neighbors' choices.	Tarde et al., 2008; Katz and Tushman, 1979; Katz, 1980; Ellison and Fudenberg, 1993; Burkhardt and Brass, 1990.	<i>"I had problems with my iPhone and couldn't use it for almost a month when I received it. I asked my friends if they could help me and I found out that I had accidentally updated the firm ware so I had to wait for a new program in order to jailbreak it."</i>

Storytelling is used to convey my perception of the case. Hence, the investigation was entered with the expectation that certain events and relationships would be important. The use of the above four social influence constructs is a consequence of such expectations; that social influences may have impacted the mobile adopters' early adoption decisions. Though being empathic and respectful of each mobile adopter's realities is emphasized, it is ultimately the researcher who decides what the story of the case is. However, as argued by Stake (2005, p. 456) this will always be the case: *"More will be pursued than volunteered, and less will be reported than was learned."*

The data are therefore analyzed and presented as a characterization of the group of early mobile adopters, by analyzing individual adoption decisions, and by analyzing social influences according to the identified constructs. Thick descriptions of the phenomenon are used and let the case tell the story itself, however, it is simultaneously attempted to avoid describing everything, as this generally results in describing nothing (Weick, 1979; Easton, 1995; Dubois and Gadde, 2002).

Trustworthiness of the case study

The following describes how I sought to satisfy the trustworthiness criteria described in section 6.2: “The Case Study and the Field Study Method”. Table 10 provides an overview.

Table 10: Trustworthiness of the Case Study		
<i>Criteria</i>	<i>Description</i>	<i>Applied elements</i>
Credibility	The level of confidence in the truth of the findings.	<ul style="list-style-type: none"> - Safe environment - Triangulation of data sources - Peer debriefing
Transferability	Extent of applicability of findings to other settings or cases.	<ul style="list-style-type: none"> - Thick descriptions
Dependability	Extent of trustworthiness that the findings are consistent and can be repeated.	<ul style="list-style-type: none"> - External audit
Confirmability	The extent to which the findings are shaped by the respondents and not researcher bias, motivation, or interest.	<ul style="list-style-type: none"> - External audit - Triangulation

To ensure *credibility* of the case study, a safe environment for the participants was created, triangulation of data sources applied, and peer debriefing used. The interviews were sought to take place in a safe environment for the subjects. The interviews took place at a convenient place for them: their work place, their private homes, or my office. As they were part of the study via our mutual social contact, the atmosphere was friendly

and outgoing, and all subjects seemed eager to participate. In the collection of data, triangulation of empirical sources was aimed for. Triangulation involves using multiple data sources in an investigation to produce a more complete understanding of the phenomenon studied. As described, semi-structured interviews were conducted, content from messages in a discussion forum were analyzed, and archival data from the media were used to ensure an adequate level of confidence in the truth of the findings. As part of a larger research project, I was able to leverage peer debriefing meetings and discussions with fellow researchers on the data collected and other issues that arose to ensure that all aspects of my inquiry were made explicit. The presentation of the findings was completed in collaboration with a researcher at another university and, I furthermore, had the chance to present the findings to department colleagues and receive their feedback. This was important to minimize researcher idiosyncrasies.

Transferability was improved by using thick descriptions. A detailed account of the five early adopters, their social relationships, and their decisions to acquire the iPhone before it was officially available in Denmark was conducted. Extensive quotes were applied to give the individuals in the case a voice. Patton (1990) describes this as a strategy to increase the face validity of the study, and applies when the case studied represents a rather distinctive phenomenon.

To ensure *dependability*, the extent to which the findings are consistent and can be repeated, external audits were performed to evaluate accuracy and whether or not the findings, interpretations and conclusions were supported by the data.

External audits also improved the *confirmability* of the case study. This, along with the triangulation of data sources, enhanced the likelihood that findings were not biased towards the motivation or interest of me as a researcher.

6.5 FIELD STUDY: USE OF APP PHONES

The field study was conducted in a project team from the DREAMS project. As described in section 6.2: “The Case Study and the Field Study Method”, the project consisted of

four researchers including myself. While each researcher pursued different objectives with regard to the study, all researchers were interested in the same overall research problem: *How can the adoption and use of mobile technologies be better explained?* To explore this, the iUSE field study was conducted, in which a number of students were provided with an iPhone for a period of seven months to allow the DREAMS-project to study usage behaviors over time. The iPhone had just been introduced on the Danish market and the novelty factor was expected to engage the subjects. Furthermore, as the iPhone combines multiple functions into one device it represents an ideal mobile device for studying usage behaviors. This time, usage behaviors were explored in the field and investigated in a “bounded system” consisting of fifteen students enrolled in the same master’s program at a Danish University. Their interactions outside the system were furthermore observed. The field study was an instrumental study in that it sought to provide a more general understanding of a usage phenomenon taking place (Stake, 1995; Yin, 2003).

6.5.1 Research Method

The field study was a cross-sectional study with multiple snapshots (Orlikowski and Baroudi, 1991) that also included a longitudinal component. The study used several data collection methods, such as semi-structured interviews, focus groups, diaries, surveys, and actual usage data from the network provider covering all calls, text messages, and Internet use over the seven-month period. The data were collected by the four researchers and were made available to the project team.

6.5.2 Data Collection

Sampling

The study subjects were selected based on an evaluation of 44 students enrolled in the same master's program at a Danish University. All potential participants completed a survey on mobile device experiences, attitudes, and beliefs as well as on specific diversity criteria. The fifteen selected participants consisted of seven males (47%) and eight females (53%) ranging from 22 to 51 years of age. The participants also represented differences in family demographics, income level, nationality, and experience with mobile devices. The survey thus highlighted individual variations in attitudes, experiences, and habits related to assimilation of the iPhone to be examined in the study. Selecting participants from the same social group further allowed for an examination of the impact of social influences. The group consisted of master's students in the same program who took the same courses over a period of two years, and who had started their degrees two months prior to the beginning of the study. The fifteen participants were given a free iPhone for the duration of the study, including a subscription plan with the network provider, though if they chose to use the phone outside the subscription plan they would have to finance it themselves. The reason for this decision was to mitigate false usage by prompting participants to think about usage as if they were paying themselves.

Data Collection

Data collection took place from mid-September 2008 to the end of March 2009. In order to get rich insights into the mobile users' usage behaviors, the study was cross-sectional with multiple snapshots (Orlikowski and Baroudi, 1991), including thirty semi-structured interviews, three surveys, three focus group interviews, and fifteen 24-hour diaries. Furthermore, data from the network operator were collected in order to analyze actual usage behavior. The resulting opportunities for data triangulation provide strong support in the investigation of the research objectives (Eisenhardt, 1989). The triangulation of data had several advantages: the interviews, diaries, and focus groups increased the

likelihood of capturing the subjective nuances of the mobile users as well as their constructed reality with the aim of uncovering how and why they used the iPhone in certain ways. The three surveys conducted during the period provide insight into beliefs, intentions, and usage behavior and the changes that occurred over time. In order to better track changes in usage behaviors over time, the seven month period was divided into three equal phases time wise: the probing phase from September to November 2008, the informed phase from December 2008 to January 2009, and the proficient phase from February to March 2009. Table 11 provides a timeline of the data collection during the seven-month period. Appendix H provides a list of participants in the study and Appendix I contains a list of the topics for all data collected in the field study.

Table 11: Timeline of Data Collection – Field Study

	09 2008	10 2008	11 2008	12 2008	01 2009	02 2009	03 2009
<i>The probing phase</i>							
Survey 1: pre-study	x						
Diaries		x					
Semi-structured interview #1			x				
<i>The informed phase</i>							
Focus group #1a			x				
Focus group #1b			x				
Focus group #1c			x				
Survey 2: mid-study				x			
<i>The proficient phase</i>							
Semi-structured interview #2						x	
Survey 3: end of study							x
Actual usage data	x	x	x	x	x	x	x

The first, paper-based survey was used to decide which respondents would be invited to participate in the study, while the second and third surveys were available to respondents via the survey web site SurveyMonkey. All interviews were tape-recorded with the permission of the respondents and were then transcribed. The interview guides included different contents of interest to individual researchers and relevant theories. Interviews lasted approximately 20 minutes and the focus group interviews lasted between 90 and 120 minutes. During the interviews, one researcher led the interview and discussions, while another researcher took notes.

Framing

The competing forces perspective described in Chapter 4: “Framing of App Phone Adoption and Use” was applied in order to study sub-question 2. Based on Quinn and Rohrbaugh’s Competing Values Framework (1981, 1983), three sets of competing forces were identified that could influence mobile adoption and use: individual and social orientation, exploration and exploitation behaviors, and utilitarian and hedonic objectives. A colleague and I developed the Competing Forces Framework (CFF) based on these three identified forces. In the CFF, the opposing forces of assimilation behavior, assimilation orientation, and objectives are synthesized into four epitomes of usage processes. Inspired by Crossan et al.’s (1999) 4-I theory of how exploration and exploitation takes place in organizational learning through intuiting, interpreting, integrating, and institutionalizing, we characterize the four assimilation processes as investigating, interacting, improving, and integrating. The aim was to depict usage of an IT as a particular combination of one or more of the four processes over time, though not necessarily sequentially.

6.5.3 Procedure for Data Analyses

Data were analyzed using *ATLAS.ti*. The coding principles adopted aimed at establishing common ground between the two researchers before coding began: quotes had to be specific to the chosen code, as data were collected to cover several researchers’ needs not all quotes should necessarily be coded, and consistency in the coding was required. A

coding scheme, see Table 12, was then developed based on the following four-step procedure. First, the two authors identified, discussed, and agreed upon an initial coding scheme based on the developed CFF. Second, a pilot analysis was conducted. During this analysis, one author independently coded one interview. The coded interview was reviewed by the second author and discussed to resolve any differences, resulting in a revision of the coding scheme to increase clarity, conciseness, and applicability. Third, an inter-coder reliability test was conducted (Tinsley and Weiss, 1975, 2000). As observed by Singletary (1993, p. 294), “*if the coding is not reliable, the analysis cannot be trusted*”. Inter-coder reliability is the most well-known measurement for determining whether independent coders evaluate a text and reach the same conclusion. It measures “*the extent to which different coders tend to assign exactly the same rating to each object*” (Tinsley and Weiss, 2000, p. 98). The inter-coder reliability test involved the two authors independently coding interview transcripts and comparing results based on Neuendorf’s suggestion (2002) that “*coefficients of 0.90 or greater would be acceptable to all, .80 or greater would be acceptable in most situations, and below that, there exists great disagreement*” (p. 145). The inter-coder reliability for the first test was measured to .7826. The authors then resolved any differences and revised the coding scheme. The inter-coder reliability in the second test was measured to .8666. Fourth, the coding scheme was approved, implemented in *ATLAS.ti*, and the first author then coded all transcripts.

Table 12: Coding Scheme – The Field Study

<i>Code</i>	<i>Description</i>	<i>References</i>	<i>Coding examples</i>
Exploration	Exploration results in learning gained through processes of concerted variation, planned experimentation, and play.	March, 1991; Baum et al., 2000; Lee et al., 2003; Gupta et al., 2007.	<i>"...I jailbroke the iPhone early on because I got tired of Apple's restrictions. I used 'Zydie', which works much as the App Store – but without the restriction in access to applications."</i>
Exploitation	Exploitation results in learning gained via local search, experiential refinement, and selection and reuse of existing routines.	March, 1991; Baum et al., 2000; Lee et al., 2003; Gupta et al., 2007.	<i>"I am now adding addresses in my contact list, so I can find the place I am going, quickly, through 'Maps'."</i>
Individual orientation	Individual orientation results in individual behavior within or related to a group during a considered time period.	Bovard, 1951; Deutsch and Gerard, 1955; Jahoda, 1959; Scheepers and Scheepers, 2004.	<i>"When I do my laundry at the laundromat, I always bring my iPhone to keep myself entertained while waiting."</i>
Social orientation	Social orientation results in social behavior within or related to the group during a considered time period.	Bovard, 1951; Deutsch and Gerard, 1955; Jahoda, 1959; Scheepers and Scheepers, 2004.	<i>"At social gatherings I often experience that friends and I discuss something, and one of us brings out our iPhone and show the others a new entertaining game, video, or fact that inspires the rest of us. One of my friends showed me an app called 'Shazam' the other day that captures music from the environment and tells you which song is being played."</i>
Utilitarian	Utilitarian objectives are motivated by an outside benefit, external to the system-user interaction, such as improving performance. It is motivated extrinsically	Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982; van der Heijden et al., 2004.	<i>"I am considering buying the 'remote desktop' app so I can get access to my home desktop while I'm in school or elsewhere."</i>
Hedonic	Hedonic objectives specify the extent to which enjoyment can be derived from using the	Hirschman and Holbrook, 1982; Holbrook and	<i>"I commute every day, and then I use my iPhone to play games or do other</i>

	system as such. It is motivated intrinsically.	Hirschman, 1982; van der Heijden et al., 2004.	<i>entertainment related activities."</i>
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The data were analyzed according the coding scheme in order to evaluate how mobile device usage was influenced by the three sets of competing forces. The aggregate results along the three dimensions of competing forces of behavior, orientation, and objective were analyzed to reveal changes in usage patterns across the probing, the informed, and the proficient phases. Then it was then analyzed how users engaged in the four identified usage processes of investigating, interacting, improving, and integrating.

Trustworthiness of the field study

Table 13 provides an overview of my attempt to improve trustworthiness in the field study.

Table 13: Trustworthiness of the Field Study		
<i>Criteria</i>	<i>Description</i>	<i>Applied elements</i>
Credibility	The level of confidence in the truth of the findings.	<ul style="list-style-type: none"> - Prolonged engagement - Triangulation of methods, and analysts - Peer debriefing
Transferability	Extent of applicability of findings to other settings or cases.	<ul style="list-style-type: none"> - Thick descriptions
Dependability	Extent of trustworthiness that the findings are consistent and can be repeated.	<ul style="list-style-type: none"> - External audit
Confirmability	The extent to which the findings are shaped by the respondents and not researcher bias, motivation, or interest.	<ul style="list-style-type: none"> - External audit - Triangulation of data sources - Reflexivity

The field study was conducted over the course of seven months. To ensure *credibility*, prolonged engagement, triangulation of sources, methods, and analysts, and peer debriefing were applied. Prolonged engagement refers to the spending of sufficient time “in the field” to learn or understand the phenomenon of interest. Since the participants in

the field study had been students of mine for approximately one month, a relationship with them was emerging. However, as this could also pose a problem for some students, the project team agreed that contact with the students would primarily be made by the three other researchers in the study. Over the seven-month period in which the field study took place, the participants established a rather close relationship with the researchers involved and felt safe contacting each of us if they experienced any type of problem. These long-term relationships were emphasized even more because the students had to physically show up at the office of the researchers to provide their monthly bill as well as to participate in interviews, focus groups, etc. Triangulation was again used to improve credibility. Triangulation of methods involved checking the consistency of findings generated by different data collection methods such as semi-structured interviews, surveys, focus groups, etc. to elucidate complementary aspects of the same phenomenon. Triangulation of analysts involved using several researchers to conduct interviews and focus groups, and to review the findings collectively. Analyst triangulation was particularly useful to provide a check on selective perception and to illuminate blind spots in the interpretive analyses. As all collected data were analyzed qualitatively for the research purposes of this dissertation, statistical generalizability was not an objective of the study. However, when presenting the findings in *Article 4* (Tscherning and Mathiassen, 2011) naturalistic generalizability (Stake, 1995) was aimed for by proposing theory and propositions based on the empirical data (Eisenhardt, 1989; Ruddin, 2006). Naturalistic generalizability makes it possible to apply the findings and propositions identified in the field study to similar contexts. Finally, peer debriefing was important in the field study, as the four researchers collected and shared data jointly.

To enhance *transferability*, thick descriptions were produced. The purpose of the thick descriptions was also to aid naturalistic generalizability.

Dependability and *confirmability* were enhanced through external audits and confirmability was further enhanced through triangulation of methods and analysts. Additionally, confirmability was strengthened through researcher reflexivity by

acknowledging that “*a researcher’s background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing and communication of conclusions*” (Malterud, 2001, pp. 483-484). My role and perspectives as researcher were discussed in Part Three: “Methodology”.

6.6 SUMMARY OF CHAPTER

The empirical study of this dissertation consists of two studies, one case study and one field study, with both studies conducted in the same domain but distinguished from each other in regard to theoretical framing, data collection, data analysis, and presentation style. It has been argued here that the approach taken was well suited to exploring the research question and benefits and weaknesses were presented. The background of the two studies was presented along with the particular methods of data collection and analysis used.

PART FOUR: RESULTS

Part Four reviews and discusses the findings obtained in the investigation of how social influences can add to an explanation of the adoption and use of app phones. Part Three described the relationship between mobile users and app phones and argued for the critical realist ontology and a constructionist epistemology. An interpretive approach to the empirical study proved consistent with the integrated theoretical perspective laid out in the Part Two. Building from the framing in Part Two and the methodological discussion in Part Three, Part Four begins in Chapter 7 with a review of the published component of this dissertation, addressing the research opportunities laid forward in Chapter 3: “Mobile Adoption and Use” and the two sub-questions presented in Chapter 1: “Introduction”. The chapter then explicates how answering the sub-questions contribute to answering the main research question. Chapter 8 provides a discussion of the results. The chapter does not discuss the research findings in relation to existing literature, as this is part of each of the four articles.

CHAPTER SEVEN: REVIEW OF RESULTS

7.1 INTRODUCTION

This dissertation set out to investigate to what extent social influences and competing forces can add to an explanation of app phone adoption and use. In order to approach the research question, the dissertation includes two sub-questions that lay the groundwork for the larger inquiry. Four articles have been produced to address these two sub-questions and, thus, also the main research question. Table 14 shows the relationship between the main research question, the sub-questions, and the four produced articles.

Table 14: Relationship between the Research Question, Sub-questions, and Articles

<i>To what extent can an understanding of social influences and, more generally, competing forces assist in explaining early adoption and use of app phones?</i>	
Article 1: (Tscherning and Damsgaard, 2008) Identification of two research opportunities leading to the choice of a social influence and a competing forces approach to mobile device adoption and use.	
<i>1) How can social influences contribute to explaining app phone adoption and use?</i>	<i>2) How can the competing forces of app phones contribute to explaining their adoption and use?</i>
Article 2: (Tscherning and Mathiassen, 2010). Article 3: (Tscherning, 2011).	Article 4: (Tscherning and Mathiassen, 2011).
Analysis of social influences on app phone adopters in early adoption decision-making, and argument as to why insight can be gained by analyzing dynamics of individual- and group-level factors.	Analysis of three sets of competing forces and four use processes that influence mobile usage behaviors.

The following is a presentation of the identification of research opportunities and each of the formulated research sub-questions. It will address the research method, research findings, and research contribution to the preliminary identification of research opportunities and to each of the two sub-questions. Then a synthesis of the results in connection with the main research question will be presented.

7.2 LITERATURE STUDY

To identify research opportunities, it is necessary to investigate how mobile devices have been approached for the purpose of explaining adoption and use and to determine how such approaches could be improved. Prior research in the broad field of diffusion and adoption of telecommunication innovations aids in identifying opportunities for this dissertation to advance the current state of research. While from the current work began with broader inquiries into diffusion and adoption research on telecommunication innovations, the main research question lead to focus on existing research within specific literature on the adoption and use of mobile devices. A suitable outcome is therefore an overview of prior research within this field.

Research Methods

The method to identify research opportunities involved two literature studies. The initial literature study produced *Article 1* (Tscherning and Damsgaard, 2008) with the purpose of examining aspects that are accentuated or overlooked in the diffusion and adoption process as reported by scholarly work. The literature study included research conducted from 1998-2007 from three conference outlets: the International Conference on Information Systems (ICIS), the European Conference on Information Systems (ECIS), and the IFIP International Federation for Information Processing conference on diffusion and adoption (IFIP 8.6). The choice of these three conferences was made to identify recent research within the area of telecommunication diffusion and adoption, as research on the topic has proliferated immensely within the time period chosen. As studies published in journals may be several years old at the time of their publication, conference papers were chosen as the target to obtain more recent research. In retrospect, however, it could have been more convincing to also include the most respected IS journals in the literature study. As noted in Chapter 3: “Mobile Device Adoption and Use”, Landau (2010) found that out of 2001 total articles published in the “basket of eight” journals between 2000 and 2010, only 76 concerned mobile ICT. With the relatively low number of articles published on the diffusion and adoption of telecommunication technologies in

these journals, the argument in *Article 1* (Tscherning and Damsgaard, 2008) could have been strengthened by the addition of further publications in the area.

The second literature study, presented in Chapter 3: "Adoption and Use of Mobile Devices", narrowed the topic of interest to specifically address the adoption and use of mobile devices. This literature study was inclusive in regard to research outlets, which was more straightforward as the area of concern was less expansive. While the first article applies a holistic framework to the literature study, the study in this cover paper focuses on main elements occupying researchers in the IS adoption literature.

Research Findings

The findings of *Article 1* (Tscherning and Damsgaard, 2008) helped to focus the main research question on consumer adoption and use of mobile devices and to indicate a theoretical direction.

Type of Innovation	Compulsory	19%	Approach	Variance	83%
	Voluntary	81%		Process	17%
	With network effects	17%		Interpretative	50%
	Without network effects	83%		Positivist	50%
Theory	Diffusion of Innovations	11%	Adoption Unit	Individual	69%
	TAM/TRA etc.	20%		Group	2%
	Other	50%		Organization	25%
	None	19%		Region	2%

Table 15 provides a typology of diffusion and adoption research on telecommunication innovations between 1998 and 2007 in the three selected outlets. Among other things, the literature study shows that several studies apply TAM and related models to this research area, while a very limited amount of studies address relations among people in groups or

organizations or relationships among organizations. Also, as discussed in section 3.4: “Research Opportunities”, most studies take a variance approach emphasizing correlation explanations but focusing less on “why” and “how” specific factors cause adoption and use of mobile devices. Hence, the research problem of this dissertation was able to focus on consumer adoption and use of mobile devices, taking a qualitative process approach to study the impact of social influences and competing forces. It should be noted there is an inconsistency in the results because of the identification of a dominance of studies taking a variance approach in the selected outlets (83%) as opposed to the equal distribution of interpretative and positivist studies. The reason for this inconsistency is that the variance approach was interpreted to be a point-in-time study, whereas the process approach was interpreted as including studies that investigated diffusion and adoption over time with at least two points in time to be investigated.

The findings of the focused literature study in Chapter 3: “Adoption and Use of Mobile Devices” can be divided into four broad areas: the role of the artifact, the role of user psychographics, the role of usage objectives, and the role of assimilation. While there is an overall agreement that research on the adoption and use of mobile devices is an important area, several research opportunities were identified. First, even though the artifact has gained increased interest since Orlikowski and Iacono’s (2001) call for its emphasis, research in the area is still limited. Second, though many studies apply user psychographics as antecedents to mobile adoption and usage behaviors, only a limited number of studies take social influences into account, and those studies investigating social influences conduct variance-based research using statistical analysis to find strong causal relationships between social influence and mobile adoption, indicating that process-based qualitative research is needed. Third, whereas researchers seem to agree that there is a need for distinguishing between utilitarian and hedonic objectives of mobile devices, they do not seem to agree on which of these objectives has the highest explanatory power and, therefore, some researchers propose a dual-purpose view of mobile devices. This indicates that the conflicting nature of the mobile device should be

investigated further. Finally, only very limited research has been conducted into the assimilation of mobile devices, though it is now widely recognized that IT assimilation gaps often occur, and that long term innovative effects fail to appear. This implies a need for understanding how mobile devices are assimilated.

Research Contribution to sub-question 1

The contribution of *Article 1* (Tscherning and Damsgaard, 2008) is an overview of existing research within the diffusion and adoption of telecommunications research presented through a holistic framework. It provides a foundation for scoping the research area of concern. Once the area of concern has been identified, the specific research question can be formulated. The focused literature review of Chapter 3: “Adoption and Use of Mobile Devices” aids in identifying the core theoretical perspectives, social influence and competing forces, used to answer the main research question.

7.3 SOCIAL INFLUENCES

Research Sub-question

The first sub-question to help answer the main research question is:

How can social influences contribute to explain app phone adoption and use?

The aim is to establish and describe the relationship between social influences and mobile adoption, and to describe how social influences can help to explain mobile adoption and use. Furthermore, as a social influence perspective involves factors from two levels of analysis (the individual being influenced and the social context that is influencing them), the aim is to investigate how additional knowledge can be obtained by considering factors from both levels of analysis. Hence, the social influence perspective, approached at the individual and the social network levels of analysis, can determine how social contexts impact app phone adoption and use at these levels. An appropriate answer to this sub-question consists of different types of answers. This dissertation presents a classification of investigated mobile adopters along with the story of each individual adoption decision to contribute contextual insights, in keeping with an interpretive

approach. An overview of which social influence constructs do or do not influence individual app phone adoption decisions is another contribution. Finally, to explicate how individual adoption decisions are made, a theoretical framework that shows how social influences impacts individual decisions contributes in answering the research question.

Research Method

To answer the research question, two articles were produced. *Article 2* (Tscherning and Mathiassen, 2010) is based on empirical data collected in Case Study 1: “Early Adoption of Mobile Devices”, while *Article 3* (Tscherning, 2011) is a conceptual paper based on constructs identified partly through the case study.

Article 2 (Tscherning and Mathiassen, 2010) is a product of the case study. As described in section 6.4: “Case Study: Early Adoption of App Phones”, the case study emerged as a response to an opportunity that arose in early 2008. A group of five socially connected individuals were identified, and relational influences were investigated through semi-structured interviews, archival data, and data obtained from an online forum. In retrospect, it could have been interesting to also interview five individuals in the same network, who were offered an iPhone prior to the Danish release but did *not* accept the offer, in order to investigate if and how the network had influenced their decision *not* to adopt the iPhone at the time. Such individuals were not identified, however, and this line of research was not pursued.

Article 3 (Tscherning, 2011) is a conceptual contribution that seeks to explain how social network theory, at the individual and social network levels, can help explain adoption decisions. The article takes its point of departure in the social influence approach presented in Chapter 4: “Framing of App Phone Adoption and Use”. The article develops the Multi-level Framework of Technology Adoption (MFTA), which conjectures that the degree to which IT is adopted can be explained based on the interaction of individual and network level phenomena for which evidence can be found in existing literature. Research in the social sciences has traditionally studied individual level phenomena, rooted in psychological phenomena, taking a micro level perspective (Rousseau and

House, 1994), or organizational level phenomena, rooted in sociology and economics, taking a macro level perspective (Dansereau et al., 1984). The MFTA takes its point of departure in the well-known diagram developed by sociologist James Coleman (1990) who attempts to create a link between these micro and macro level phenomena in a holistic way. *Article 3* (Tscherning, 2011) applies four groups of social network theories identified by Monge and Contractor (1998) to the framework: *social network analysis*, *homophily* theories, theories of *self-interest and collective action*, and *contagion* theories. The application of the four groups of theories is thus broader than the social influence theories applied in *Article 2* (Tscherning and Mathiassen, 2010).

Research Findings

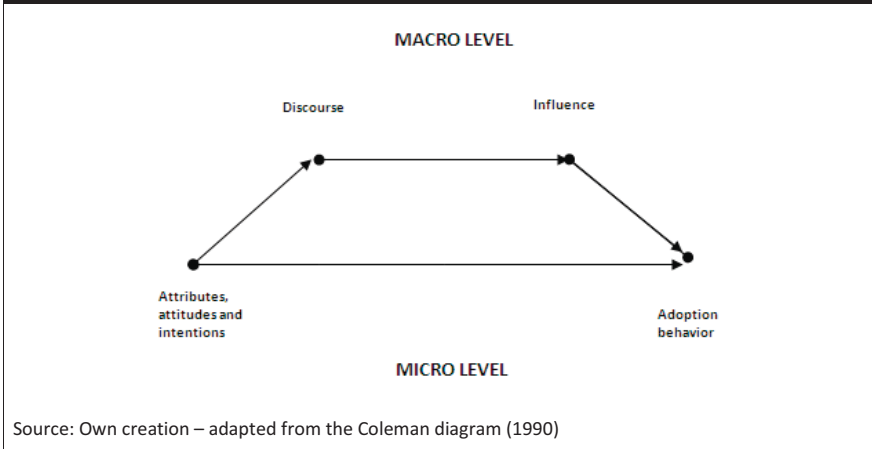
The findings of *Article 2* (Tscherning and Mathiassen, 2010) aid in establishing a relationship between social influences and app phone adoption. The case study characterized the five individual adopters as *surfers* (advanced users) according to Constantiou et al.'s (2007) categorization of mobile adopters. Apart from using their previous mobile device for talking, text-messaging, photography, and surfing, the subjects seek information about new mobile phones regularly and are usually among the first to try out new mobile technologies and services. They enjoy experimenting and find it fairly easy to make their mobile device perform as they wish. Data from an online social network, furthermore, shows that they are highly interconnected. The analysis of how their adoption decision shows a relationship with certain social influence constructs, as depicted in Table 16. *Adoption threshold*, *information transfer*, *competitive concerns*, and *social learning* all seemed to impact their adoption decision-making, while no evidence was found for a relationship between *opinion leaders*, *normative pressure*, or *performance network effects* and their adoption decision making.

Table 16: Social Influence Construct Evidence

<i>Social influence construct</i>		<i>Result</i>
Adoption Threshold		Adopters had low adoptions threshold.
Opinion leaders		No evidence that opinion leaders had an impact.
Social contagion	Information transfer	Information transfer had an impact.
	Competitive concerns	Some evidence for competitive concerns.
	Normative pressure	No evidence for normative pressure.
	Performance network effects	No evidence for performance network effects.
Social learning		Social learning had an impact.

Article 3 (Tscherning, 2011) aims at investigating how the social influence perspective can determine how social contexts impact the different levels. The article develops the MFTA (see Figure 11) to show that IT adoption involves more than one level of analysis. The MFTA is adapted from the Coleman diagram and includes prior adoption research in the development of the model. Coleman’s (1990) original model seeks to explain occurrences at the societal level by acknowledging that individual attitudes, values, and behaviors should be taken into account. The MFTA takes the opposite approach and seeks to explain individual behaviors by taking social network influences into account. In retrospect, the development of the MFTA model could have followed Coleman’s (1990) diagram more strictly and attempted to explain how individual attributes, attitudes, and intentions impact the success of certain mobile devices compared to others. The goal of this dissertation, however, is to investigate social influences on *individual* adoption and usage decisions.

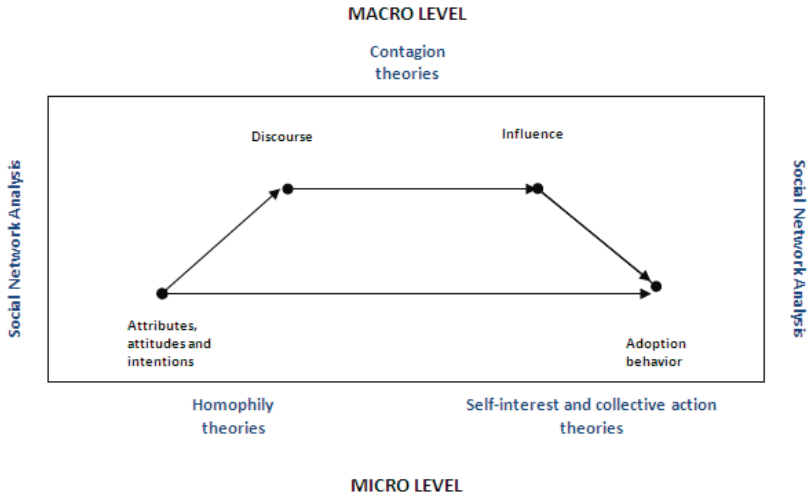
Figure 11: The Multi-level Framework of Technology Adoption



Source: Own creation – adapted from the Coleman diagram (1990)

As described in section 4.2: “The Social Influence Approach”, Monge and Contractor (1998) conducted a comprehensive literature review of the emergence of social network perspectives on communication in which they identify ten groups of theories that have been used in organizational research. This article applies four of these ten groups to the MFTA to make it clear to which level the social network theories originate, and thus to investigate how they influence other levels of analysis. This is depicted in Figure 12, which shows that *homophily* as well as *self-interest and collective action* theories depart at the individual level, whereas *contagion* theories describe network level dynamics. *Social network analysis* measures originate at both levels of IT adoption, and thus also connect the micro and macro levels.

Figure 12: Social Network Theories Applied to the MFTA



Source: Own creation – adapted from the Coleman diagram (1990)

Research Contribution to sub-question 1

Article 2 (Tscherning and Mathiassen, 2010) contributes to answering research sub-question 1 in a number of ways. First, it provides an in-depth description of a group of very early adopters of a groundbreaking technology, the iPhone, and their efforts to overcome uncertainty and other switching costs. Second, based on a social influence perspective, it is shown that traditional network measures can provide an in-depth understanding of the decision-making processes of early iPhone adopters. Finally, the research conducted is relevant to academics, as they may apply the findings to explain how and why individuals adopt emergent devices that differ substantially from previous devices and are not yet available through conventional supply chains. Practitioners can obtain new insights into the behaviors of early adopters of mobile devices and may incorporate these into their mobile device and development strategies.

Article 3 (Tscherning, 2011) contributes to answering research sub-question 1 in two key ways. First, it develops the MFTA to emphasize the dynamics occurring between the micro and the macro levels in IT adoption situations. Second, it shows that a social influence perspective that takes the individual and social network levels in account can help explain these dynamics. The MFTA thereby attempts to create awareness of the benefits of applying a multi-level approach when studying IT adoption.

7.4 *COMPETING FORCES*

Research Sub-question

The second sub-question supporting the main research question is:

How can competing forces of app phones contribute to explaining their adoption and use?

The aim is to identify a second theoretical perspective that may complement the social influences approach in order to conduct an in-depth study of app phone adoption and use and develop reliable scientific knowledge. The expectation is that multiple frames of reference can improve understanding of the studied phenomenon. To answer the second sub-question, a framework showing how mobile usage decisions are made while under the influence of competing forces can contribute to understanding mobile usage decisions.

Research Method

To address the research question, *Article 4* (Tscherning and Mathiassen, 2011) was produced. *Article 4* (Tscherning and Mathiassen, 2011) is based on empirical data collected in section 6.5: “Field study: Use of App Phones”. As described, the field study was part of a larger project that included the research objectives of four researchers interested in investigating how we can better explain the adoption and use of mobile technologies. A group of fifteen students, all part of the same Master’s program, received an iPhone as part of the field study. Several types of data collection methods were used to investigate how a competing forces perspective can contribute to explaining the adoption

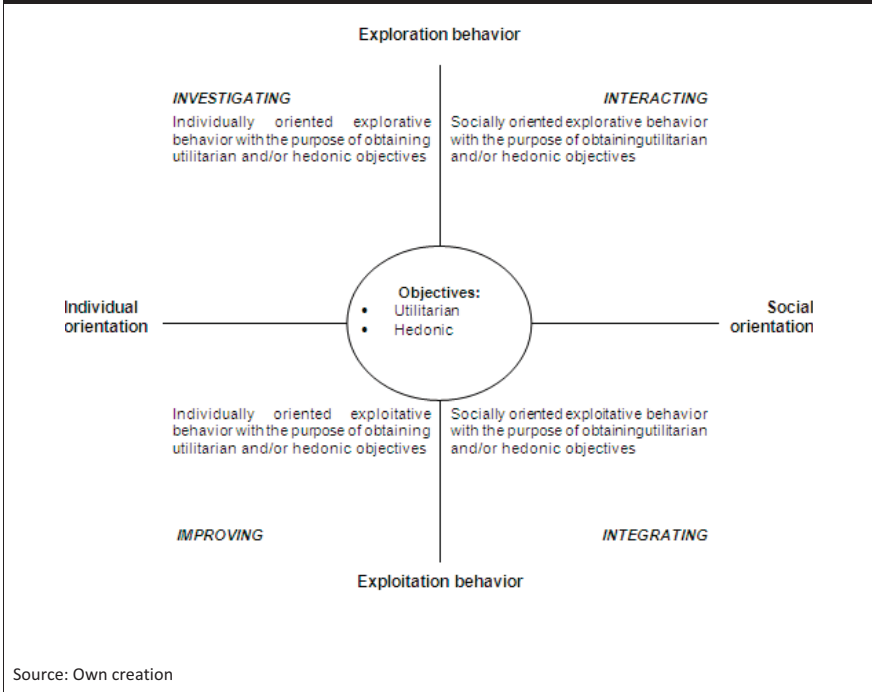
and use of app phones. *Article 4* (Tscherning and Mathiassen, 2011) specifically investigates app phone *assimilation*. The literature study in section 3.3: “Adoption and Use of Mobile Devices” found that while research on the adoption and use of mobile devices may indicate considerable impact, it has been established that the long term innovative effects and benefits occur when users subsequently assimilate a technology, making it their own, and embedding it in their lives (Bar et al., 2007; Fichman and Kemerer, 1997). As only very limited research has been conducted on the assimilation of mobile devices, and as the participants of the study received an iPhone from the DREAMS project and therefore had not made an adoption decision, the field study was concerned with investigating the assimilation of mobile devices.

Research Findings

Article 4 (Tscherning and Mathiassen, 2011) develops the Competing Forces Framework (CFF), inspired by Quinn and Rohrbaugh’s (1987) Competing Values Framework (CVF). The purpose of the CFF is to add to current explanations of human behavior in relation to assimilation of IT, and the framework posits that the degree to which IT is used, or assimilated, can be explained based on three sets of competing forces for which evidence was found in the literature on IT and mobile devices. The first set of values is related to IT usage behavior, distinguishing between exploration and exploitation. The second set of values is related to the shaping of IT usage, distinguishing between individual and social orientation. Finally, the third set of values is related to the objectives of using IT, with a distinction between hedonic and utilitarian objectives. We synthesize the opposing forces of usage behavior, usage orientation, and objectives in the CFF into four types of usage processes, inspired by Crossan et al.’s (1999) 4-I theory of how exploration and exploitation take place in organizational learning through intuiting, interpreting, integrating, and institutionalizing. We characterize the four assimilation processes as *investigating*, *interacting*, *improving*, and *integrating*. Using the CFF we can then depict the assimilation of an IT as a particular combination of one or more of the four processes over time. As detailed in Figure 13, investigating and improving are individually

oriented, while interacting and integrating are socially oriented; investigating and interacting are exploratory, whereas improving and integrating are exploitative; and, finally, all four processes can have both utilitarian and hedonic objectives.

Figure 13: The Competing Forces Framework



Based on the CFF, we put forward three propositions to be investigated in future research:

1) *Proposition on Objectives:*

Assimilation of IT is increasingly shaped through utilitarian as well as hedonic objectives. When individuals can readily transition between and combine utilitarian and hedonic objectives, they will likely increase learning and reduce the assimilation gap.

2) Proposition on Orientation:

Individuals' assimilation of IT is shaped through interactions with the social context. Stimulating socially oriented behavior will likely contribute to increased learning and reduction of the assimilation gap. However, emphasizing socially oriented behavior at the cost of individually oriented behavior will unlikely lead to sustained learning and an effective level of usage.

3) Proposition on Behavior:

Effective assimilation of IT requires maintaining an appropriate balance between exploratory and exploitative behaviors. When users emphasize exploration while ignoring exploitation their efforts will unlikely lead to an effective level of usage. Conversely, when users refine exploitation more rapidly than exploration they will arrive at an effective level of usage in the short run, but sustain an assimilation gap in the long run.

Research Contribution

Article 4 (Tscherning and Mathiassen, 2011) contributes to answering research sub-question 2 in three key ways. First, it develops the CFF to show how competing forces impact assimilation decisions through the processes of investigation, interaction, improvement, and integration. Second, it validates the framework by providing rich data from an empirical study. Third, it develops related propositions as a foundation for future research into how competing forces shape IT assimilation in social contexts.

7.5 ADOPTION AND USE OF APP PHONES

The main research question asked in section 1.1: "A Mobile Revolution" is:

To what extent can an understanding of social influences, and more generally, a set of competing forces, assist in explaining the early adoption and use of app phones?

The research question was motivated by the unprecedented development of mobile technologies in general and mobile devices in particular experienced since the late nineties. Encouraged by the fierce mobile device competition that emerged during the

early stages of this Ph.D., and the ever more noticeable contradictory impacts of mobile devices, the research question was formulated with the aim of understanding mobile devices in social contexts. The overall objective of this dissertation is to explore app phone adoption and use, and in particular to examine, via an interpretive approach, how consumers are impacted by social influences and competing forces.

Research Method

A case study on app phone adoption and a field study examining app phone use were conducted to add to current explanations. The objective was to suggest new frameworks that reflect and synthesize the work that is already being done in the area by applying two related, yet different, theoretical perspectives – see Table 17. The case study investigated early adoption of app phones taking a social influence approach, and the field study investigated usage behaviors, specifically assimilation, taking a competing forces approach. In hindsight, it would be interesting to investigate more comprehensively how a competing forces approach could help explain app phones adoption, and how a social influence approach could help explain app phone usage and assimilation.

Table 17: Two Approaches Applied to Mobile Adoption and Use		
	<i>Social influences approach</i>	<i>Competing forces approach</i>
<i>Adoption</i>	Case Study	-
<i>Use (Assimilation)</i>	-	Field Study

Research Findings

The four articles reviewed in this chapter all provide part of the answer to the main research question. *Article 1* (Tscherning and Damsgaard, 2008) confirms a number of research opportunities in the area of mobile device adoption and use and aids in identifying the area of concern. *Article 2* (Tscherning and Mathiassen, 2010) establishes and describes the relationship between social influence constructs and app phone adoption. *Article 3* (Tscherning, 2011) argues that a social network approach to IT adoption reveals that adoption decisions are influenced by factors at both the individual

and the social network level and that both should be taken into account. Finally, *Article 4* (Tscherning and Mathiassen, 2011) establishes that a competing forces approach can contribute to explaining assimilation of app phones.

Research Contribution

The major research contributions of this dissertation are the two conceptual frameworks and empirical evidence that shows that a social influences and a competing forces perspective can add to the explanation of app phone adoption and use by addressing consumer objectives, orientation, and behavior. Table 18 indicates the conceptual and empirical nature of each of the four articles. The articles are divided between those that provide mainly conceptual input and those that apply empirical input in addition, as well as between those that apply existing concepts and those that generate new frameworks.

Table 18: Findings Applied on Mobile Adoption and Use		
	<i>Empirical input</i>	<i>Conceptual input</i>
<i>Concept application</i>	Article 2	Article 1
<i>Concept development</i>	Article 4	Article 3

7.6 SUMMARY OF CHAPTER

This chapter has presented the results from the four articles produced as they aid in identifying research opportunities and answering the two research sub-questions and main research question of the dissertation. The chapter has presented each research question, the methodology applied for answering it, the findings, and the overall contribution.

First, the literature studies identify adoption and use of mobile devices as the area of concern. To answer the main research question, two theoretical approaches are identified: the social influence approach and the competing forces approach.

Second, the social influence approach is applied to explain the early adoption of app phones through a qualitative case study. The case study describes how social influence constructs can explain early adoption of groundbreaking technologies, such as app phones.

Third, the competing forces approach is applied to explain app phone use through a qualitative field study. The field study explains how three dimensions of competing forces influence app phone users in their assimilation behaviors through the processes of investigating, interacting, improving, and integrating.

PART FIVE: DISCUSSION AND CONCLUSION

This final Part Five begins with a reflection on the PhD process in Chapter 8. It then provides a discussion of the conclusions drawn from the dissertation as a whole in Chapter 9, and based on the theoretical and methodological considerations in Part Two and Three as well as the empirical studies presented in Part Four, the chapter, furthermore, discusses the theoretical and practical contributions, while Chapter 10 discusses limitations, implications, and future research.

CHAPTER EIGHT: PERSONAL REFLECTION

8.1 INTRODUCTION

This chapter displays my reflections of the process that formed this dissertation and lessons learned during the process. The aim is explicate the decisions made over the course of the PhD formation.

8.2 REFLECTIONS ON THE PROCESS

The research process started in the fall of 2008, when I was admitted to the doctoral program at the Copenhagen Business School. While the overall theme of the Ph.D. had already been decided, the research process was extensive and emergent in nature. The starting point was to uncover how mobile technologies diffused through networks and how groups of consumers adopted these technologies. As this research topic was rather new to me, I started the process by conducting a literature review on the diffusion and adoption of telecommunication innovations to obtain an overview of research already conducted in the field. I immediately discovered that the volume of research published was substantial, and thus decided to limit the scope of investigated outlets. The choice to investigate a technology that has developed extensively over the past decade stimulated the decision to review literature from conferences to avoid the time-delay inherent in journal publications. The choice of outlets was based on the popularity of the conferences. The international and European conferences on information systems are the most respected conference outlets in IS research in general, and the IFIP 8.6 conference focuses on the diffusion and adoption of technologies, and is therefore central to the research area. The literature review introduced me to the field under investigation, and I rapidly discovered that the field was too broad for a dissertation. I narrowed down the research question to focus on the adoption of mobile devices.

In the spring of 2008, I read an article in BBC News²⁸ which stated that a quarter of all US iPhones sold had been unlocked and that 8000 iPhones had been imported to Denmark and hacked by users²⁹ as the device was not available there at that time. I was familiar with some of these importers and, based on the initial topic of the dissertation as well as the literature study, which revealed that only limited research had been conducted analyzing group level adoption, I decided to investigate social network effects on whether and how a decision to adopt an app phone was made. I contacted one person who had acquired the iPhone in the US prior to the Danish release and was introduced to four other persons in his social network who had adopted the iPhone as well. While five persons in a social network represented a very limited case study, I decided to continue the study, as it represented a new adoption phenomenon that had never occurred before. Never before had a mobile device manufacturer constrained sales to be conducted through only one network provider, and never before had a single mobile device been hacked like the iPhone. I continued to seek more individuals and their social networks to conduct more case studies, but did not manage to find other cases to study. In the study, I applied social network constructs in a qualitative manner to investigate the relation between these constructs and the early adoption phenomenon. At the time, I had wanted to investigate group level adoption, but found that I was in fact studying the adoption decisions of individuals as influenced by their social network.

I was still interested in seeking to explain group level adoption decisions, and I began work on a conceptual article that was aimed at explaining multi-level adoption decisions. I had found that individuals make their own adoption decisions under the influence of their social contexts. It was my aspiration to be able to explain how adoption decisions take place at multiple levels of analysis, and to show that adoption research should seek to take all levels into account. My reasoning was that in organizations both the organization and the individual make an adoption decision, and in consumer contexts individual consumers and their social networks make adoption decisions. Based on

²⁸ <http://news.bbc.co.uk/2/hi/business/7214873.stm>

²⁹ <http://www.business.dk/tech-mobil/8.000-hackede-iphones-i-danmark>

previous adoption research, it was evident that individuals can be described through their attributes and attitudes and that these influence their intention to adopt a technology, which reflects an actual adoption decision. After being presented with Coleman's (1990) diagram, I was confirmed in my considerations that adoption takes place at a micro and a macro level. As typical adoption research investigates how individual attributes and attitudes influence intention to adopt and final adoption, I believed that I could explain individual adoption by taking into account the social network, or organization, a reversal of the original model developed by Coleman (1990) that seeks to explain macro level phenomena by taking into account micro level phenomena. While I was aware that a problem might occur as I turned the original model upside down, I was also convinced that I needed to be loyal to the immense amount of research being conducted in the adoption field. This led to the development of the Multi-level Framework of Technology Adoption (MFTA). Because my goal was to emphasize the importance of conducting multi-level adoption research, and because I had become interested in social network theory, I applied four groups of social network theories to the MFTA to show that these theories implicitly encompass factors occurring at multiple levels. In reflecting on the MFTA and the application of social network theories, I now see two noticeable weaknesses. First, it may have been more appropriate to adhere to the original model developed by Coleman (1990) and to seek to explain how certain technologies have an impact on society as a consequence of individual adoption decisions. Second, the application of social network theories to the MFTA does not provide a multi-level perspective on technology adoption, but rather takes into account factors from the social network level at the individual level. While the article presenting the model has been accepted and I believe it makes an interesting contribution to technology adoption research, succeeding in arguing that factors at multiple levels influence individual adoption decisions, it may also trigger discussions of the two above weaknesses.

In the fall of 2008, the field study was initiated in the DREAMS-project. Four researchers were interested in investigating the adoption of iPhones in depth by conducting a field

study over a period of seven months. We planned the field study during the summer of 2008 and the investigation took place from September 2008 to March 2009. We approached 44 students in a Master's level course that I was teaching in the fall semester of 2008 and invited them to participate in the study. After evaluating the students based on a questionnaire, we decided to invite 15 students to participate. They all received iPhones as described in section 6.5: "Field Study: Use of App Phones". While the data collection took place, I went to the Polytechnic Institute of New York University, where I stayed for 14 months. The development of the research design and survey was the joint effort of all members of the project.

Based on my interest in how social networks influence individual decision making, my goal was to conduct a social network analysis of the interactions that took place during the study period using the iPhones as well as analyzing the detailed use of the iPhone as the users downloaded apps from App Store. I made an agreement with the network provider that they would provide me with all usage data in the group, but as I received the data I came to realize that I would not be able to conduct the planned research. First, the data I received contained only outgoing calls, text messages, and data traffic and did not contain incoming calls and text messages. Second, data traffic was measured in number of seconds spent on the Internet as well as volume downloaded, but it was not possible to receive data on which applications were downloaded and used. I therefore had to revise my goal for the field study through a type of systematic combining, which is "*a process where theoretical framework, empirical fieldwork, and case analysis evolve simultaneously, and is particularly useful for development of new theories*" (Dubois and Gadde, 2002). The field study had been designed to be inclusive, and the main themes identified by the four researchers were technology experience in general and mobile device experience in particular, usage of the iPhones over the period of seven months, social network influences, and consumption values. Based on the research design, I altered my research question. First, I was not able to study adoption in the field study, as the participating students were explicitly given an iPhone. I was, however, able to study

their usage behaviors. Discussing the field study with my co-author, I decided to study assimilation of the iPhone. Based on the Competing Values Framework (Quinn and Rohrbaugh, 1981; 1983), previous adoption research, and the empirical data from the field study, we developed the Competing Forces Framework (Tscherning and Mathiassen, 2011). After writing this paper, I furtherer adjusted my research question, as the main part of the empirical data is the result of the field study and as my original research focus was no longer tenable. Originally, the objective of this dissertation was to investigate network adoption and how groups make mobile device adoption decisions. The focus then shifted to explain how social network influences could add to explaining app phone adoption. Finally, I realized that I was not able to obtain the data needed in the field study, and, hence, the competing forces approach became central to the dissertation, while still emphasizing the individual versus socially orientated dimension.

In January 2010 I started writing this cover paper to present a coherent narrative of the contents of the Ph.D. and to reflect on the results, as the process is never linear and straightforward. The aim of this reflective section is to allow readers of the dissertation to evaluate the final work as a result of a more transparent process as well as to allow myself to reflect upon the research process.

8.3 SUMMARY OF CHAPTER

Chapter 8 has provided a discussion of the results presented as reflections of the PhD process. As with most research projects, I experienced the emergence of different challenges during the process and adjusted the focus of the PhD project along the way.

CHAPTER NINE: CONCLUSION AND CONTRIBUTIONS

In an attempt to assess the answers proposed to the main research question and the two research sub-questions, this chapter summarizes the dissertation and discusses the theoretical and practical contributions to the field of mobile device adoption and use.

9.1 CONCLUSION

In this dissertation, I have presented and explored two approaches to explaining app phone adoption and use. Specifically, I have examined the perspective that consumers do not make adoption and use decisions based solely on their individual intentions, but are influenced by the social context in which they are situated. The research presented here forms a part of the growing interest in understanding how consumers, as well as networks and organizations, make adoption and use decisions while being influenced by the social context as well as competing forces. In this dissertation, however, I have extended current research in two key directions. First, this work investigates *how* decisions are made, by taking the underlying reasoning of adopters into account. Second, it specifically addresses the distinctiveness of the specific technology being targeted. Most adoption researchers take the technology for granted in favor of establishing a correlation between different factors and intention to adopt and use mobile devices. While this type of research has much to offer in understanding the complexity of these decisions, this dissertation is a modest attempt to expand knowledge by opening the technology “black box” and investigating the underlying assumptions and reasoning of early mobile adopters and users.

To answer the question of to what extent social influences and competing forces can assist in explaining the early adoption and use of app phones, this dissertation approaches the stages of adoption as consisting of a pre-adoption process, a point-in-time adoption decision, and a subsequent use process. The dissertation consists of two studies investigating the early iPhone adoption decision process through a case study and iPhone assimilation in the use process through a field study.

The study of the early adoption decision incorporated a social influence perspective to determine whether a relationship exists between early adoption of iPhones and social network constructs and how social influences can aid in explaining the phenomenon. The study of iPhone assimilation incorporated a competing forces perspective to provide explanations of how competing forces influence mobile users' assimilation of app phones.

The two studies provide evidence that social constructs can help to explain the early adoption of app phones and that competing forces can provide insight into the tensions raised by technologies used for multiple purposes, such as app phones.

In the following the theoretical and practical contributions will be discussed in more detail.

9.2 THEORETICAL CONTRIBUTIONS

Academic research is most often evaluated by peers in the field based on its theoretical, methodological, and empirical quality as well as its novelty and relationship to existing work. It is therefore of interest to discuss to what extent this dissertation contributes to the conceptual understanding of mobile adoption and use, and to what extent this dissertation expands existing research that applies the social influence and a competing forces approach.

First, this dissertation expands the body of knowledge on mobile adoption and use by applying two new perspectives. The social influence approach explains how and why early adopters of a groundbreaking technology are influenced by their social network when they face uncertainties in the adoption decision. The approach complements the existing body of literature by describing early adopters and establishing which social influence constructs impact their decision-making. The competing forces approach identifies three sets of competing forces that influence the ways consumers choose to assimilate and use app phones and the learning processes associated with this. The

approach complements the existing body of literature by developing a comprehensive framework to explain these dynamics.

Second, an interpretive approach to investigating the research question was taken. As presented in Chapter 3: “Adoption and Use of Mobile Devices”, most researchers have taken a positivistic variance approach to adoption research. By taking an interpretive approach, this dissertation provides an in depth, qualitative contribution to the three key factors in mobile adoption and use decisions already identified by existing research, namely objectives, orientation, and behavior.

Specifically, section 3.3: “Adoption and Use of Mobile Devices” identified four areas of research that have been discussed in the field but need more attention: the artifact, user psychographics, usage objectives, and technology assimilation. The following is a description of how this dissertation contributes to the four areas. The contributions are also depicted in Table 19.

Table 19: Contribution to Existing Research within the field of Mobile Device Adoption and Use

<i>Area of Research</i>	<i>Research Opportunity</i>	<i>Contribution</i>
The Artifact	Studies need to take into account the characteristics and values of the mobile artifact and its implications for adoption and use.	The object of study is the iPhone, and perceived characteristics and values are taken into account in the case study and the field study on app phone adoption and use.
User Psychographics	Studies of social influences on mobile device adoption and use are limited. The studies that exist take a variance approach and establish correlations between social influences and adoption and use without considering the process itself.	The case study describes the relation between social influences and early adoption of iPhones. The field study is a cross-sectional study with multiple snapshots and a longitudinal component, which measures actual iPhone usage over a seven month time period. The use process is investigated for the purpose of explaining how mobile users assimilate their devices and which use processes they engage in during that time.
Usage Objectives	Hedonic usage objectives are increasingly taken into account alongside utilitarian objectives in order to explain the adoption and use of mobile devices. There is, however, little agreement on which of the two objectives has the greatest explanatory power.	The field study explicitly investigates the dual purpose of mobile devices and confirms that iPhone users' objectives are both utilitarian and hedonic and used for both work and personal purposes.
Technology Assimilation	Limited research has been conducted on assimilation of mobile devices, though the assimilation gap has been widely recognized in IT research. As new mobile devices offer increasingly prolific usage opportunities, their assimilation provides ample opportunities for research.	The field study investigates the assimilation of the iPhone, and how competing forces affect assimilation processes. This field study shows how mobile devices are assimilated over time.

Previous research on mobile device adoption and use has treated the artifact as a “black box” without considering the artifact itself as central to IS studies (Benbasat and Zmud, 2003; Orlikowski and Iacono, 2001). However, recently the artifact has gained more attention in mobile adoption and use research. Hong and Tam (2006) have explicitly tested an adoption model that takes into account the technology-specific perceptions of

devices, while others (Al-Natour and Benbazat, 2009; Bruner and Kumar, 2005; Cambell and Russo, 2003) have considered specific characteristics of devices in their adoption and use studies. While this dissertation avoids treating the mobile device as a black box, the purpose is not to investigate the artifact itself as the main driver of adoption, but rather to acknowledge that the app phone being adopted is not a mere commodity but a new type of mobile device that defies a straightforward classification in relation to existing technology categories. Neither just a mobile phone nor a portable computer, the app phone expands both technology categories and provides entirely new communication forms and computing capabilities. It denotes a paradigm shift that is apparent in the changed mobile ecosystem as described in section 2.3: 'The Mobile Ecosystem'. In particular, it is now the case that the mobile device manufacturer and mobile platform provider orchestrate the ecosystem as rather than the network provider, who had previously enjoyed vast control prior to the introduction of the app phones.

Research on user psychographics suggests that the categorization of adopters can provide additional insights into the rate of adoption and use of mobile devices (Bina and Giaglis, 2005; Constantiou et al., 2006; Constantiou et al., 2007). Researchers have investigated the impact of several psychographic factors, such as innovativeness (Bar et al., 2005; Lu et al., 2008; Yang, 2010), trust (Lin and Wang, 2005; Luarn and Lin, 2005), and value (Kim et al., 2005; Yang and Jolly, 2009). Social influences have also received attention (Dickinger et al., 2008; Lu et al., 2008; Nysveen et al., 2005), but the studies have largely been limited to variance approaches to establishing a correlation between social influence and mobile adoption without investigating the profound relationship between the factors. This dissertation contributes to the existing literature by conducting an investigation of the impact of social influences in early mobile adoption decisions and by providing a framework that emphasizes that attention should be given to factors at the individual and network levels of analysis.

Lately, usage objectives have received increased attention, as mobile devices are being used for both work and personal purposes, as well as for utilitarian and hedonic purposes

(Van der Heijden, 2004). While the utilitarian uses of mobile devices have dominated the research literature, along with utilitarian adoption models such as TAM, several studies have acknowledged that hedonic purposes could increase the explanatory power of utilitarian models, and thus several recent mobile studies have taken hedonic objectives in account (Lee et al., 2009; Nysveen et al., 2005; Wu and Du, 2010). These potentially contradictory usage objectives are considered in the field study, which employs the competing forces approach to explain mobile device usage. The framework developed provides a contribution to existing research by indicating that three competing forces shape usage processes.

Finally, it was stated in the literature review that few studies consider the assimilation of mobile devices though assimilation indicates long-term innovative effects and benefits (Bar et al., 2007; Fichman and Kemerer, 1997). This dissertation adds to the growing number of assimilation studies, showing how users assimilate their mobile devices over time and processes involved in this.

9.3 PRACTICAL CONTRIBUTIONS

In addition to theoretical contributions, this dissertation includes two practical contributions that are primarily a consequence of the theoretical framework developed based on the competing forces approach.

First, it has been established that app phones serve both utilitarian and hedonic purposes. Previously, mobile phones have been marketed as either “business phones”, such as the Blackberry, “music phones”, such as the Sony Ericsson W880i, or “camera phones”, such as the Nokia N8. App phones combine all these functions, and include the capabilities of several types of devices, such as the phone, camera, mp3 player, personal digital assistant (PDA), game console, and laptop. They provide access to work-related content as well as to personal content. Second, it has been established that the social context does in fact influence adoption and usage decisions. While the mobile device was previously a simple commodity with few possibilities, users today carefully select a device based on their

personal attributes, beliefs, and intentions – and the choices of people in their social context. Marketing departments should therefore consider the competing forces in future campaigns.

CHAPTER TEN: IMPLICATIONS AND FUTURE RESEARCH

10.1 LIMITATIONS

Although the present dissertation provides solid evidence of the usefulness of taking a social influence and competing forces approach to the adoption and use of app phones, certain limitations exist.

First, this dissertation is delimited by the consumer context in general and by app phone adoption and use in particular. While the results are likely applicable to other new consumer technologies, investigating app phone adoption within organizations will almost certainly differ because the adoption and use situations are not necessarily voluntary. Other mechanisms should therefore be taken into account, such as resistance toward compulsory adoption of technologies. Competing forces of mobile adoption may, however, still be relevant because the adoption and use of mobile technologies in organizations will probably be used for both utilitarian and hedonic purposes.

Second, this dissertation set out to investigate how consumer objectives, orientation, and behavior can aid in explaining the early app phone adoption and use. These three elements were chosen based on previous literature in the field that indicates they are key influences. It was thus assumed that objectives, orientation, and behavior could in fact provide additional insight into explaining app phone adoption and use. This assumption may have represented a researcher bias, as the purpose was to explain *how* these three elements could aid in explaining the phenomena, not just to either confirm or refute that a relation exists.

Third, the dissertation approached the research question with an interpretive approach. While most research on adoption and use of IT and mobile technologies has taken a variance approach, seeking to identify causal relationships and suffering from the limitations of a positivistic approach, the more seldom used interpretive approach also has limitations. Both the case study and the field study consisted of a relatively small sample size. Although purposive sampling was used for both studies to ensure rich data,

the case study sample size of five and the field study sample size of fifteen represent narrow studies. Both studies provided detailed insights into early adoption and assimilation of iPhones, but statistical generalizability has necessarily not been established. Further, the investigation of groups of adopters makes generalizability to other groups complicated, as these need to be identified, and participate in a study. However, the identification of such groups of early adopters and users of app phones could have established whether the results also enjoyed statistical significance.

10.2 FUTURE RESEARCH

The submission of a dissertation marks a symbolic end to a research project, but there are naturally several aspects and improvements one still wants to develop further before considering the work truly complete. To me, this dissertation signifies an interim stage of studying the adoption and use of mobile devices in which research results are opened to public inspection and learning can take place. Consolidating several years of work further allows me to look back and reflect on how to proceed with future research, and a number of suggestions come to mind.

First, the most immediate direction for future research is to conduct the research I did not have time for in this project. Revisiting Table 17 in section 7.5: “Adoption and Use of App Phones”, it is apparent that I applied the social influence approach to investigate the adoption of app phones, but did not apply the competing forces approach to the same phenomenon. Conversely, I applied the competing forces approach to study the assimilation of app phones, but did not apply the sole social influence perspective to investigate assimilation, though social influences are partly contained in the competing forces approach. This is depicted in Table 20. The application of a competing forces approach to early adoption of app phones might generate especially interesting insights into the tensions that mobile adopters face when making adoption decisions.

Table 20: Future Research of Two Approaches Applied to Mobile Adoption and Use

	<i>Social influences approach</i>	<i>Competing forces approach</i>
<i>Adoption</i>	Dissertation	Future research
<i>Use (Assimilation)</i>	Future research	Dissertation

Second, I would be interested to advance the Competing Forces Framework and its application. I wish to engage in two particular areas for future research. First, I wish to understand each of the three identified dimensions in the framework more deeply in relation to adoption, assimilation, and use of IT. While exploration and exploitation have been widely discussed in relation to organizational effectiveness and learning, more research on IT user exploration and exploitation efforts is needed. Furthermore, the tensions and dynamic interactions between individual and social orientation in IT adoption, assimilation, and use studies needs to be emphasized instead of working from a more static perspective. Finally, many IT products, such as mobile devices and laptops, are used for utilitarian and hedonic purposes, and studies should consider the tensions inherent in such dual-objective situations. Second, I wish to enhance naturalistic generalizability as proposed in section 6.5: “Field Study: Use of App Phones” by applying the framework to empirical investigation across different organizational contexts to verify the validity of the framework in these new contexts as well.

Third, I am intrigued by the idea of explaining how adoption in society at large, a macro level phenomenon, can be explained by investigating micro level phenomena, such as individual attributes, attitudes, and behaviors. A revision of the Multi-level Framework of Technology Adoption is, therefore, a key significant topic for future research.

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APPENDIX A: ARTICLE 1

Article 1: Tscherning, H. and Damsgaard, J. (2008). "Understanding the Diffusion and Adoption of Telecommunication Innovations: What We Know and What We Don't Know," In IFIP International Federation for Information Processing (287), *Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion*, eds. León, G., Bernardos, A., Casar, J., Kautz, K., and DeGross, J. (Boston: Springer), 2008, pp. 41-62.

UNDERSTANDING THE DIFFUSION AND ADOPTION OF TELECOMMUNICATION INNOVATIONS: WHAT WE KNOW AND WHAT WE DON'T KNOW

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Abstract

This paper provides a systematic account about what we know and what we don't know about the diffusion and adoption of telecommunication innovations. As our sample we obtained research papers from IFIP 8.6, ICIS and ECIS from the past ten years concerning telecommunication innovations diffusion and adoption to examine what aspects of the diffusion and adoption process are accentuated or overlooked using a general view of the process. As our theoretical vehicle we build a holistic framework that comprises the innovation, the unit of adoption and their interaction as captured by demand pull and supply push forces. The framework also takes into account the environment which embeds the diffusion and adoption. We find that there are certain shortcomings in the existing research within the field that needs to be addressed to provide a more comprehensive view of adoption and diffusion of telecommunication technologies.

Keywords: Telecommunication, Innovation, Diffusion, Adoption.

INTRODUCTION

The success of the mobile phone has been unprecedented; from being almost unknown 15 years ago most people in the developed world now own one or more mobile phones. It has been embraced as the fourth technology carried by man – so in addition to the watch, the wallet and the keys we now also carry the mobile phone. Many people see the mobile phone as an extension of the self and in a sense we have become Cyborgs³⁰.

The speed of which the mobile phone has spread has surprised most researchers. Today there are more than 3.3 billion mobile phone subscriptions in use in the world³¹ growing at an astonishing number of 200 million phones per quarter. It is not something that is limited to the Western world as the mobile phone spreads pandemic. By 2011 it is estimated that nearly everyone on earth will own a mobile phone.

Even though the mobile phone has claimed global victory not all telecommunication innovations are adopted with the same pursuit. That may not in itself be surprising but it has proven quite difficult to predict which innovations will succeed and which ones will fail. To illustrate, some telecommunication innovations such as SMS have previously exceeded expectations in terms of speed of adoption while others, like for example MMS have not met expectations at all. The same holds true for GSM which has been tremendously successful in many parts of the world whereas UMTS has been much less so even though it has gained momentum more recently.

Scholars of diffusion and adoption have also focused on telecommunication innovations and many different theories have been put to the test of explaining the phenomenon with varying results (Blechar et al. 2008). There seems to be no synthesis or dominant theory that captures all relevant aspects of the

³⁰ The definition of a Cyborg is a cybernetic organism, a hybrid of machine and organism (Haraway, 1991)

³¹ Reuters – 29 November 2007: <http://investing.reuters.co.uk/news/articleInvesting.aspx?type=media&storyID=n1.29172095>

telecommunication diffusion process adequately. Indeed, some may argue, there may not be one best theory that will fit all our needs for understanding different aspects of the diffusion process. We agree to that point of view and just observe that at the moment we do not have a systematic account of the experiences of using different theories. In a respond to this deficit this paper synthesizes what we know and by exclusion what we do not know about the diffusion and adoption of telecommunication innovations, as we believe that contributions to these three conferences the past ten years cover most important findings in this area. As an analytical tool we develop a framework based on an overall model of diffusion and adoption of innovation. All articles published in IFIP 8.6, ECIS and ICIS over the last ten years that portray the diffusion and adoption of telecommunication innovations are analysed using the framework to provide an overall picture of the accounts. We realise that not all papers on this topic has been published in these outlets but they provide a large and broad sample of available accounts. The aim is to condense knowledge that can help scholars better navigate between theories and their explanatory power vis-a-vis the research question they seek to remedy.

To achieve this objective this paper is composed as follows. It begins with an overview of the telecommunication innovations and especially the remarkable success of mobile phones is noted. The preceding section presents our research method, and the next section presents and adapts a generic analytical tool for investigating diffusion and adoption literature. The investigative tool is then applied to all relevant papers from IFIP 8.6, ECIS and ICIS from the past ten years and an analysis is conducted. Finally our results are condensed and final conclusions are drawn.

TELECOMMUNICATION INNOVATION

Since its discovery telecommunication has changed our lives in many ways both privately and professionally. From a diffusion and adoption point of view the first installations suffered from a lack of critical mass. If only few people had access to a telephone there where few people to call and hence the benefits of adopting a telephone were limited. However, as more people adopted the telephone the benefits of joining the adopters also increased. This phenomenon where one additional adopter increases the utility of the other adopters is labelled network externalities (Shapiro & Varian, 1999; Economides and Salop 1992) or network effects. Once the basic universal fixed line telecommunication infrastructure were in place many subsequent telecommunication innovations shared the accomplishments of this and have therefore not had to establish critical mass by themselves, i.e. subsequent telecommunications piggy-backed on the success of the fixed line network.

This is for example the case of the mobile phone that is always connected to the omnipresent fixed line telecommunication infrastructure. The mobile phone represents an interesting case in so that it is not only a device for voice communication but it has evolved into a data communication tool and also increasingly into a sophisticated computing device that can offer many different services. As an example many mobile phones bundle cameras, FM radio-receivers, Instant Messengers, music players and internet browsers. This means that the mobile device is not a fixed single purpose innovation but a multi-faceted and open-ended device. Its adoption is therefore not an atomic event but something that stretches over time and is quite learning intensive and the adopter will probably never use all the possibilities that the mobile device can offer.

From a diffusion and adoption perspective this complicates the matter. What is really the innovation being adopted? And also at what point in time should we denote the innovation as adopted? Finally it is worth noticing that the mobile phone has to compete with other devices or communication channels that the potential adopter already uses. So at any given time an adopter chooses between different available alternatives to satisfy her needs (Blechar et. al. 2006) so therefore any diffusion and adoption theory that seeks to understand and predict the faith of a telecommunication innovation has to consider not only the innovation at hand but also the alternatives and here it is imperative to consider established standards and habits as captured by switching costs and lock in effects (Shapiro & Varian, 1999).

Telecommunication innovations have always been subject to regulation (Petrazzeni, 1995; Melody, 1999). This holds true for the right to establish infrastructure and also the right to offer telecommunication services upon such infrastructure. Even though the period from the mid 1980s until now has been characterized as a period of de-regulation it is worth noticing that de-regulation has only been achieved through heavy use of regulation and legislation. For example to increase the competition in the mobile telephony market a number of licenses have been offered. The number and terms of the licenses is regulated by some telecommunication office. This means that a diffusion and adoption theory that seeks to offer broad and relevant explanations of the telecommunication innovation has to consider the context in which the process occurs.

RESEARCH METHOD

To recapture, the objective of this paper is to examine what aspects on the diffusion process are accentuated or overlooked in the diffusion and adoption process as reported in scholarly work and thereby condense knowledge that can help in the navigation between theories and their explanatory power. The overall research method applied is a literature study. In order to explore the aim of the paper, we use the following elements in a holistic framework to probe and analyze the articles: type of technology, adopting unit, interaction between the innovation and adopting unit expressed as supply-push or demand-pull mechanisms as well as the context in which the diffusion and adoption occurs. Furthermore, we also explore the underlying theory and cause and effect structure of each paper.

DATA COLLECTION

The search for articles was conducted at the AIS website to locate ECIS and ICIS papers from the past ten years, and the key words included: diffusion, adoption, innovation, telecommunication, mobile (service), UTAUT, technology acceptance, actor-network, network, institutional theory, critical mass, theory of reasoned action and theory of planned behaviour. The selection of these key words is based on the dominance they pose in diffusion and adoption research as well as the context in which this literature study is conducted. The search for IFIP 8.6 was conducted browsing through the last 10 years of proceedings identifying the same key words as for the ECIS and ICIS papers. Initially the combined search resulted in a total of 94 papers. However after scanning the papers and eliminating those that were not specifically related to either a telecommunication technology or information and communication technologies in general that *could* include a telecommunication technology we ended up with 36 papers. From the IFIP 8.6 6 papers (17%) were analysed, from ECIS, we analysed 23 papers (64%), from ICIS: 7 papers (19%). There was no IFIP 8.6 conferences in the years 1999 and 2000 hence those years are marked as "No Conf." in the table (for an exhaustive IFIP 8.6 literature study see Kautz et. al. 2005).

Conference	Nb. 3	No Conf.	No Conf.	Nb. 4	Nb. 5	Nb. 6	Nb.7	Nb.8	Nb.9	Nb.10
IFIP 8.6	0			0	1	1	1	0	1	2
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ECIS	0	0	0	0	4	2	4	7	3	3
ICIS	0	1	0	1	1	1	1	1	1	0

Table 1. Number of papers investigated from the IFIP 8.6, ECIS and ICIS conferences from 1998-2007.

DATA ANALYSIS

One of the authors read each paper carefully making notes of sentences that relate to the categories in our study framework. The analysis was an iterative process, and after this first categorisation, the paper was re-read if any category was still left empty in search for clues to determine the right categorisation.

Initially, the analysis was conducted searching for the main categories identified; type of innovation, adopting unit, interaction and context as well as a category for interesting observations. As the analysis progressed it was clear that some of the categories were too broad and that it was necessary to perform a further division in some categories. It was for example of interest in the category 'cause and effect structure' to determine how many papers investigated cause-effect or applied a process view and also whether the approach to the research was interpretive or positivistic.

Furthermore, it became clear as the analysis of an 'interesting observations' category was analysed that more categories were of interest for this analysis. An example is the 'theory' categorisation that seemed obvious as the papers analyzed are all papers of diffusion and adoption, however, the papers utilised both traditional diffusion and adoption theories as well as other theories.

MODEL OF DIFFUSION AND ADOPTION

Technology diffusion and adoption has been a key area of research in the IS discipline since the influential work of (Tornatzky & Klein 1982; Davis 1989), and research has increased massively ever since.

Research has dealt with specific technologies such as the diffusion and adoption of e.g. EDI (Damsgaard & Lyytinen 1996; Lyytinen & Damsgaard 2001), internet services (Pedersen & Ling 2003) and adoption of telecommunication services (Mahler & Rogers 1999). Researchers have also investigated such different perspectives as the level of adoption (Yoo et al. 2002), gender differences in individual technology adoption (Venkatesh et al. 2000), grouping of users into distinct profiles (Constantiou et al. 2007) and adoption of technologies in different geographical regions; e.g. mobile services in German banks (Mahler & Rogers 1999), and South Korean broadband services (Yoo et al. 2002). Most papers apply one or more theoretical instruments developed for analysing and predicting diffusion and adoption as it is recognized that technological advances and service availability do not automatically lead to widespread adoption and use (Constantiou et al. 2007). Based on previous research, a generic framework for investigation of technology diffusion and adoption is assembled. The framework is based on previous research and experience of one of the authors.

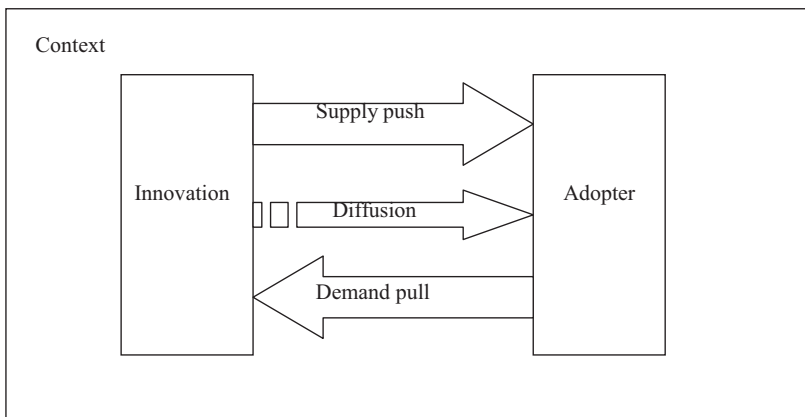


Figure 1. Holistic framework for investigating technology diffusion and adoption – static view.

Figure 1 shows a simple holistic framework for investigating technology diffusion and adoption of a snapshot in time. An innovation is diffused and adopted by one individual or a group of adopters as a consequence of a push from the producer or a pull from the adopters. This mechanism happens within a certain context; however the framework shows a static view of this process and the changes that occur over a certain time period is not captured.

Often when an innovation is diffused and adopted by an adopting unit, the use of the innovation is further expanded. As the adopting unit identifies additional ways of using the innovation, or recognises further needs in relation to the innovation, a demand pull mechanism takes place, and a transformation of the innovation transpires. This is depicted in figure 2 that shows the process view of the holistic framework, where the innovation and the adopting unit is considered at times T_0 and T_1 to explore these changes.

It is therefore of great interest to capture the distribution of articles that take a static view and a process view on the diffusion and adoption of telecommunication innovations.

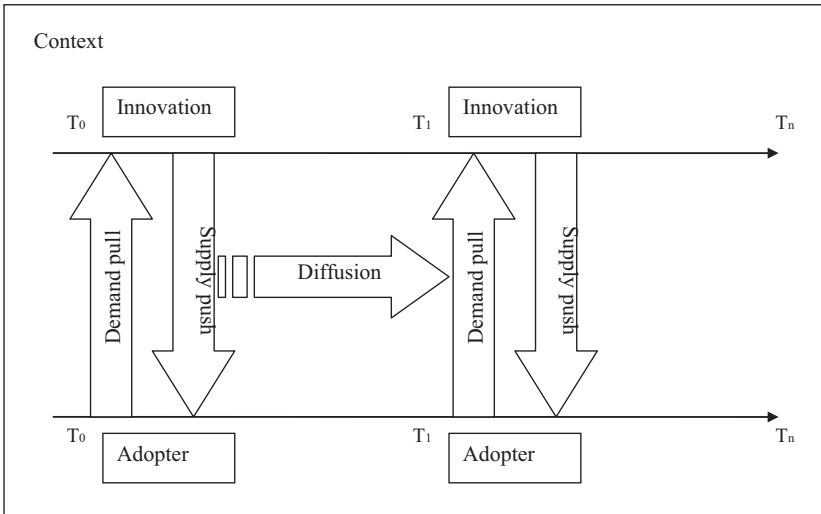


Figure 2. Holistic framework for investigating technology diffusion and adoption – process view.

Figure 1 and figure 2 provides an illustration of the diffusion process of innovations. They assist in understanding the elements and mechanisms of such a process. The elements of the framework are briefly introduced next.

FRAMEWORK FOR ANALYZING DIFFUSION AND ADOPTION TELECOMMUNICATION LITERATURE

TYPE OF INNOVATION

Telecommunication technologies have developed extensively the past decades and the massive increase of internet users has led to dramatic shifts in the way of conducting business.

The type of innovation investigated in this paper can be labelled a telecommunication innovation as the telecommunication industry is in focus. As part of the type of innovation, there are certain traits of the innovation that are interesting to investigate as they affect the diffusion and adoption process. Some technologies are integrated in the work environment and are therefore compulsory whereas other technologies are adopted voluntarily. According to (Moore & Benbasat 1991) this issue of compulsory versus voluntary adoption of a technology is of great significance. They define the voluntariness of use as 'the degree to which use of the innovation is perceived as being voluntary or of free will'. One can assume that when a technology is compulsory the adoption rate is either higher as a consequence of the innovation being forced upon the adopting unit or the opposite; the adoption rate is lower as a consequence of the adopting unit's resistance of adopting a compulsory technology. Therefore, consideration must be given to whether individuals are free to implement personal adoption or rejection decisions when examining the diffusion and adoption.

As stated above some technologies – especially networked technologies – enjoy network externalities. It is therefore moreover interesting to investigate whether the innovation only has an inherent value for the individual user (private utility) or it only has value if most people in a community of practice use it (collective utility).

ADOPTING UNIT

Researchers have for many years acknowledged that technologies affect organisations at different levels in different ways, and sought to understand associated behavioural phenomena (Banker & Kauffman 2004). We have adopted the classification of Lyytinen & Yoo (2002) who analysed the changes in demand in services and infrastructures at the individual, team, organisational and inter-organisational³² levels. Besides these four levels, when we found a paper studying the regional level so we included that in our categorisation.

The primary focus of IS research has been done with the individual (Venkatesh et al. 2000, Carlsson et al., 2006) and the organisation (e.g. Venkatesh & Davis, 2007; Mahler & Rogers, 1999) as the focal points, and only little research has centred at the group level. In addition group level analysis of diffusion and adoption of technologies have in general considered diffusion at an aggregate level of analysis of individuals instead of acknowledging that adoption of technologies at this level maintain synergy effects and therefore have different adoption curves.

In our analysis we distinguish between the following levels of analysis: individual, group/team, organisational, inter-organisational and regional levels.

INTERACTION BETWEEN INNOVATION AND ADOPTING UNIT

Technology diffusion can furthermore be understood by using two additional means of explanations: supply-push and demand-pull theories (Zmud 1984; Damsgaard & Lyytinen 1996) which display the interaction between technologies and the adopting unit.

Supply-push theories assume that the functionality of a technology enables the diffusion of it. The innovation is being determined before it is pushed to the users and the push forces enclose the adoption decision as a rational choice problem between a former and a new technology. The main source of information to make this decision is different communication channels (Rogers 1995), notably mass media and peer networks, however Lyytinen & Damsgaard reported that networked technologies can also be pushed “by powerful actors (gatekeepers) such as hubs, industry associations or government” (Lyytinen & Damsgaard 2001). Moreover, through sustained innovations within technologies, supply-side organizations try to make technologies more attractive for potential clients by encouraging users to acquire technologies as a technological problem-solver.

Demand-pull theories are conversely determined by the users’ rational choice (Rogers 1995; Lyytinen & Damsgaard 2001). The demand-pull theories would explain the technology diffusion by a growing demand for technological solutions created by potential clients and their needs. Users’ perceived usefulness and image is improved by applying scientific or technical knowledge. This creates the demand for innovations and triggers their adoption. This could for example be realised in the form of new technologies. The pull perspective predicts that innovators will choose to work on topics which are perceived as problems on the demand side (Thirtle & Ruttan 1987) and accordingly increase the probability of a technology being adopted and diffused by improving its fit to the personal or business needs of the adopting unit.

³² The inter-organizational level is defined as adoption across the supply chain.

Though the diffusion of a technology cannot be explained either by the supply-push or the demand-pull forces alone, it is of interest to identify the force that drives the interaction between the technology and the adopting unit when studying diffusion and adoption.

CONTEXT OF RESEARCH

In addition to the supply push and demand pull it is also necessary to consider the context in which the diffusion and adoption of a technology takes place. The analysis of the context is mainly a macro analysis in which the diffusion and adoption of an innovation takes place and consists of entities such as national governments, international agencies, consumers, products and services and other entities that might have an affect or the power to change the industries within the IS field (Damsgaard & Lyytinen, 2001; King et. al. 1994). Our analysis provides examples of the use of context in research but will not present data in tabular form as the context is characteristic for every single study.

THEORY

The underlying theory of diffusion and adoption of an innovation revolves around different diffusion theories. The perception of diffusion and adoption was initially based on five classic characteristics of innovation derived by Rogers from Diffusion of Innovations (DOI) literature (Rogers 1995). The exploration of diffusion and adoption of technologies in the IS field furthermore include other theories such as the Technology Acceptance Model (TAM) (Davis 1989), the Theory of Reasoned Action (TRA) (Ajzen & Fishbein 1980), Theory of Planned Behaviour (Ajzen et al. 1985) as well as extensions to the above and the Unified Theory of Acceptance and Use of Technology UTAUT) (Venkatesh et al. 2000). These theories have been widely used within the IS field, however they are reported to show significant shortcomings in their ability to capture the diffusion and adoption of telecommunication services (Blechar et al. 2006).

Diffusion of innovations theory has had considerable impact on IS and has therefore been a widely used instrument to explain and predict rates of IT innovation diffusion (Moore & Benbasat 1991; Rogers 1995). It derives from rational theories of organisational existence and has its roots in economics, sociology and communication theory and has attempted to explain mainly individual adoption decisions (Lyytinen & Damsgaard 2001).

TAM is one of the most widely accepted theories to explain and predict IS acceptance and facilitate design changes before users have experience with a system (Venkatesh et al. 2000; Venkatesh et al. 2003). TAM predicts user acceptance based on two specific behavioural beliefs: perceived ease of use (PEU) and perceived usefulness (PU), which determine an individual's behaviour intention (BI) to use IT and subsequently actual use (Davis 1989). Several researchers have extended its use to different settings and succeeded in demonstrating reliability and validity of the instrument (Adams et al. 1992).

The Theory of Reasoned Action (Ajzen & Fishbein 1974; 1980) is a model for the prediction of behavioural intentions and/or behaviour. The theory has been useful for identifying where and how to target strategies for changing behaviour. Later Ajzen (1985) extended the boundary condition of pure volitional control in the model to incorporate perceived behavioural control as an antecedent to behavioural intentions in the Theory of Planned Behaviour by extending the Theory of Reasoned Action (Ajzen et al. 1985).

UTAUT is an attempt by (Venkatesh et al. 2003) at unifying eight renowned models of technology acceptance, diffusion and adoption: TRA, TAM, Motivational Model, TPB, Combined TAM-TPB, Model of PC Utilization, Diffusion of Innovations theory and Social Cognitive Theory. The model is validated with six longitudinal field studies in usage intention and UTAUT is regarded as a superior model than the above models individually. However, only few studies apply this theory (Anderson & Schwager 2004).

The above theories within the field of diffusion and adoption of technologies are considered during the analysis; however some papers include other theories in their analysis or do not include theories at all. This is taken into account in the analysis where we examine the theories employed.

CAUSE AND EFFECT STRUCTURE

Causality or causation captures the directional relationship between a cause and an effect. The effect is the outcome (result) of the cause³³. Often in diffusion and adoption models there is an aim to identify a set of predictor variables with a certain desirable outcome (adoption). There is often a distinction between necessary and sufficient causes of adoption. For example TAMs constructs of *perceived ease of use* and *perceived usefulness* are both necessary and sufficient conditions for the intention to adopt. This type of theory that explains why adoption occurs is labelled variance theory (Markus & Robey 1988). Process theory on the other hand identifies a number of necessary conditions that through a process explains *how* the diffusion occurs.

ANALYSIS AND DISCUSSION

The initial data material consisted of 94 conference contributions, however after an initial evaluation the material was reduced to 36 conference contributions pertaining to diffusion and adoption of a telecommunication technology.

The analysis is conducted by analysing the conference contributions according to the six elements described above. The analysis is structured in the following way: each element is discussed in relation to the framework described above. For an overview the discussion paragraph also contains a table showing the number of contributions within each element. The papers are referenced through a unique ID (from 1 to 36) associated with each contribution. The appendix shows a table linking each ID with a paper contribution and the elements of the framework. The analysis draws upon findings that show both findings that are representative to the articles and findings that are peculiar. The results are represented in percentages and are discussed though the sample is relatively small as percentages act as a visualisation of the results.

TYPE OF INNOVATION

All papers investigated studied a specific telecommunication technology or the more general concept of ICT. The ICT papers selected for this literature study all analysed ICT that could irrefutably include a telecommunication technology. 94% of the papers deal directly with telecommunication technologies and innovations and only 6% of the papers concern ICT. Although several researchers have formerly classified types of technologies, no classification has been provided within ICT or telecommunication technologies. It is however apparent that the majority of the papers (72%) analyse the diffusion and adoption of mobile devices and services such as mobile TV services (Lin & Chiasson, 2007), mobile devices and services (Constantiou et al. 2005) and video streaming (Stanoevska-Slabeva & Hoegg, 2005) whereas only 22% analyse the diffusion and adoption of broadband technologies (e.g. Choudrie & Dwivedi 2005, Damsgaard & Gao 2004). A few papers include a study of both; e.g. a solution containing a combination of GPRS phone, PC and WLAN (Breu et al. 2005) and broadband and mobile services (Middleton 2002).

Looking at the division of papers investigating the diffusion and adoption of compulsory and voluntary use of technologies, it is worth noticing that the papers contain an overweight of voluntary use (81% of

³³ From Wikipedia, the free encyclopedia.

the papers) of technologies. This is expected as these technologies are widely used in personal settings where users adopt a technology voluntarily. There is a clear correlation between voluntary use of a technology and the level of adoption analysed i.e. 67% of the papers investigating technologies adopted voluntarily where adopted at the individual level. However, at the organisational, group and regional levels 19%³⁴ of the papers were related to compulsory and 14%³⁵ were related to voluntary diffusion and adoption of technologies.

There is a slight overweight of papers investigating compulsory use of technologies in organisations. Muzzi & Kautz (2003) investigated adoption of ICT through two studies and found that firms that involve high investments and a clear projection, such as ERP, videoconferences, EDI and groupware have not been widely adopted. Most of these are technologies enforced upon employees in an organisation and further research could therefore benefit from the investigation of compulsory use of ICT to explain this lack of adoption. As noted before, the adoption rate of a compulsory can be higher or lower as a consequence the adopting unit's resistance to adopting the enforced technology.

17% of the papers analysed are directly concerned with technologies that enjoy network externalities and 83% are not. However, it cannot be deduced that the technologies do not benefit from these; it is just not apparent in the papers.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
Compulsory	2	4, 5	3	10, 22, 23	2	32, 36
Voluntary	4	1, 2, 3, 6	20	7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29	5	30, 31, 33, 34, 35
With network effects	2	2,4,	1	11	3	30, 34, 36
Without network effects	4	1, 3, 5, 6	22	7,8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29	4	31, 32, 33, 35

Table 2. Papers distributed on the compulsory and voluntary use of technologies

ADOPTING UNIT

Approximately 69% of the research conducted the past ten years represents the individual level. This is not surprising as mobile services and technologies are often targeted to individuals and their needs. The units of adoption investigated are distributed in the papers as follows: individuals: 25 (69%); groups/teams 1 (3%), organisations 9 (25%), inter-organization 0 (0%) and regions 1 (3%). It is interesting to notice that research at the inter-organisational level is not represented at all.

The distribution of papers from the three investigated conferences is representative for research of the different adopting units within the IS field as such.

Diffusion and adoption of technologies in social networks have been discussed lately; however, only one paper out of 36 discusses adoption at the group level of analysis (Harrington & Ruppel, 1999). They discuss practical and value compatibility and its relationship to telecommuting's adoption, diffusion and

³⁴ Compulsory use: organisational level: 14%, group level: 2,5% and regional level: 2,5%

³⁵ Organisational level: 14%

success among IS personnel. The study is therefore conducted in an organisational setting but the authors study group values, and therefore the paper has been classified as research at the group level. It should be mentioned that Sarker (2006) examined the levels of analysis issue in understanding technology adoption by groups. Sarker points out that groups should be investigated and “treated in their own right,” and not as an aggregation of the individuals (Sarker, 2006, pp.1276) we concur with this point of view.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
Individual	3	1, 2, 6	17	7, 8, 9, 11, 12, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29	5	30, 31, 33, 34, 35
Group / team	0	-	0	-	1	36
Organizational	2	3, 4	6	10, 13, 14, 22, 23, 24	1	32
Inter-organizational	0	-	0	-	0	-
Regional	1	5	0	-	0	-

Table 3. Papers distributed on adopting unit of technologies

It can be argued that in the future researchers should conduct studies at the group level and within organisations. When investigating organisations, researchers should bear in mind that the internal structure of many organisations consists of working groups and teams with their own and not just a large number of individuals.

CONTEXT OF RESEARCH

The context in which the research in the investigated studies takes place is of great importance to research question posed. Most of the papers performing empirical data collection describe the context in which the study is performed with a fair amount of detail. When conducting research in the telecommunication industry it is necessary to capture local regulations and policies for the markets investigated as these may have considerable impact in explaining the adoption and diffusion of a telecommunication innovation. Constantiou & Papazafeiropoulou (2006) explains the Danish market in detail, when they investigate the providers perspective in IP-telephony diffusion. Oh & Lee (2005) explain how alliances between mobile carriers, banks, and other related parties are formed, and analyse how technology affects competition and collaboration among them when a new convergence service is created by two, previously unrelated industries banks and mobile carriers as mobile carriers had a hidden agenda to enter the financial market. These information provide a deeper understanding of the market and thereby the adoption and diffusion

THEORY

It is common for researchers to use an analytical framework in the analysis of diffusion and adoption studies. Rogers' (1995) Diffusion of Innovations is one of the often applied theories in numerous fields of study; still researchers have come to understand that other frameworks and theories might explain the diffusion and adoption of telecommunication technologies even better. There are still some gaps in the application of certain theoretical frameworks, and it is apparent from the table below that both the TRA and TPB or even more interesting the UTAUT are totally absent in the research conducted in this field of research the past ten years in contributions submitted to the three investigated conferences.

TAM is still the most applied theory in the field even though the application of the theory in this study seems moderate. 19% of the papers analyse technology acceptance using this theory. TAM has been

widely criticised for not being falsifiable, questionable heuristic value, and limited explanatory and predictive power (e.g. Szajna, 1994). This could be the reason for the relatively diminished application. Researchers have attempted to explain (the lack of) diffusion and adoption of technologies using a variety of other theories relevant to the context they are investigating; for example, Walden et al. (2007) apply the Braudel rule as a theoretical framework to find out why and how mobile services can make sense as a basis for viable business. They paraphrased the Braudel rule by stating that “mobile services become mobile value services when they offer the possibility to expand the limits of the possible in the structure of everyday routines”. They found that the mobile services investigated did not satisfy the Braudel rule.

Haghirian & Madlberger (2005) use advertising theory to analyse the consumer attitude toward advertising via mobile devices in Austria, and Cheng & Arthur (2002) propose using the Trans-theoretical Model of Behaviour Change to explain the construction of a mobile internet healthcare solution for problem drinkers. Several papers choose not to apply a theoretical framework to their studies but instead conduct empirical data collection and analyse the results statistically (e.g. Abu-Samaha & Mansi, 2007).

Dahlberg & Mallat (2002) use consumer perceived value (Grönroos, 1997), technology acceptance model (Davis et. al., 1989), and network externalities theory (Shapiro & Varian, 1999) to explain managerial implications of consumer value perceptions in relation to mobile payment service development. The usage of the three theories is an attempt to impede the shortcomings of each theory individually. This implies a need for testing and evaluating more theories within the field of diffusion and adoption of telecommunication innovations to explain the observable facts.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
DOI	2	1, 3	1	20	1	36
TAM / TRA	0	-	7	10, 13, 15, 19, 23, 25, 27	0	-
TPB	0	-	0	-	0	-
UTAUT	0	-	0	-	0	-
Other	3	4, 6, 7	10	7, 9, 12, 17, 18, 21, 22, 24, 26, 29	5	30, 31, 32, 33, 34, 35
None	2	2, 5	5	8, 11, 14, 16, 28	0	-

Table 4. Papers employing the most applied theories of diffusion and adoption

CAUSE AND EFFECT STRUCTURE

Of the papers investigated 83% depict the relationship between a cause and an effect and only 17% of the papers take a process view and seek to explain *how* diffusion and adoption occurs over time. Most research within telecommunication theory takes a static view when investigating diffusion and adoption of technologies and thereby does not take into account that when an innovation is adopted and diffused by an adopting unit, the use of the innovation is further expanded and a transformation of the technology takes place. Wareham et al. (2002) is an example of a paper that tries to accommodate this shortcoming in research as they gather data in two stages to investigate the implications for the digital divide in wireless diffusion and mobile computing. The first sample of survey data is obtained in 1994 and contains information from 8,700 households, and the second sample is gathered in 1998 and contains over 16,000

households. Their results should be used to predict how mobile telecom diffusion may affect the digital divide as internet access is incorporated by smartphones and wireless.

Studies taking a process view provide a dynamic and thereby more realistic view on the diffusion process, and therefore more studies should be conducted to offer further insight.

A slight majority of the studies within the field take a positivistic approach – 56% - but the distribution of interpretive versus positivistic papers are fairly even.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
Cause-effect	5	1, 2, 3, 4, 6	19	7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 27, 28	6	31, 32, 33, 34, 35, 36
Process	1	5	4	9, 18, 22, 29	1	30
Interpretive approach	5	1, 3, 4, 5, 6	9	10, 11, 13, 20, 21, 22, 24, 27, 28	4	30, 31, 32, 34
Positivistic approach	1	2	14	7, 8, 9, 12, 14, 15, 16, 17, 18, 19, 23, 25, 26, 29	3	33, 35, 36

Table 5. Papers depicting cause-effect or process view and research approach

CONCLUSION

This paper has provided a framework for analysing what we know and what we don't know about the diffusion and adoption of telecommunication innovations and provided insight into what aspects of the diffusion and adoption process are accentuated or overlooked using a general view of the process. Three conferences have been chosen in this analysis, as the coverage at these conferences spans IS research to a wide extent. Many important contributions have been accepted in a variety of journals and we do not claim that this literature study is comprehensive; however we believe that the elements within the diffusion and adoption framework are covered at these conferences.

Through our holistic framework, we found that most research has been conducted on the voluntary use of technologies targeting the individual. There is nearly a total absence of papers investigating the group and the inter-organisational level of adoption. As social networks have gained attention the past ten years, this is surprising and it is therefore recommended that further research into this level of adoption is performed.

Many different theories and frameworks are used to explain the adoption and diffusion of innovations, and TAM is used frequently. It seems that researchers apply theories not only linked to adoption and diffusion to investigate further explanations to the research problem in question but also theories from other fields of study and this trend is encouraging as there are no dominant theory that captures all relevant aspects of the telecommunication diffusion process adequately. Theories that look into the network externalities that the telecommunication technologies benefit from are especially interesting when seeking explanations for the diffusion and adoption.

Most studies take a cause-effect view in a snapshot in time and not a process view that could provide a dynamic and thereby more realistic view on the diffusion process and therefore more studies should be conducted to offer further insight. The distribution of interpretive versus positivistic approaches to the studies is equal and this trend should continue.

Finally, it is worth mentioning the emerging field of neuroeconomics that might complement diffusion and adoption research within information systems. Neuroeconomics seeks to develop our understanding of human behaviour and in particular the role of emotions and emotional response (Damasio 1994; Hansen and Christensen 2007; Seo and Baret 2007). As TAM has recently been criticized for redirecting researchers' attention away from the antecedents of beliefs, not taking the IT artifact or its design into account, neglecting important outcomes of information technology (Benbasat and Barki 2007), as well as reaching maturity (Venkatesh et al. 2007), Dimoka et al. (2007) have proposed the application of neuroscience theories, methods and tools to the field and labelled it Neuro-IS. The field might benefit from the exploration and exploitation of cognitive neuroscience to improve and advance information systems.

This paper contributes with an overview of the existing research within diffusion and adoption of telecommunications research and provides a suggestion for areas in which further research is needed: research is needed at the group level, continual research applying different theoretical views than the widely used DOI and technology acceptance theories (e.g. theories from the field of neuroeconomics) may capture new aspects of the telecommunication diffusion process and finally research taking a process view.

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APPENDIX

This table provides an overview of the papers analysed from the IFIP 8.6, ECIS and ICIS conference from 1998 – 2007. The table shows all elements of the framework for each conference contribution. For further information on the papers, see the References.

ID	Author	Title	Conference	Year	Compulsory /Voluntary	With/without Network effects	Adopting unit	Interaction	Theory	Cause effect/ Process	Methodology
1	Lin Chiasson &	A dynamic approach to context diffusion research: An actor-network theory study of mobile TV service	IFIP 8.6	2007	V	w/o	I	Pull	DOI, other	C-E	I
2	Abu-Samaha & Mansi	Information technology diffusion in the Jordanian telecom industry	IFIP 8.6	2007	V	w	I	Pull	None	C-E	P
3	Wainwright & Waring	The politics of ICT diffusion: A case study in a UK primary health care trust	IFIP 8.6	1998	V	w/o	O	Pull	DOI	C-E	I
4	Ney, Schätz, Höck, Salzmann &	Introducing mobility: The mPolice project	IFIP 8.6	2004	C	w	O	Pull	Other	C-E	I
5	Muzzi & Kautz	Information and communication technologies diffusion in Industrial districts	IFIP 8.6	2003	C	w/o	R	Push	None	Process	I
6	Hampe & Schwabe	Enhancing mobile commerce: Instant music purchasing over the air	IFIP 8.6	2002	V	w/o	I	Pull	Other	C-E	I
7	Coursaris & Hassanein & Head & Bontis	The impact of distractions on the usability and the adoption of mobile devices for wireless data services	ECIS	2007	V	w/o	I	Pull	Other	C-E	P
8	Knebel & Leimeister & Kremer	Personal mobile sports companion - Design and evaluation of IT-supported product-service bundles in the sports industry	ECIS	2007	V	w/o	I	Pull	None	C-E	P
9	Walden &	The sleeping giant - a	ECIS	2007	V	w/o	I	Pull	Other	Process	P

10	Han Carlsson & Majlander	longitudinal study surveying the mobile service market in Finland	ECIS	2006	C	w/o			O		Pull	TAM	C-E	I
11	Banderker & VanBell	Mobile technology adoption by doctors in public healthcare in South Africa	ECIS	2006	V	w			I		Pull	None	C-E	I
12	Constantiou & Papazafteopoulou	The providers perspective in IP-telephony diffusion - Insight from the Danish market	ECIS	2006	V	w/o			I		Push	Other	C-E	P
13	Dwivedi & Choudrie & Weerakkody	Broadband adoption in the UK household - Towards reliability and construct validity of a survey instrument	ECIS	2005	V	w/o			O		Pull	TAM	C-E	I
14	Breu & Hemingway & Ashurst	The impact of mobile and wireless technology on knowledge workers - an exploratory study	ECIS	2005	V	w/o			O		Pull	None	C-E	P
15	Carlsson & Carlsson & Walden	Mobile services for the hospitality industry	ECIS	2005	V	w/o			I		Push	TAM, DOI	C-E	P
16	Choudrie & Dwivedi & Damsgaard & Knutsen	Investigating broadband diffusion in the household Beware of Dane-geld - Even if paid-in-service adoption can be slow	ECIS	2005	V	w/o			I		Push	None	C-E	P
17	Haghriani & Madlberger	Consumer attitude toward advertising via mobile devices - an empirical investigation among Austrian users	ECIS	2005	V	w/o			I		Push	Other	C-E	P
18	Stanoevska-Slabeva & Hoegg	Towards guidelines for design of mobile services	ECIS	2005	V	w/o			I		Pull	Other	Process	P
19	Van der Heijden & Ogerschmig & Van der Gaast	Effects of context relevance and perceived risk on user acceptance of mobile information services	ECIS	2005	V	w/o			I		Pull	TAM	C-E	P
20	Damsgaard	Mobile telecommunications	ECIS	2004	V	w/o			I		Pull	DOI,	C-E	I

	& Gao	market innovation - the transformation from 2G to 3G																					
21	McManus & Standing	The value of life histories in researching the adoption and use of m-services	ECIS	2004	V		w/o		I		Pull			Other	C-E								I
22	Scheepers & McKay	An empirical assessment of business value derived from implementing mobile technology - a case study of two organisations	ECIS	2004	C		w/o		O		Pull			Other	Process								I
23	Sell & Patokorpi & Walden & Ancker	Adoption of mobile communication technology - an empirical study on females working in elderly care	ECIS	2004	C		w/o		O		Pull			TAM	C-E								P
24	Choudrie & Papazafeiropoulou	Applying stakeholder theory to analyse the diffusion of broadband in South Korea	ECIS	2003	V		w/o		O		Pull			Other	C-E								I
25	Van der Heijden	Measuring attitudes towards Mobile Information Services - An empirical validation of the HED-UT scale	ECIS	2002	V		w/o		I		Pull			TAM	C-E								P
26	Cheng & Arthur	Constructing a virtual behaviour change support system - A mobile internet healthcare solution for problem drinkers	ECIS	2002	V		w/o		I		Pull			Other	C-E								P
27	Dahlberg & Maillat	Mobile payment service development - managerial implications of consumer value perceptions	ECIS	2002	V		w/o		I		Pull			TAM, other	C-E								I
28	Leimeister & Daum & Kremer	Mobile virtual healthcare communities - an approach to community engineering for cancer patients	ECIS	2002	V		w/o		I		Pull			None	C-E								I
29	Wareham & Levy & Cousins	Wireless diffusion and mobile computing - Implications for the digital divide	ECIS	2002	V		w/o		I		Pull			Other	Process								P
30	Wang & Yan	The role of SMS in mobile data service-Diffusion in China- Longitudinal case study based on ANT	ICIS	2006	V		w		I		Push			Other	Process								I

31	Oh & Lee	How technology shapes the Actor-Network of convergence services-Case of mobile banking	ICIS	2005	V		w/o		I	Push	Other	C-E	I
32	Scheepers & Scheepers	The implementation of mobile technology in organizations-expanding individual use contexts	ICIS	2004	C		w/o		O	Push	Other	C-E	I
33	Goh & Lee & Lee	IT product bundling in presence of complementarities, quality-uncertainty and network effects-an agent-based approach	ICIS	2003	V		w/o		I	Push	Other	C-E	P
34	Middleton	Exploring consumer demand for networked services-the importance of content, connectivity and killer apps in the diffusion of broadband and mobile services	ICIS	2002	V		w		I	Pull	Other	C-E	I
35	Dutta & Roy	The mechanics of Internet diffusion in India: Lessons for developing countries	ICIS	2001	V		w/o		I	Push	Other	C-E	P
36	Harrington & Ruppel	Practical and value compatibility - their roles in the adoption, diffusion and success of telecommuting	ICIS	1999	C		w		G	Push	DOI	C-E	P

APPENDIX B: ARTICLE 2

Article 2: Tscherning, H. and Mathiassen, L. (2010). "The Role of Social Networks in Early Adoption of Mobile Devices," In IFIP International Federation for Information Processing (288), *Human Benefits Through the Diffusion of Information Systems Design Science Research*, eds. Pries-Heje, J., Venable, J., Bunker, D., Russo, N., and DeGross, J. (Boston: Springer), 2010.



**Early Adoption of Mobile Devices—A Social Network
Perspective**

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Abstract:

As mobile devices have become the personal information-processing interface of choice, many individuals seem to swiftly follow fashion. Yet, the literature is silent on how early adopters of mobile devices overcame uncertainties related to shifts in technology. Based on purposive sampling, this paper presents detailed insights into why and how five closely related individuals made the decision to adopt the iPhone before it was available through traditional supply chains. Focusing on the role played by social networks, we analyze how adoption threshold, opinion leaders, social contagion, and social learning shaped adoption behaviors and outcomes. The analyses confirm that network structures impacted the early decision to accept the iPhone; they show that, when facing uncertainty, adoption decisions emerged as a combined result of individual adoption reflections and major influences from the social network as well as behaviors observed within the network; and, they reveal interesting behaviors that differed from expectations. In conclusion, we discuss implications for both theory and practice.

Keywords: adoption, social networks, adopter characteristics, qualitative research

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Early Adoption of Mobile Devices—A Social Network Perspective

INTRODUCTION

Advanced mobile devices, such as smart phones and personal digital assistants, have become ubiquitously available and have changed the ways people organize relationships (Haddon 1997). Mobile users carry their device everywhere, they use it around the clock, and it has become their personal information-processing interface of choice. The symbolic value of these devices has increased, and many mobile users, therefore, swiftly follow fashion and change brand, as new devices and features become available. As a recent example, when Apple introduced the iPhone to the U.S. market in July 2007, 270,000 devices were sold in the first thirty hours of the launch weekend¹ and eight million in total in the U.S. during 2007 (Brightman 2008). The original iPhone was subsequently made available in five other countries: the UK, Germany, and France (November 2007), as well as Ireland and Austria (March 2008). However, early use of the iPhone was not limited to these countries. Countless users around the world acquired iPhones from the six official markets, and started to use them in their home countries. To do so, they needed to unlock the phone from the SIM-card and adapt it to network providers other than Apple's exclusive partners, i.e., AT&T in the U.S. During this period, one million iPhones, equivalent to 27 percent of the 2007 U.S. sales, were adapted to other networks.

While shifts in technology occur regularly, change of technology brand bears several switching costs for adopters, including initial fixed costs, uncertainty about quality of device, and time spent on learning how to use the new technology (Hall and Kahn 2003). For early adopters, these costs are even higher as they have no references to imitate or expert users to consult. Nevertheless, the literature is silent on why and how individuals overcome these uncertainties as they decide to adopt a new voluntary technology such as a mobile device. Early adopters have imperfect information about the benefits of a new technology, and, therefore, their behavior largely depends on acquired human capital, relevant information (Wozniak 1987) and in some cases also on access to unique technical skills (Hall and Kahn 2003).

Against this backdrop, this study investigates why and how five closely related individuals made the decision to adopt the iPhone before it was made available through conventional supply chains. Contextual factors, such as one's social environment, generally have significant impact on technology adoption and usage behaviors (Lewis et al. 2003; Magni et al. 2008). The role of social networks has also been used more broadly to understand social behavior (Van den Bulte and Lilien, 2001; Vidgen et al., 2004) and information systems practices (Cambell and Russo 2003). Following these insights, our assumption is that a social network perspective will help us understand the context in which the five individuals managed to adopt the iPhone despite the many uncertainties they faced.

Purposive sampling (Teddle and Yu 2007; Maxwell, 1997) allowed us to investigate social influences on how individuals adopt mobile devices at a very early stage, i.e., before the official product launch. Because the sample represents a rather closely related group of individuals, we had direct access to rich data about these individuals, their mutual relationships, and their interactions with other people and information sources. Below, we unfold and

CONTRIBUTION

The research contributes to the IS literature in a number of ways. First, it describes a group of very early adopters of a groundbreaking technology and their efforts to overcome uncertainties when switching costs are high. The study provides an in-depth description of this group of adopters and helps us understand the specific profile of early adopters of an iPhone.

Second, based on a social network perspective, we show that traditional network measures can provide an in-depth understanding of the decision-making processes of early iPhone adopters. We provide multiple perspectives on adoption using four measures from the social network literature to explain how the social network influenced individual adoption decisions.

Finally, this research is relevant to both academics and practitioners. Academics may apply our findings to explain why and how individuals adopt emergent devices that break away from previous devices and are not yet available through conventional supply chains. Practitioners can obtain new insights into the behaviors of early adopters of mobile devices and may incorporate these into their mobile device and development strategies.

¹ Apple Inc. 28–06–2007: <http://www.apple.com/pr/library/2007/06/28iphone.html>

² Quarter of US iPhones 'unlocked', BBC News: <http://news.bbc.co.uk/1/hi/business/7214873.stm>



present our analysis of these data as follows. First, we review the literature on adoption of mobile devices and services. We then present the social network perspective and explain our choice of research design that guided the empirical investigation. After a detailed presentation of the characteristics of the observed adopters and our analysis of their adoption decisions, we conclude and discuss the implications for theory and practice, as well as limitations of our study.

ADOPTION OF MOBILE DEVICES

Our research draws on the specific literature on adoption of mobile devices, as well as the general literature on individual adoption of communication technologies within information systems research. Adoption is the result of a decision-making process whereby an individual, group, or organization engages in activities that lead to a decision to use an innovation (Rogers 2003). Today's advanced devices combine communication and computing into a multipurpose gadget that provides users with various types of services (Bergman 2000). Furthermore, they have a one-to-one binding with the user, offer ubiquitous access, and provide a set of utilitarian and hedonic functions (Hong and Tam 2006). With this definition, we consider mobile services and applications as part of advanced mobile devices.

Since the early 1990s, research on mobile devices has gained increased attention, as these devices were expected to "revolutionize many aspects of everyday life in the Western world" (Green et al. 2001, p. 146). Adoption research has typically been centered on studies of either the artifact being adopted or the user setting. While adoption research in general has been criticized for lack of attention to the attributes of the adopted devices and services (Orlikowski and Iacono 2001), few studies have considered the mobile artifact as an object of expression (Chuang et al. 2001) and related mobile device design issues (Lee and Benbasat 2003; Tarasewitch 2003).

Historically, the majority of mobile users acquired their device through work, although this did not prevent private and leisure usage (Fisher 1994). Early studies have, therefore, in general studied mobile adoption in organizations, for example, changes in organizational structure (Meehan 1998) and effects on the divide between work and leisure (Nippert-Eng 1996). Later work has also studied the blurring of work- and leisure-related functions of the mobile device (Palen et al. 2001) and the possibilities of business-to-business e-commerce (Wang and Cheung 2004). More recently, the focus has increasingly shifted toward individual adoption, as the mobile device has become the personal information-processing interface of choice. Studies are now concerned with the commercial possibilities, e.g., how mobile commerce exposure influences adoption (Khalifa and Cheng 2002); how users create value when adopting mobile banking services (Laukkanen and Lauronen 2005); and which factors induce users to accept mobile devices to communicate promotional content (Bauer et al. 2005).

Understanding variations in adoption patterns between the personal and professional context and across individual, group, and organizational levels raises interesting issues related to voluntary versus compulsory adoption (Venkatesh et al. 2003; Moore and Benbasat 1991). Individual level adoption is generally optional and organizational adoption is more often than not based on authoritative decisions. It is, however, far from clear whether group adoption of mobile devices is the result of a collective decision or whether it emerges as the result of individual decisions by the members of the group with only minor influence between group members during the decision making process. As many organizations allow their employees to choose a preferred device, most of the recent research continues to be concerned with the individual level adoption (Tscherring and Damsgaard 2008).

Pedersen and Ling (2002) suggest that adoption research in general "seeks explanations of why a particular adoption behavior may be observed at the individual level" (Pedersen and Ling 2002, p. 9). They found three explanatory approaches that may also be applied to adoption of mobile devices. These are rationalistic or utilitarian explanations, explanations based on social influence, and explanations focused on personal characteristics. Utilitarian studies use constructs such as usefulness and ease of use to measure individuals' willingness to adopt, exemplified by Carlsson et al.'s (2000) application of the UTAUT (Unified Theory of Acceptance and Use of Technology) model to explain acceptance of mobile devices and services. Social influence explanations add elements of how social mechanisms influence individuals' adoption of a particular mobile device or service. One illustration is Lu et al.'s (2005) investigation of the relationships between personal innovativeness and social influences on one side and intention to adopt wireless Internet services via mobile technology on the other. Their study also covers the third kind of explanatory variable in mobile adoption research—personal characteristics—and it develops and validates measures for personal innovativeness perceived as a personal trait of adopters (Agarwal and Prasad 1999). In addition, the literature offers attempts to describe different categories of adopters. Constantiou et al. (2007) developed a grouping that divides mobile users into distinct consecutive categories: talkers, writers, photographers and surfers, and Pedersen (2005) studied the adoption of mobile commerce of early adopters by extending the Theory of Planned Behavior (TPB) with the Technology Acceptance Model (TAM) constructs to explain early adoption of mobile commerce.



While existing research provides useful insights into the relationship between constructs that may lead to acceptance or rejection of mobile devices, recent studies (Lyytinen and Yoo 2002; Sarker and Wells 2003) have called for research to further examine factors that explain mobile device adoption. Lyytinen and Yoo (2002) argue that the emergence of nomadic information environments, which is a result of high levels of mobility, digital convergence, and mass scale services and infrastructure, calls for a re-analysis of the adoption of devices and services at all levels, including individuals, groups, and organizations.

Against this backdrop, we are not aware of research that focuses on how early adopters of mobile devices leverage their social networks to overcome uncertainties related to shifts in technology. While a few studies investigate social influence on mobile adoption (Dickinger et al. 2008; Lu et al. 2005), they mainly develop and test models explaining causal relationships between different constructs and adoption. Only one study (Dickinger et al. 2008) employs an explorative phase, followed by model development and testing, analyzing the effect of peers on individuals' adoption behavior of a VoIP (Voice over Internet Protocol) service. This study concludes that with highly interactive services, social norms are strong drivers of usefulness and perceived enjoyment due to network effects. Another study (Lu et al. 2005) takes a Structural Equation Modeling approach to assess the relative importance and the strength between different constructs, including perceived enjoyment, social norm, usefulness, ease of use, and intention to use. With the aim to achieve representativeness, they show that a mobile user's social network influences the individual's adoption decision. They do not, however, address social influence on early adoption decision as a result of technology shifts in the mobile market, and they do not reflect on the thought process of mobile users' that enables adoption.

This gap in the literature limits our understanding of how early adoption decisions are shaped by an individual's peers and network. We suggest that by analyzing frequent exposure to news from traditional and electronic media, active participation in discussion groups, and readily available access to unique technical capabilities, we can offer additional explanation as to why and how a group of closely related individuals made the decision to adopt a mobile device before it was made available through traditional supply chains.

SOCIAL NETWORK INFLUENCE

A social network is a structure of individuals or organizations connected by some type of interdependency (Wasserman and Faust 1994). The relationship between the actors depends on the context as well as the research question being studied. Social influence is more meticulously defined as the "change in an individual's thoughts, feelings, attitudes, or behaviors that results from interaction with another individual or a group" (Rashotte 2007, p. 1). Earlier definitions included norms and roles (French and Raven 1959); however, the current notion is that individuals make genuine changes to their feelings and behaviors as a result of interaction with others, who are perceived to be similar, desirable, or experts (Rashotte 2007). We use the term social network influence as we investigate social influence from an individual's social network.

It is widely accepted that our social and professional lives are constituents of interactions, with many actors linked together in network structures and that these structures impact the performance of the network (Vigden et al. 2007). The structure of a system can either favor or impede diffusion and adoption of innovations (Katz 1961; Rogers 2003). Therefore, the notion of a social network has attracted considerable interest from the social and behavioral sciences, such as sociology (Clawson et al. 1986; Emirbayer and Goodwin 1994), anthropology (Wellmann 1999), epidemiology (Rothenberg et al. 1998; Potterat et al. 1999), economics (Bala and Goyal 1998; Manski 2000; Chwe, 2000) and diffusion of innovations theory (Coleman et al. 1957; Coleman et al. 1966; Burt 1986; Young 1999). Many of these studies use social network analysis to investigate complex sets of relationships between members ranging from interpersonal, over inter-organizational, to international. Barnes (1954) was one of the first to use the term systematically when he discovered that, though a community shared cultural values, most individuals made decisions with reference to personal contacts. Social network analysis has since been developed (Friedkin 1980; Burt and Minor 1983; Krackhardt 1987, 1990; Wasserman and Faust 1994) to include technological networks and derived effects; e.g., the long tail (Anderson 2006; Oestreicher-Singer and Sundararajan 2008) and user-generated content in online social networks (Oh et al. 2006).

Another stream of research investigates central constructs in analysis of social network structure and interdependency between actors. These constructs describe partly overlapping forms of social network influence and represent increasing levels of sophistication from quantitative oriented measures toward comprehensive frameworks for understanding. In the following, we review these constructs: adoption threshold, opinion leaders, social contagion, and social learning—in increasing order of sophistication.



Valente (1996) studied previous categorizations of innovation adopters, such as the well-known classification by Rogers (2003) and Ryan and Gross (1943, 1950) and used these to create personal or system network threshold categories. Thresholds are the proportion of adopters in a social system needed for an individual to adopt an innovation (Granovetter 1978). The threshold model follows Rogers' division of adopters and demonstrates that very low threshold individuals have thresholds two standard deviations lower than the average threshold for the network or community, and very high threshold individuals have thresholds two standard deviations higher than the average. Adoption thresholds, therefore, can be viewed as a characteristic of adopters. Valente (1996) argues further that innovativeness can be distinguished with respect to their personal network or the social system. Mobile users with high network thresholds who adopt early relative to the social system are only innovative relative to the entire system, not compared to their personal communication network. Low network threshold adopters are individuals who adopt early relative to their personal network, yet they may, though not necessarily, adopt late relative to the social system.

Opinion leader (Burt 1999; Valente and Davis 1999; Watts and Dodds 2007; Oh et al. 2006) is another social network influence construct. The definition of opinion leaders is more precisely "opinion brokers who carry information across the social boundaries between groups" (Burt 1999, p. 37). They are located at the edge of networks and act as brokers between groups and may induce two mechanisms: contagion by cohesion as opinion leaders diffuse information across groups, and contagion by equivalence as opinion leaders stimulate adoption within a group. Contagion by cohesion is dependent on the strength of the relationship between two individuals. The more frequent communication between the two, the more likely it is that one individual will adopt an innovation of the other individual. Discussions between the two allows the adopting individual to come to a normative understanding of costs and benefits of adopting the idea. Contagion by structural equivalence refers to the degree to which two individuals have similar relationships to other people; i.e., their extended network. Contagion, therefore, may occur because of competition or simply because they have a similar idea of what will make them attractive to their network.

Social contagion refers to an actor's decision to adopt an innovation depending on other actors' attitudes, knowledge, or behaviors concerning the innovation. Studies (Van den Bulte and Lilien 2001; Dodds and Watts, 2004) have established that those individuals most receptive to social contagion have an enormous influence on the diffusion and adoption process. Influential individuals could be single opinion leaders or it could be a number of individuals from one's social network making their adoption decision visible. Consequently, social contagion is an outcome of the individual's structural position in the network. Degree centrality can be calculated from the number of direct ties an individual has, divided by the number of ties in the system. Adopters with a higher number of direct ties have greater opportunities to disseminate and receive information about a technology because they have more ties and, therefore, more choices (Granovetter 1973; Burt 1999). Thus, the number of direct ties captures the power and the opportunities to receive information. Van den Bulte and Lilien (2001) identify a number of theoretical accounts from the literature that describe different causal mechanisms of social contagion. These are information transfer (Katz and Lazarsfeld 1955), which may occur from both traditional and electronic media; normative pressures (Coleman et al. 1966), which may occur when an adopter feels discomfort or when peers, whose approval they value, have adopted an innovation, but they have not; competitive concerns (Burt 1995), which can be viewed as opposed to normative pressures; and, performance network effects (Katz and Shapiro 1999) that refer to the benefits of use that increase with the number of prior adopters of the innovation.

Social learning is a related factor that affects an individual's choices when faced with substantial uncertainty in sampling new innovations. It occurs through the observation of neighbors' choices (Tarde et al. 2008). A common explanation for such changes in behavior is that innovations create uncertainty about expected consequences, and to overcome uncertainty, individuals tend to interact with their social network to consult on others' adoption decisions through informational and normative social influences (Burkhardt and Brass 1990; Katz 1980; Katz and Tushman 1979). While learning occurs as a conscious process of interactions between related individuals, contagion may be the mere result of brief encounters with individuals who share information about the iPhone. Oh et al. (2006) built on Ellison and Fudenberg's (1993) prior research and found evidence for a number of mechanisms by which social influence is transmitted, such as preference for conformity and social learning.

The four constructs all contribute to explaining social behavior in networks. We adopt them to investigate how five closely related individuals made the decision to adopt the iPhone before it was made available through conventional supply chains. Hence, with a focus on how early adopters of mobile devices overcome uncertainties related to shifts in technology, we draw on the adoption threshold, opinion leaders, social contagion, and social learning constructs to investigate:

How and why does the social network of early adopters of the iPhone impact their decision to adopt?

RESEARCH METHOD

We chose the case study method to investigate this research question because it is preferred when "how" or "why" questions are being posed, when the extent of control of the investigator is little, when the focus is on a contemporary phenomenon and not historical events (Yin 2008), and when the focus is on understanding the dynamics within a single setting (Eisenhardt 1989). We further conducted an exploratory study, as opposed to a descriptive or experimental study (Yin 2008), because we aimed at learning how and why five closely related individuals made the decision to adopt an iPhone before it was made available through conventional supply chains.

Inspired by Eisenhardt's (1989) process of building theory from case studies, we adopted the same conceptual framing throughout our investigation, though our goal was not theory building in particular, but rather exploration and presentation of empirical insights. We first identified the research question and adopted four social network concepts as *a priori* framing constructs. We then selected specific early adopters of the iPhone as our case material to help answer the research question. After generating an interview guide, based on the identified theoretical constructs, and while collecting data, we initiated the analysis phase. In this phase, we analyzed and reflected on the data to present new insights. As Eisenhardt (1989) emphasizes, this was a highly iterative process.

Research Context

The case focuses on five individual mobile users who adopted the iPhone prior to its official release in Denmark. Denmark is among the leading countries in the use of mobile devices and mobile communication services (Economist Intelligence Unit 2008) and is, therefore, an appropriate venue for studying adoption of the iPhone. The way in which early adopters surmount the uncertainties related to adoption is particularly interesting since they experience high switching costs because of lack of references to imitate or expert users to consult. Purposive sampling provided direct access to rich data about these individuals, their mutual relationships, and their interactions with other people and information sources. Purposive sampling techniques are primarily used in qualitative studies when the aim is to select individuals based on a specific purpose associated with answering the research question (Teddlie and Yu, 2007) and extending emergent theory (Eisenhardt 1989). It is, furthermore, a type of sampling in which "particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices" (Maxwell 1997, p. 87). The aim was to gain access to a group of closely related individuals to determine, how their mutual relationship as well as their wider social network influenced their decision to adopt the iPhone at this time and why.

People with similar characteristics, tastes, and beliefs may associate in the same social networks (Manski 2000) and our sampling criteria were, therefore, that the group of individuals should be homogenous with similar characteristics and interests, and they should be part of the same social network. Homogenous sampling was chosen, as we wanted to understand the decision to adopt an iPhone in a particular group of early adopters. The participants were similar with respect to several variables, such as demographics and experience with mobile phones. As individuals who adopt at a very early stage can be expected to share characteristics, we recruited five closely related early adopters. One author had access to an individual who then contacted other individuals in his network who had also adopted the iPhone. Our investigation is, as a result, based on multiple perspectives. We observed and analyzed the behavior of the five individuals as a group while at the same time focusing on each individual, his social network, and decision-making.

Data Collection and Analysis

The study employed qualitative methods to understand the affluent nature of mobile users thought processes when overcoming uncertainties and adopting a new mobile device. The data collection took place from April 2008 to July 2008. It involved techniques such as semi-structured interviews, archival records, and data collected from a specific discussion forum on the Internet. The triangulation of data collection methods provides stronger support in the exploration of the research question (Eisenhardt 1989). The semi-structured interviews lasted from one hour to one hour twenty minutes. The interview-guide consisted of five main parts: demographics, the user's mobile device history, the user's iPhone history, the closed social network consisting of the five individuals, as well as each individual's extended network, and finally the adoption decision.

Table 1 describes the five main themes the interview-guide was based on. Table 2 describes how the analysis phase was broken down into three phases (Eisenhardt, 1989).



Table 1: The Interview Guide	
Theme	Description
<i>Demographics</i>	Demographic data
<i>Mobile device history</i>	Experience with mobile devices; purpose of the device; experience with related products
<i>iPhone history</i>	Experience with the iPhone prior to adoption and after adoption; thoughts on future technological acquisitions
<i>Social network</i>	The network of the five individuals; the extended network of each individual
<i>Adoption decision</i>	Information gathering; thoughts prior to adoption of device; the actual decision; after receiving the device

Table 2: Phases of Analyses		
Phase	Focus	
	<i>Adoption level</i>	<i>Result</i>
Phase 1	Individual level	Detailed description of each early adopter
Phase 2	Individual and group level	Analyses of adoption decisions and behaviors based on four constructs from the social network literature
Phase 3	Individual and group level	Identification and reflection on empirical results as contributions to the literature

Table 3: Constructs Guiding the Investigation		
Construct	Description	References
<i>Adoption threshold</i>	Does the proportion of individuals in the user's close and extended network, who has adopted the iPhone, affect his decision to adopt? Does the individual have a low or a high network threshold, and are there any differences between the close network and the extended network?	Granovetter 1978 Valente 1996
<i>Opinion leaders</i>	How did information about the iPhone enter the social network? Were there any opinion brokers to bring information about the iPhone into the network and someone who was the main driver of adoption within the group?	Burt 1999 Valente & Davis 1999 Watts & Dodds 2007 Oh et al. 2006
<i>Social contagion</i>	How did other people's attitudes toward, knowledge of, or behaviors toward the iPhone influence the decision? Did the individual decide to adopt the iPhone early?	Van den Bulte & Lilien 2001 Dodds & Watts, 2004
<i>Social learning</i>	Did the individual observe his neighbors adoption decision prior to making an adoption decision? Did he interact with his social network to consult on their adoption decisions in order to be guided by informational or normative influences?	Tarde, 1899 Katz & Tushman, 1979 Katz, 1980 Ellison & Fudenberg, 1993 Burkhardt & Brass, 1990 Oh et al., 2006



The first phase focused entirely on the individual level and involved a detailed description of each of the five early adopters based on the main themes from the interview-guide (Table 1). The second phase focused on both the individual level as well as the group as a whole and it consisted of analyses that built on the descriptions from the first phase to explore how the four constructs in Table 3—social contagion, social learning, opinion leaders, and adoption threshold—could explain the decision to adopt the iPhone before it was commercially available in Denmark. The third phase focused on explicating contributions to the literature by systematically identifying and reflecting on the empirical insights in relation to the existing literature. The adoption process is analyzed at the individual level, taking group level influences into account. We refrain from generalizing to the organizational level as previous research (Venkatesh et al. 2003; Venkatesh and Davis 2000) has stated that adoption dynamics are different in mandatory and voluntary adoption and usage contexts.

RESULTS

Characterizing the Group of Adopters

There are several methods for categorizing adopters in general, the most well known are those by Rogers (2003) and Ryan and Gross (1943, 1950). However, these methods do not provide insights into how the iPhone is received before it has gone through its adoption curve. Constantiou et al.'s (2007) categorization of mobile adopters is developed for the purpose of dividing mobile users into distinct groups based on their usage behavior. Users can be categorized as talkers, writers, photographers, and surfers. Each new level is inclusive, so writers are also talkers, photographers are also talkers and writers, and surfers are also talkers, writers, and photographers. The authors argue furthermore, "Adoption of a new mobile service does not lead to abandonment of the previous ones but instead are adopted in addition to existing ones due to complementarities" (Constantiou et al. 2007, p. 52).

Table 4: Description of Mobile Users Participating in the Study

	Adam	Ben	Chris	David	Eric
Gender	Male	Male	Male	Male	Male
Age	36	33	33	34	33
Occupation	Private sector	Private sector	Private sector	Public sector	Private sector
First mobile device	1995	2000	1994	2000	1994
No. of mobile devices	~ 7	~ 5	~ 14	~ 8	~ 20
Bought iPhone	Dec 2007	Mar 2008	Mar 2008	Jan 2008	Sep 2007
Previous mobile device	Sony Ericsson W950i	Sony Ericsson K800i	Nokia N73	Sony Ericsson K810i	Nokia N95
Service use	Talk, SMS, e-mail, calendar, Internet, MMS, camera, Mp3, games, 3 rd party software (e.g., maps)	Talk, SMS, e-mail, calendar, Internet, MMS, camera, Mp3, games, 3 rd party software (e.g., maps)	Talk, SMS, e-mail, calendar, Internet, Mp3, 3 rd party software (e.g., maps)	Talk, SMS, e-mail, calendar, Internet, MMS, camera, Mp3, 3 rd party software (e.g., maps)	Talk, SMS, e-mail, calendar, Internet, MMS, camera, Mp3, games, 3 rd party software (e.g., maps)
Service experience	Surfer	Surfer	Surfer	Surfer	Surfer



Table 4 provides a description of the observed five mobile users. They are all male in their early to mid-thirties, and they have extensive experience with mobile phones, which is apparent in years of experience with mobile devices, number of mobile devices, and service experience. The demographic data shows a homogenous group of individuals consisting of surfers. They are all situated in the capital of Denmark, Copenhagen, and are, hence, part of the urban population. According to Constantiou et al.'s 2007 study, the typical surfer is male, between twenty and forty years of age, has a higher education, and works in the private sector. Surfers seek information about new mobile phones regularly and are usually among the first to try out new mobile technologies and services. They like to experiment and find it fairly easy to make their mobile device perform as they wish.

The five adopters have more characteristics in common. They display a positive attitude toward change and science, which is apparent in their interest in obtaining the iPhone before its release in the US. They already used most functions on their previous mobile devices—all smart phones. The users appear to cope well with risk and uncertainty, as they bought the iPhone from the US and were forced to jailbreak and unlock the phone before being able to use it. They are highly interconnected in their social networks measured by number of Facebook “friends”—Table 5³. This increases the flow of information. Furthermore, they benefit from vast exposure to media that delivers information about topics of interest—both mass media and interpersonal media channels, such as the discussion forum they participated in. They are active information seekers, and they display considerable knowledge of technological innovations.

Table 5: Facebook Friends April 2008 and April 2009

	April 2008	April 2009
Adam	890	1531
Ben	124	143
Chris	635	1089
David	194	373
Eric	672	2000

The five adopters are furthermore highly interconnected as suggested by the number of Facebook friends the five adopters have in common—Table 6. This pattern of common friends relates to Dunbar (1995) who initially used cross-cultural studies to predict that humans socialize in groups of approximately 150 individuals—also referred to as the Dunbar number. Later Hill and Dunbar (2002) raised the question whether social networks in modern, postindustrial societies exhibit a comparable pattern, and they found that social networks are still constrained to 150 due to limits in human communication.

Table 6: Number of Friends in Common, Facebook April 2008

	Adam	Ben	Chris	David	Eric
Adam	890	115	254	115	165
Ben	115	124	96	27	105
Chris	254	96	635	96	155
David	115	27	96	194	194
Eric	165	105	155	105	672

Evidence for Individual Adoption Decisions

The five adopters decided to adopt the iPhone at different points in time ranging from September 2007 to March 2008. In the following, we present each individual adopter and his reflections leading to the decision to adopt.

Adam, thirty-six years of age, holds a leading position in a private company within the music industry. He obtained his first mobile device in 1994 and acquires a new device approximately every second year the iPhone in December 2007—five months after its release in the US. He waited five months to buy the iPhone even though he always knew he *had* to attain it, as he was concerned with the lack of 3G. Adam had possessed iPods for years; however, he does not particularly use Apple products. He monitored the exposure of the iPhone in the media and noticed an explosion in the development of techniques on how to jailbreak the firmware on the iPhone. He is, furthermore, a member of the discussion group, HF, on the Internet where he and others discussed the recent development in releasing the iPhone and how to jailbreak and unlock the device. He decided to buy the iPhone when a friend let him try out the device.

³ According to statistics on Facebook, the average user has 120 friends.



Ben is thirty-three years. He holds an analyst position in a private company and creates music in his leisure time. He obtained his first mobile device in 2000 and acquires a new device roughly every second year. He obtained his iPhone in March 2008 when he travelled to the US, and he acquired several copies and brought them to Denmark to his friends. Ben has possessed iPods for four years and Mac computers for five years, mostly for music production purposes. He is an Apple enthusiast and was initially exposed to the iPhone through the media. He watched the MacWorld Expo presentation of the iPhone on the Internet. He also discussed the device with friends and acquaintances and was at an early point convinced he would obtain the iPhone. Ben decided to adopt based on two considerations. First, the instructions on the Internet on how to jailbreak and unlock the phone had advanced and it was now rather easy to do. Second, he was traveling to the US and could easily buy one. He says, "When I held it the first time, I just knew I had to get it now. I didn't want to wait any longer."

Chris is thirty-three years and works as a consultant in a private company. He obtained his first mobile device in 1994 and acquires a new device approximately every year. He bought his iPhone March 2008. Chris went to the US in December 2007 and seriously thought of acquiring the device at that time, but decided to wait. His mobile device at the time suddenly got slower, and he decided to obtain the iPhone when returning to the US in March 2008. Chris has been in possession of PowerBooks and iPods since 1999 and can be labeled an Apple-consumer. He followed the presentation and release of the iPhone through the media and participated in the discussion forum HF. He had made a decision to acquire the phone even before the release. When it was released in the US, he did not have an excessive need and thought that the device would come to Denmark quickly in a 3G version. However, as the Danish release was extended and his mobile device at the time became slow, he decided he couldn't wait any longer when he travelled to the US. He added: "I will definitely buy the phone when it comes to Denmark in a 3G version."

David is thirty-four years and holds a project management position in a public institution. He obtained his first mobile device in 2000, acquires a new device approximately every year, and bought his iPhone in January 2008. David has been using his households' Mac hardware and software, although he states that the only Apple product he has owned himself is the iPod (2001). David has been aware of the iPhone since before Apple's presentation and he always knew he would acquire one. When asked why, he stated, "It's partly a question of practicality, gathering all gadgets into one, so that you don't have to carry all these devices in your pockets. And it's partly a question of being able to use the services that the network operators have tried to push for so long. We now have a device that shows applications as if you were sitting in front of your computer. Now mobility is for real." He was concerned that the device was not made for the Danish market; however, he finally decided to obtain the iPhone, not waiting for the Danish release: "The iPhone was too cool, and I don't want to wait for some decelerated network operator to get their stuff together ... it is an unheard [of] situation, that it's not just there, and agreements have to be made."

Eric, thirty-three years of age, holds a project coordinator position in a private company and performs music in his leisure time. He obtained his first mobile device in 1994 and acquires a new device approximately twice a year. He acquired his iPhone in September of 2007. Eric has extensive knowledge about Apple's computers, as he has been using both iMac and MacBook for several years. However, he had, never had an iPod before he acquired the iPhone. Eric has been aware of the iPhone since before it was presented at the MacWorld Expo conference: "That was the first time pictures were revealed. Here it is. But even before that, in 2006, there were a lot of speculation on what the phone would look like. I remember a lot of photos of white phones that matches the look of the white MacBooks." He noticed that, whenever Apple releases a new product, they create plethora of hype, and they succeeded in building up excitement about the iPhone. It became prestigious to possess an iPhone.

Analyzing Social Network Influences

Adoptions thresholds of collective behavior are the proportion of adopters in a social system needed for an individual to adopt an innovation (Granovetter 1978). We asked the iPhone adopters how many people in their network they knew had adopted the iPhone prior to their acquisition. Adam replied five and the rest replied one. Given that they had between 124 and 890 Facebook friends at the time (see Table 5), the proportion of iPhone adopters in their networks was relatively small; between 0.0015 (Chris and Eric) and 0.08 (Ben). At the time of the interviews⁴ the five adopters believed that between 10 and 60 people in their extended network had adopted the iPhone. This indicates that all five adopters have a low network threshold in regard to their extended network. Eric was the first to adopt the iPhone (September 2007) and is also the person with the lowest network threshold in regard to his close network. Adam was also aware of a benefit of adopting early: "It is still a bit nerdy. You can't go down in the local store and buy one yet." Hence, the five early iPhone adopters all have a low network threshold, both in regard to their close network and their extended network.

⁴ The interviews were conducted in April 2008; eight months after the first adopters in the study acquired their iPhone, one month after the latest adopters in the study adopted the iPhone and three months before the iPhone was released on the Danish market.



Opinion leaders are "opinion brokers who carry information across the social boundaries between groups" (Burt 1999, p. 37) to stimulate contagion by cohesion or contagion by structural equivalence. We asked the five adopters how many contacts they had in common (Table 6) and how many contacts they had in their extended network (Table 5). The number of Facebook friends is the most precise measure of the adopters' networks we could obtain. Adam, who had the highest number of Facebook friends at the time (see Table 5) of the interview, reflected that the high number is a consequence of him working in the music industry, and he does not have frequent interaction with most of his contacts. Chris's and Eric's high numbers of Facebook friends are also the result of socializing with individuals through the music scene. The five adopters have between twenty-seven (Ben and David) and 254 (Adam and Chris) friends in common (see Table 6). According to all of them, there was no single person who brought information about the iPhone into their extended networks. Though they all had decided to obtain the iPhone at some point, it was the testing of a friend's device that stimulated the acquisition. All adopters claim they actively sought information about the iPhone as soon as they became aware of it. There is hence no evidence that opinion leaders played a significant role in the adoption decision made by the five adopters.

Social contagion refers to an individual's decision to adopt an innovation depending on other individuals' attitudes, knowledge, or behaviors concerning the innovation (Van den Bulte and Lilien 2001). Mobile adopters with higher number of direct ties have greater opportunities to disseminate and receive information about the iPhone because they have more choices (Granovetter 1973; Burt 1999). Thus the number of direct ties captures the power and the opportunities to receive information about the iPhone. According to statistics on Facebook, the average user has 120 friends, which is also supported by a small-scale investigation conducted by the Economist (Kluth 2009). All five iPhone adopters in this study have a number of friends higher than the average, which increases the likelihood of getting contaminated with attitudes, knowledge, and behaviors toward the iPhone from their Facebook network.

As identified by Van den Bulte and Lilien (2001) four mechanisms may cause social contagion (see Table 3).

Information transfer occurs both from traditional media, such as newspapers and TV, and Internet-based media, such as podcasts, to individual mobile users, as well as between individuals. The five adopters all received information and news about the iPhone from various types of media, and all except Ben were part of a particular discussion forum on the Internet. The main topic of the forum was electronic music, but the participants also discussed related topics, including the latest news on the release of the iPhone. As the five adopters are part of the same social setting and met regularly, they also exchanged information directly. Adam even decided to buy the iPhone at the exact moment a friend in his extended network let him try out his iPhone. He says, "It is my clear belief that this is where something snaps. One thing is what you read ... everybody's skeptic ... but that is only until you get a demonstration." Hence, information transfer and demonstrations from both different media and the social network had significant influence on each individual's decision to adopt the iPhone.

Normative pressure occurs when the mobile user experiences discomfort, when peers whose approval they value have adopted an innovation, but they have not yet adopted it themselves. When asked how many people in their social network owned an iPhone before they bought theirs, Adam answered five, and the four other adopters answered one. There is, therefore, no evidence that normative pressures influenced the iPhone adopters.

Competitive concerns can be viewed as opposed to normative pressures. As Eric stated, "The iPhone has a high prestige factor that will probably descend when it is released in Denmark." He further argued that the iPhone attracts a lot of attention from peers who do not own an iPhone. Adam and Ben have a similar view. David, on the other hand, does not feel that competition had any influence on his adoption decision. He believes that the iPhone is simply the best phone on the market, which Chris agrees with. Hence, it appears that competitive concerns influenced some individual's decision to adopt the iPhone.

Performance network effects refer to the benefits of use that increase with the number of prior adopters of the innovation. These effects are apparent for mobile devices in general as the benefits of usage increases with the amount of prior users. As all five adopters had advanced mobile devices prior to the iPhone and most of these devices offer similar communication functions (talk, text messaging, instant messaging), the adopters did not experience increased network effects from adopting an iPhone, as compared to their previous phone, or after their friends adopted it.

Social learning is related to social contagion. As mobile users are faced with uncertainty in the decision to adopt the iPhone, they may observe their neighbor's choices and interact with their social network to consult on their adoption decision through informational and normative social influences (Burkhardt and Brass 1990; Katz and Tushman 1979; Katz 1980). We asked the five adopters if they would be able to make the iPhone work when they received it and if they depended on other people in their network to help them. All five adopters replied they had at least one friend they relied on to help in case they were not able to make the iPhone work by themselves. However,



they all initially depended on themselves to be able to jailbreak and unlock the phone based on instructions from a website. David made the purchasing decision when "the instructions became easy to comprehend, and I could see myself fix everything—installation of new applications, jailbreaking, unlocking, update firmware. Everything that had to do with the iPhone, I could do it myself without being dependent on others." Adam found: "It became a competition for Mac nerds to determine who could break the latest firmware. So, the information and software on the web is quite good. Therefore, there is evidence that social learning played an important part in the individual's decision to adopt the iPhone.

DISCUSSION

We have presented a case study investigating the behaviors and decisions of a group of five early adopters of the iPhone. Drawing on utilitarian research on mobile adoption studies (Pedersen and Ling 2002; Carlsson et al. 2000) as well as studies that have established correlation between an individual's social network and the decision to adopt (Dickinger et al. 2008; Lu et al. 2005), our study provides a detailed description of adopters that faced high uncertainties when adopting the iPhone before it was readily available. We offer new insights into how early adopters of mobile devices overcome uncertainties related to shifts in technology. Explaining these behaviors can be challenging, and relying on too simplistic models might not suffice. Therefore, we relied on multiple perspectives and were open to question insights from traditional adoption theory. Such an explorative, multi-construct, and multi-perspective has previously been left unexamined.

We analyzed both individual adoption decisions as well as social network influences. In contrast to existing studies on early adoption (Wozniak 1987; Kauffman and Techatassanasoontorn 2009), our study was based on a qualitative approach in which we used four complementary social network influence constructs—adoption threshold, opinion leaders, social contagion, and social learning. Interestingly, these analyses confirmed some previously identified insights and questioned others.

The study confirms that contemporary mobile devices revolutionize many aspects of everyday life (Green et al. 2001) as they combine many gadgets into one device. The study also shows that when facing uncertainty, adoption decisions emerged as a combined result of individual adoption reflections and major influences from the social network, as well as behaviors observed within the network. Specifically, the analyses confirmed that network structures impact the decision to accept a mobile device (Vigden et al. 2007; Katz 1961; Rogers 2003) while also revealing new details on social network influences on early adoption decisions.

The study also supports several insights from previous work on mobile adoption. Lu et al. (2005) found that perceived ease of use of wireless Internet services on mobile devices had a direct effect on the intention to adopt the service. Our study supports this finding, as the early adopters of the iPhone relied on easy to use instructions on how to jailbreak and unlock their iPhone as well as on their network to provide the help they needed. Similarly, Dickinger et al. (2008) found that attitudes toward "Push to Talk" services had a positive effect on the intention to use the service. Our study shows that early adopters of the iPhone had a positive attitude toward the device long before it was released, contributing to their intention to adopt.

Finally, the study is consistent with previous research on characterization of adopters. Lu et al. (2005) found that personal innovativeness had an impact on intention to adopt wireless Internet services via mobile technology. Constantiou et al. (2007) divided mobile users into categories that describe several traits of each category: talkers, writers, photographers and surfers. The personal innovativeness construct and Constantiou et al's. (2007) description of the "surfer" fits well with our early adopters who all belong to the surfer category. Wozniak (1987) studied early adoption of new technology in organizations and found that adoption behavior is a "human capital intensive activity" that depends on acquired human capital and investment into receiving adoption information. Our study confirms that the social influence construct "information transfer" which is part of social contagion was characteristic for the observed early adopters.

As a new contribution to our understanding of how early adopters of mobile devices overcome uncertainties related to shifts in technology, the combination of four constructs from social network research provided the comprehensive insights summarized in Table 7. Low adoption threshold (Granovetter 1978; Valente 1996) was characteristic of the early iPhone adopters. The threshold construct considers only the proportion of adopters without taking into account whether one particular individual had greater influence on an individual's adoption decision. The opinion leader construct, however, addressed this issue. Opinion leaders carry information about the iPhone across social boundaries between groups of people (Burt 1999; Valente and Davis 1999; Watts and Dodds 2007; Oh et al. 2006). However, the study showed no evidence that the adoption decision was influenced by opinion leaders.



Table 7: Results		
Social network construct		Result
Adoption Threshold		Adopters had low adoptions threshold.
Opinion leaders		No evidence that opinion leaders had an impact
Social contagion	Information transfer	Information transfer had an impact.
	Competitive concerns	Some evidence for competitive concerns
	Normative pressure	No evidence for normative pressure
	Performance network effects	No evidence for performance network effects
Social learning		Social learning had an impact.

Considering social contagion (Van den Bulte and Lilien 2001) mechanisms, the analysis showed vast support for the impact of the information transfer that occurred from various media, as well as between the five individuals and their extended networks. Hence, Katz and Lazarsfeld's (1955) "two-step flow" concept may explain why opinion leaders did not have direct impact on the observed adoption decision-making. Competitive concerns (Burt 1986) had some influence on the observed adoption decision-making. The adopters agreed that the iPhone attracted a lot of attention from peers; however, three adopters viewed this as a beneficial trait of possessing the iPhone, whereas two adopters felt they had no competitive concerns. Finally, our analysis revealed no evidence for normative pressure and positive network effects.

Social learning (Tarde 1899; Katz and Tushman 1979; Katz 1980; Ellison and Fudenberg 1993; Burkhardt and Brass 1990; Oh et al. 2006) overlaps partly with the contagion construct and focused on how the five adopters observed the choices of other individuals in their network and consulted with them on their iPhone adoption decision. As a conscious process of interactions between related individuals—in contrast to contagion resulting from brief encounters to share information about the iPhone—social learning played an important part in the individual's decision to adopt the iPhone.

This comprehensive analysis of how five early adopters of mobile devices overcame uncertainties related to shifts in technology reveal interesting behaviors that differ from expectations. First, opinion leaders were found to have no influence on adoption of the iPhone; i.e., the individuals acquired information about the iPhone themselves and were not influenced by a particular person in the social network. The social network influence occurred at later stages in the process. Watts and Dodds (2007) argue that social change is typically driven by easily influenced individuals influencing each other. However, we found no evidence among the observed early adopters that they were easily influenced. They all had extensive experience with mobile devices and were among the first to try out—and in some cases discard—new technologies. Opinion leaders' influence is direct and derives from their informal status as being informed, respected, or simply "connected" (Watts and Dodds 2007). The five observed early adopters may therefore have acted on their own rather than have been subjected to opinion leaders. A second interesting behavior among the five early adopters is their limited emphasis on competitive concerns. While the analyses showed some evidence of this aspect—the social contagion construct—we would expect these early adopters to be more strongly competitive, as they belong to the surfer category (Constantiou et al. 2007). An explanation for this may be that the iPhone simply was a breakthrough mobile device and the best on the market at the time.

Our findings have implications for the development of new mobile devices and platforms. The initial exclusive collaboration between the producer of the iPhone (Apple) and the network provider (AT&T in the US) was an attempt to control market forces by providing a business proposition of revenue sharing from applications developers and network operators. However, as this study shows, some individuals overrule company strategies to break normal practice. In this case, software was developed and made available for free on the web along with recipes for jailbreaking and unlocking iPhones in order to make them work on other network providers' networks. Adopters of the iPhone did not only develop software to access the iPhone on other networks, they also created third-party applications and made them available for download and use. As a response, in March 2008, Apple released a software developer kit (SDK) that allows developers to create applications for the iPhone and test them on an iPhone simulator. It is, however, only possible to load applications onto the devices after paying an iPhone Developer Program fee; applications are, furthermore, to be downloaded via the Apple App Store in iTunes—Apple's music download software. As a consequence, the production of third-party applications has exploded. On July 10, 2008, Apple CEO Steve Jobs announced that the App Store contained 500 third-party applications for the iPhone.



Eight months later, the App store had passed 30,000 applications⁵ and by February 2010 the store contained 150,000 applications⁶. Two points may be derived from our research and these subsequent events. First, when producing and hyping a groundbreaking technology, the very first global adopters will do what it takes to be able to use the new technology, and they will share solutions with their network to help peers overcome potential uncertainties and enjoy similar benefits. Second, the subsequent user involvement approach worked for Apple (although Apple continues to be a closed innovation company) and may also be incorporated in the strategy of other mobile device and platform developments.

CONCLUSION

This paper outlines a social network perspective on adoption of the iPhone at a very early stage. We used the case study method to explore why and how five closely related individuals made the decision to adopt the iPhone before it was made available through conventional supply chains. The findings suggest this perspective is useful for research that seeks to leverage social network constructs to understand adoption situations. Our research specifically demonstrates how the combination of four different constructs—adoption threshold, opinion leaders, social contagion and social learning—provided detailed insights into behaviors and interactions that allowed us to explain how and why the social network impacted the five individuals' decision to adopt the iPhone.

Still, it is important to consider alternative explanations. The artifact itself possesses some unique characteristics that were emphasized by the adopters; design characteristics as well as utilitarian characteristics. Following the observation of Orlikowski and Iacono (2001) that the IT artifact tends to be taken for granted in research, we acknowledge that the iPhone itself had significant impact on the adopters' decision-making beyond the focus of our analyses. It is also of interest to look at Apple's marketing effort. Van den Bulte and Lilien (2001) found that when they control for marketing efforts in the diffusion of the drug Tetracycline, contagion effects disappear. The heavy promotion of the iPhone by Apple, the hype that was created by the media and the public, and the limited supply of iPhones (Verhallen 1982, Verhallen and Robben 1994; Lynn 1991) could have been additional important influences on the five adopters. This observation relates to Leibenstein's (1950) "snob effect," and, though the five adopters did not see themselves as "snobs," they agreed that owning the iPhone at the time was prestigious.

Our research involved some limitations. The sample used in the study is rather homogenous. Though we believe that early adopters at this stage exhibit certain common traits, we acknowledge that it could have been interesting to compare the results with other types of users with other characteristics. The nature of the research question, which required a sample containing a group of closely related adopters and access to very early adopters, was very limited. We believe that our trade-offs were necessary to conduct a study as rich in information on mutual relationships as this study is. Acknowledging the limited opportunities to generalize based on our sample, we found a qualitative, in-depth approach the most appropriate method of investigation. However, the insights provided from our research are encouraging and demonstrate that more research on the very first adopters of groundbreaking technologies is needed.

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⁵ <http://brainstormtech.blogs.fortune.cnn.com/2009/03/26/iphone-app-store-30000-apps-but-slowng/>

⁶ <http://techcrunch.com/2010/02/12/app-store-numbers-books-ipad/>



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APPENDIX C: ARTICLE 3

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A Multi-level Social Network Perspective on ICT Adoption

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Abstract

Adoption of technologies has long been a key area of research in the information systems (IS) discipline, and researchers have thus been interested in the *attributes, beliefs, intentions, and behaviors* of individuals and organizations that could explain information and communication technology (ICT) adoption. The focal unit of adoption has mainly been individuals and organizations, however, research at group or social network level as well as the inter-organizational level have recently gained increased interest from IS researchers. This recent focus supports the view of the world as being the sum of all relations. Various social network theories exist that seek to emphasize different proficiencies of social networks and explain theoretical mechanisms for behavior in social networks. The core idea of these theories is that social networks are valuable, and the relations among actors affect the behavior of individuals, groups, organizations, industries, and societies. IS researchers have also found that social network theory can help explain technology adoption. Some researchers, in addition, acknowledge that most adoption situations involve phenomena occurring at multiple levels, yet most technology adoption research applies a single level of analysis. Multilevel research can address the levels of theory, measurement, and analysis required to fully examining research questions. This paper therefore adapts the Coleman diagram into the Multi-level Framework of Technology Adoption in order to explain how social network theory, at the individual and social network level, can help explain adoption of ICT. As Coleman (1990) attempts to create a link between the micro and macro level in a holistic manner, his approach is applicable in explaining ICT adoption.

Keywords: Adoption, ICT, social network theory, multi-level approach, MFTA

1 Introduction

The adoption of information and communication technologies (ICT) has long been a central concern in the field of Information Systems (IS) as this type of research has great practical implications for value chain activities, from product discovery, and development to marketing and sales. Researchers have thus been interested in the *attributes, beliefs, intentions, and behaviors* of individuals and organizations that could explain adoption. Currently, several frameworks for individual level adoption of technologies exist; e.g. Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1973; Fishbein and Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), and the Technology Acceptance Model (TAM) (Davis, 1989, Davis et al., 1989). At the organizational level, a central theory is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

Some of these frameworks add to the number of constructs in order to better explain adoption behavior; however, along with number of constructs, complexity also increases. Hence, lately there has been a diversion to the study of *relations* among individuals (Tscherning and Mathiassen, 2010) and among

organizations (Teo et al., 2003; Lyytinen and Damsgaard, 2010) to explain how these units influence and are influenced in their adoption decision processes and how technologies are diffused in a system (Rogers, 2003; Moore and Benbasat, 1991). This supports the view of the society as being the sum of social relationships: “*What exist in the social world are relations – not interactions between agents or inter-subjective ties between individuals, but objective relations, which exist independently of individual consciousness and will*” (Bourdieu and Wacquant, 1992, pp. 97). In our daily lives we are linked to each other in many different ways; through marriage, friendship, work, advice, support, information transfer, and other types of relationship, and we influence and are influenced by each other through these relations. Some of these social network relations are intentional and some are oblivious.

Currently, there are only a few frameworks seeking to provide explanations of technology adoption in social networks (Valente, 1996; Rice et al., 1990). Prior studies have provided explanations of group level adoption by computing the arithmetic mean of individual level adoption of the same technology assuming that individual members’ behavior can be aggregated to explain group behavior (e.g. Jung and Sosik 2003; Lapointe and Rivard 2005). Sarker (2006) found that aggregation of individual-level measures might, however, not be suitable for understanding behavior in a group or social network. Findings at one level of analysis do not generalize exactly to other levels of analysis, except under very restrictive circumstances (Firebaugh, 1979). The adoption and diffusion of technologies sometimes occur as current users at the individual, group or organizational level share their newly acquired experiences with other individuals, groups or organizations, hence providing a platform for ICT adoption. The conception is that a heterogeneous group of individuals may adopt the same technology simply because they are part of the same social network and not because they are similar (though similarity may also explain similar adoption patterns in social networks; e.g. Aral et al., 2009, Gu et. al., 2008).

Social network theory emphasizes different proficiencies of social networks and explains theoretical mechanisms for behavior in social networks. The core idea is that social networks are valuable (Wasserman and Faust, 1994), and the relations among actors affect the behavior of individuals (van den Bulte and Lilien, 2001), groups (Oh et al., 2006), and organizations (Dodds et al., 2003). Different sub-categories of social network theory address behavior at different levels, and some of these can therefore be applied in ICT adoption research to explain the dynamics of, and the interaction between, individual level and network level adoption. The sub-categories that have been applied in ICT adoption are *social network analysis*, theories of *homophily*, *self-interest and collective action*, and *contagion*.

However, only few studies have investigated technology adoption in social networks (Lu et al. 2005; Dickinger et al. 2008; Tscherning and Mathiassen, 2010). It is less complicated to understand adoption of ICT at the individual level; nonetheless individual adoption decisions seem to be influenced by social

network dynamics, and hence, taking a multi-level approach can provide additional insight into ICT adoption.

Past research in more conventional sciences, such as sociology and political science acknowledges that a paradox exists between the individual's capacity to make (adoption) decisions independently, and the discourse of a higher level society, such as the individual's social network, which seems to influence or limit the choices and opportunities that individuals' possess³⁶. However, the field of IS has only conducted little research that takes a similar approach, e.g. Poole and DeSanctis (1990). Most ICT adoption situations involve phenomena occurring at multiple levels, yet most ICT adoption research applies a single level of analysis. Multi-level research addresses the levels of theory, measurement and analysis required to fully examining research questions. It describes some combination of individuals, groups, organizations, industries, and societies thus bridging the micro-macro divide by integrating the micro domain's focus on individuals with the macro domain's broader focus resulting in a richer depiction of the dynamics (Klein et al., 1999). Furthermore, it is well known that relationships that hold at one level of analysis may be stronger or weaker at a different level of analysis or may even reverse direction (Ostroff, 1993).

Following these insights, and as the adoption studies in the IS field matures (Choudrie and Dwivedi, 2005), the assumption is that a sole micro or macro stance provides an incomplete understanding of behaviors occurring at either level (Porter, 1996) and that a multi-level approach will help in understanding the ICT adoption decision made by individuals, social networks and other units of adoption. This paper therefore presents and adapts the Coleman diagram (Coleman, 1990) in order to explain individual level and network level adoption of ICT. As Coleman (1990) attempts to create a link between the micro and macro level in a holistic manner, his approach may also be applied to ICT adoption research.

This research contributes to the IS literature in a number of ways. First, it develops the Multi-level Framework for Technology Adoption, which adds to current explanations of human behavior in relation to adoption of ICT. Second, based on a social network perspective, it becomes apparent that traditional social network theories can provide an in-depth understanding of the dynamics that occur at the individual and network levels and their mutual influence. Finally, this research promotes a qualitative approach to social networks and their analysis as opposed to the conventional quantitative approach.

The next section contains a literature review of multi-level research conducted on adoption of ICT. Section three presents the multi-level approach and the Coleman diagram is adapted into the Multi-level

³⁶ This is referred to as the ontological discussion of structure and agency on human behavior (Giddens, 1984).

Framework of Technology Adoption (MFTA). Section four presents the four social network theory sub-categories; *social network analysis*, *homophily*, *self-interest and collective action*, and section five discusses how the theories can explain adoption of ICT.

2 Multi-level Research on ICT Adoption

This research is based on the conceptual multi-level research in general and multi-level research on ICT adoption in particular. The interest in analyzing and interpreting multi-level data is rooted in educational and sociological research, where a surge in theoretical and statistical discussions occurred during the 1970s. Sociology studies collective phenomena, and the study of relationships between individuals and their contexts; tracing back to Lazarsfeld and Menzel (1961), who developed a typology to describe relations between different types of variables, defined at different levels. Their typology is mainly conceptual and argues that related variables can be created by aggregation or disaggregation.

Originally, two research perspectives prevailed in the social sciences (Hitt et al., 2007). Research at the individual level takes a micro perspective and is rooted in psychological phenomena. The focus is on understanding thoughts, feelings and behavior of individuals (e.g. Rousseau and House, 1994). Research at the organizational level is considered macro and is rooted in sociology and economics. The focus is on understanding organizations and market dynamics (Dansereau et al., 1984).

Recently, several efforts to generate multi-level frameworks for organizational behavior research, has been conducted. Dansereau et al., (1984) specify and test theories that involve two or more levels of analysis. Their framework aims to understand changes in multiple levels of analysis over time. In management research, Klein et al., (1994) investigate the underlying assumptions specifying levels of theory in organizational behavior. As no single framework have succeeded in establishing emergent common constructs, to be used more broadly in the social sciences, Klein and Kozlowski (2000) later identify what they find are critical choices and issues, when changing research focus from single-level to multi-level research. They provide guidelines for constructs and measurements, model specification, research design, sampling, and data analyses.

In today's networked society where social structures and activities are organized around electronically processed information networks, it is increasingly important that researchers take the level of adoption into account when conducting technology adoption research. Accordingly, multi-level research has been conducted within IS as depicted in figure 1.

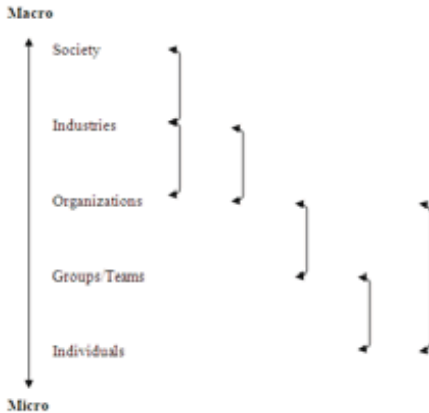


Figure 1. Multiple Levels of Analysis in ICT Research

Levels of Analysis: Society - Industries – Organizations

One study by Gopalakrishnan et al. (2003) examine factors that influence adoption of Internet banking at three levels of analysis; the external context of the industry, the industry, and the organization. At the external context level, they analyze how a favorable external context facilitates the adoption of Internet banking. Different factors that impact the speed of Internet banking diffusion, is analyzed at the industry level, and at the organizational level, differences in bank strategies and organizational designs, associated with the adoption of Internet banking as an added delivery channel versus as a separate business, are analyzed. Based on the multi-level analysis, they discuss the unique features in the emergence and adoption of Internet banking and its potential performance implications.

Levels of Analysis: Industries – Organizations

As inter-organizational information systems have become available, a line of research investigates organizational ICT adoption in industries. Gregor and Johnston (2000) find that strategies and policies for the adoption and development of inter-organizational systems require further understanding of the theoretical background to these systems. They argue for the development of theory that is multi-level, processual and has an emergent perspective, and, hence, develop a theory that deals with complex interactions between organizational activities at the micro-level and industry structure at the macro-level, and use structuration theory as a vehicle to advance further understanding.

Christiaanse and Rodon (2005) study, how new IS-standards, based on open technologies, increase the potential for inter-organizational collaboration. They do this by raising the level of analysis to that of the

constellations of organizations that are part of the industry network. They examine how the structural properties, of the network, impact on the adoption decision, and how the adoption in turn produces changes in the structure of the network.

Lyytinen and Damsgaard (2010) also propose an approach to studying inter-organizational information systems (IOIS) adoption, which they call configuration analysis. It is a widely shared observation that the structure and the strategy of IOIS are inter-dependent, and researchers hence need to look beyond the single organization, when deciding on the appropriate unit of analysis. Lyytinen and Damsgaard (2010) consider what they call adoption configurations, and they specify each type of configuration along dimensions, such as vision, key functionality, mode of interaction, structure, and mode of appropriation. They postulate that particular organizing visions assume certain inter-organizational structures and, hence, propose a typology of configurations.

Levels of Analysis: Organizations – Groups/Teams

Other studies concern individual and group/team adoption in organizations. Lapointe and Rivard (2005) seek to explain resistance to information technology (IT) implementation, by using a multi-level, longitudinal approach. Using semantic analysis on extant models of resistance to IT, they identify five basic components of resistance: behaviors, object, subject, threats, and initial conditions. They examine data from three case studies of clinical IS implementations in hospital settings, focusing on physicians' resistance behaviors. Their findings suggest that group resistance behaviors vary during implementation.

Schepers et al. (2008) propose that psychological safety, a sense of interpersonal trust, and being valued in a work team, are important determinants of groupware technology adoption in educational settings. They develop and test a model of antecedents and consequences of psychological safety, which reveals positive effects.

Levels of Analysis: Groups - Individuals

Another set of studies examine individual and group level adoption of ICT. van Dolen and de Ruyter (2002) investigate Moderated Group Chat, which is on-line, real-time interactions between groups of customers with an active coordinating role for a company representative and a commercial objective. They develop a conceptual framework and examine empirically which factors drive customer satisfaction with the chat sessions that involve multiple participants and interactions and take place within an electronic group environment. They, hence, test relationships between identified determinants and chat-session satisfaction using a multi-level model.

Levels of Analysis: Organizations – Individuals

Finally, a number of studies examine individual and organizational level adoption of ICT. Frambach and Schillewaert (2002) identify and integrate variables that determine or influence organizational decisions on innovation adoption. They posit that two types of organizational adoption decisions can be identified; the decision made by an organization to adopt an innovation and the decision made by an individual within an organization to make use of an innovation. They formulate a multi-level model of organizational innovation adoption that incorporates determinants at both the organizational and the individual level, which serves as analytical tools that can be used in new product marketing planning.

Meyer and Goes (1988) study assimilation of innovations into organizations, a process unfolding in a series of decisions to evaluate, adopt, and implement new technologies in a longitudinal study. Their research, which concerns assimilation of medical innovations into community hospitals, focuses on discrete decisions about specific equipment. Assimilation is conceptualized as a nine-step process and measures 300 potential adoptions through organizations during a six-year period. The authors develop a model to suggest that organizational assimilation of technological innovations is determined by three classes of antecedents: contextual attributes, innovation attributes, and attributes arising from the interaction of contexts and innovations.

This study believes to its best knowledge that there is no significant study of multi-level research that can help explain the dynamics between individual level and network level adoption of ICT. While previous research efforts have provided conceptual contributions to multi-level research (Lazarsfeld and Menzel, 1961; Klein and Kozlowski, 2000), their typologies are rooted in the quantitative stream and provide guidelines to make it clear to which level measurements properly belong, and how related variables can be created by aggregation or disaggregation. They do not consider the rich data about individuals, their mutual relationships and their interactions with other people and information sources in social networks, teams, organizations etc. This is a gap in the literature that limits our understanding of ICT adoption.

3 Multi-level Framework for Technology Adoption

To explain the individual level and social network level dynamics in the study of adoption of ICT, this study draws on a diagram developed by Coleman (1990) in his “*Foundations of Social Theory*”. Coleman was a sociologist studying diffusion of innovations through networks (Coleman et al., 1966) and how social capital affects the productivity of individuals and groups (Coleman, 1988a, 1988b) among other things. He, moreover, developed a diagram in order to properly explain the requirements that social scientists have to meet. The diagram operates with two empirical levels; the macro-level and the micro-level. It identifies the challenges of existing macro-level empirical generalizations in social sciences that are presented as *true* explanations of macro phenomena, and shows that crucial steps are missing in

macro-level empirical generalizations. Coleman’s diagram departs from Weber’s “*The Protestant Ethic and the Spirit of Capitalism*” (1904) and argues that there are significant weaknesses in Weber’s arguments as they remain at the macro-level (see figure 1). Weber claim that the religious values of a society contributed to the rise of the capitalist economic organization of a society. This corresponds to Coleman’s macro-level empirical generalizations (arrow 4). He argues that Weber’s explanations leaves unclear how the religious values of a society affected the individuals, the macro-to-micro problem (arrow 1), and how the actions and interactions in turn contributed to a certain economic behavior (arrow 2), the rise of capitalism, displayed by the micro-to-macro problem (arrow 3).

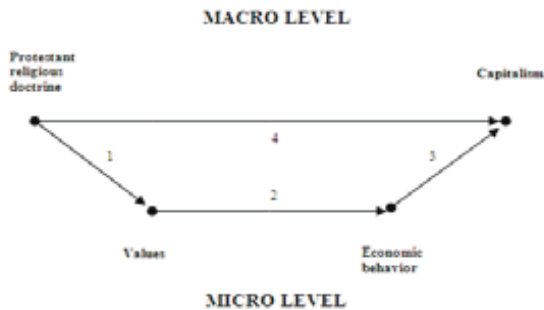


Figure 2. The Coleman Diagram, 1990³⁷

The diagram has been found to be a useful model for explaining similar macro-level empirical generalizations in the field of strategic management. Felin and Foss (2005), Foss (2007), and Abell, Felin and Foss (2008) have adapted the diagram to justify that macro explanations utilized in the capabilities view in strategic management neglects micro-foundations and are therefore incomplete. They argue that strategic management researchers usually posit a direct relation between capabilities and competitive advantage; however, this direct relation at the macro, or organizational, level can only be used under special circumstances as a shortcut for representing more complex underlying behaviors. They claim that “there are no conceivable mechanisms that directly take us from the organizational-level construct of capability to organization-level outcomes, such as competitive advantage” (Foss, 2007, pp. 35).

Within IS, a direct relation between individual attributes and beliefs on one side, and adoption intention and behavior on the other, is often observed; however several examples of more complex underlying behaviors at the social network level exist. Lu et al. (2005) study the relationships between personal

³⁷ Reprinted by permission of the publisher from FOUNDATIONS OF SOCIAL THEORY by James S. Coleman, Cambridge, Mass.: The Belknap Press of Harvard University Press, p. 8, Copyright © 1990 by the President and Fellows of Harvard College.

innovativeness and social influences on one side and intention to adopt wireless Internet services via mobile technology on the other, and find that a mobile user's social network influences the individual's adoption decision. Dickinger et al. (2008) analyze the effect of peers on individuals' adoption behavior of a VoIP (Voice over Internet Protocol) service, and find that with highly interactive services, social norms are strong drivers of usefulness and perceived enjoyment due to network effects. Finally, Tschering and Mathiassen (2010), in a qualitative study of social network level constructs, find that adoption threshold, opinion leaders, social contagion, and social learning, reveal varying impact on individual iPhone adoption.

As previously mentioned, individuals are often influenced by their social network in their adoption decisions, and the Coleman diagram can therefore also be used to explain ICT adoption and the dynamics that occur between micro and macro level. In the following, the Coleman diagram is adapted into the Multi-level Framework for Technology Adoption (MFTA). The purpose of the MFTA is to add to current explanations of human behavior in relation to adoption of ICT. The MFTA conjectures that the degree to which ICT is adopted can be explained based on the interaction of individual and network level phenomena for which evidence can be found in the ICT adoption literature. The Coleman diagram distinguishes between a micro and macro level, however, as the MFTA seeks to explain ICT adoption based on individual and network level interactions, the model is therefore divided into these two levels. It should be pointed out that the network level here is a 'higher' level and might as well refer to the organizational, industry, or society levels.

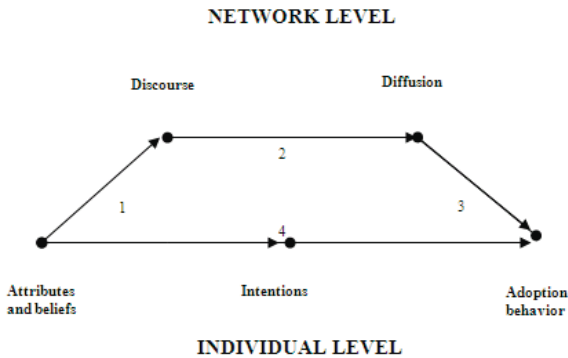


Figure 3. The Multi-level Framework for Technology Adoption (Adapted from Coleman Diagram, 1990)

In the following, the two levels in the Multi-level Framework for Technology Adoption is explained in detail.

3.1. Individual Level

The first level concerns phenomena occurring at the individual level. An individual level approach assumes that adopters are independent and does not take the structural context of the individual, such as communication relationships into account. A prevalent way of explaining ICT adoption is by justifying that an individual's *attributes* and *beliefs* lead to an *intention* to adopt an ICT, which in turn results in a certain adoption *behavior*. This type of research has contributed to explaining adoption behavior in well-known models such as TAM, TRA, TPB, and other derived models. These models cover the adoption process as perceived at the individual level, and therefore take the viewpoint of the adopter. They typically contain a variation of the variables: *attributes*, *beliefs*, *intentions*, and *adoption behavior*.

Concept	Definition	Reference	ICT Reference
Attributes	The characteristics of an individual that contributes to a certain adoption behavior. Examples are socioeconomic status, personality values, and communication behavior.	Rogers (2003) Venkatesh et al. (2003)	Lu et al. (2005) Tscherning and Mathiassen (2010)
Beliefs	The psychological state in which an individual holds a proposition or premise to be true. Examples are behavioral, normative, and control beliefs.	Ajzen, 1985	Davis et al. (1989) Hsu and Lin (2008)
Intentions	Indication of a individual's readiness to perform a given behavior.	Ajzen, 1988	Venkatsh and Morris (2000) Gefen et al. (2003)
Adoption behavior	An individual's observable response in a given situation with respect to a given target.	Ajzen, 1975	Davis (1989) Davis et al. (1989)

Table 1. Individual Level Variables in ICT Adoption

Attributes and beliefs

Individuals in a social system do not all adopt an ICT at the same time, but rather sequentially over time. Individual adopters can hence be described according to their characteristics, or attributes, and beliefs. Rogers (2003) use socioeconomic status, personality values, and communication behavior to characterize adopters of innovations, and Venkatesh et al. (2003) apply gender, age, experience, and voluntariness of use as modifiers of the adopters' intentions in the UTAUT-model to explain organizational ICT adoption.

Human behavior is directed by three types of beliefs: behavioral, normative, and control beliefs (Ajzen, 1985). Behavioral beliefs concern the likely outcomes of a behavior and the evaluations of these outcomes. Normative beliefs involves the normative expectations of others and motivation to comply with these expectations, and finally control beliefs concern the presence of factors that may facilitate or impede performance of the behavior and the perceived power of these factors (Ajzen, 1985). Previously

identified beliefs include performance expectancy, effort expectancy, social norms, facilitating condition (Venkatesh et al., 2003), attitude toward behavior, and subjective norm (Ajzen and Fishbein, 1980).

Intentions

Intention is an indication of a individual's readiness to perform a given behavior, and it is considered to be the most immediate antecedent of behavior. Intentions can be seen as behavioral dispositions until, at an appropriate time and opportunity, they are turned into action (Ajzen, 1988). Hence attitude and beliefs affect intention and subsequently behavior.

Adoption behavior

Adoption behavior refers to an individual's observable response in a given situation with respect to a given target. It is assumed, behavioral intention is a function of attributes and beliefs about the likelihood that performing a certain behavior will lead to a specific outcome. According to Fishbein and Ajzen (1975) external factors can only influence intention and behavior through beliefs.

Figure 4 shows a simplified version of the individual level approach to ICT adoption; the lower part of the MFTA.

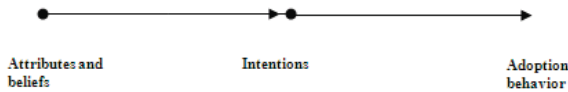


Figure 4. Individual Level Approach to ICT Adoption

3.2. Network Level

The second level concerns phenomena occurring at the network level, i.e. the collective behavior of an individual's network. A network level approach posits that networks are valuable and that the relations among individuals in the network affect the behavior of both the individuals and the network.

Concept	Definition	Reference	ICT Reference
Discourse	A formalized way of thinking that can be manifested through language; a social boundary defining what can be said about a specific topic. Language is intertwined with symbols, rituals and norms.	Foucault (1970, 1972)	Thompson (2002)
Diffusion	The process by which an innovation is communicated through certain channels over time among the members of a social system ⁷	Rogers (2003)	Liebowitz and Margolis (1995) Shapiro and Varian (1999)

Table 2. Network Level Variables in ICT Adoption

Discourse

Each network is different and so their characteristics vary along dimensions such as relationship, distance, trust, information sharing etc. (Ford, 1980; Ford et al., 1986). Each network pertain a certain discourse. A discourse is a formalized way of thinking that can be manifested through language; a social boundary defining what can be said about a specific topic (Foucault, 1970, 1972). A discourse, however, is more than words that reflect topics, rules, and norms of behavior. It is a way of *knowing* in the network, as language is intertwined with symbols, rituals and norms. Hence, discourses affect our views on all things, and it is not possible to escape discourses (Putnam and Fairhurst, 2001). Individuals, who are part of a network, are shaped by the discourse in the network. They use similar language, and adhere to the rules and norms of behavior in the group. Within IS, discourse analysis has been widely used to demonstrate how technologies have become deeply involved in the conception and practice of socio-economic development within less-developed countries (Thompson, 2002), for policy makers (Wilson, 2009)

Diffusion

Our social and professional lives are constituents of interactions with many individual actors linked together in network structures (Vigden et al., 2004) and a certain discourse is present in this network. These structures and the discourse can either favor or impede diffusion of ICT in a network (Katz and Levine, 1963; Rogers, 2003). Diffusion is “*the process by which an innovation is communicated through certain channels over time among the members of a social system*” (Rogers, 2003, pp. 5). Diffusion of innovations theory has had considerable impact on the IS field and has therefore been a widely used instrument to explain and predict rates of ICT diffusion (Moore and Benbasat 1991; Rogers 2003). It derives from theories of organisational existence and has since attempted to explain mainly individual adoption decisions (Lyytinen and Damsgaard 2001). The ICT decision process is a five-step process through which an individual, group, or organization move from gaining initial knowledge of an ICT to forming an attitude about it, and finally making a decision whether to adopt or reject (Rogers, 2003).

Individuals may be unaware of a certain ICT when being exposed to initial knowledge about it. The discourse in the network may reinforce an awareness process, and as an ICT is diffused in the network, network effects³⁸ may occur (Liebowitz and Margolis, 1995; Shapiro and Varian 1999). Research shows that network effects require a critical mass of adopters in the ICT diffusion process, before the diffusion takes off in the widespread S-shaped curve of adoption (Markus, 1987; Mahler and Rogers, 1999). It may thus be derived that the network impacts each individual's decision to adopt or reject an ICT.

Figure 5 shows that, at the network level, the upper part of the MFTA, a certain discourse exists. The symbols, rituals, norms, and debate influence the subsequent diffusion of ICT in the network.



Figure 5. Network Level Approach to Diffusion of ICT

3.3. Individual and Network Level Interaction

Thus far, it has been accounted for that most adoption explanations remain at the individual level: phenomena or events at the individual level are explained in terms of characteristics, phenomena or events at the individual level and do not refer to what is going on at the network level. Figure 6 shows how the degree, to which ICT adoption can be explained, is based on the interaction between individual and network level phenomena.

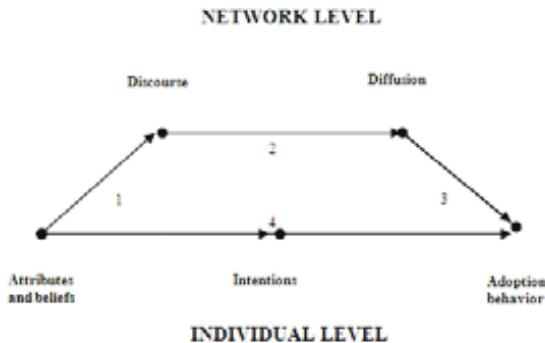


Figure 6. The Multi-level Framework for Technology Adoption (Adapted from Coleman Diagram, 1990)

³⁸ When the value of an ICT to one user depends on how many other users there are, the ICT is said to exhibit network externalities or network effects.

Individuals' attributes and beliefs regarding an ICT may influence the discourse in their network. Rules, norms, and behavior in the network changes accordingly and drives, or impedes, diffusion of the ICT in the network. When the network discourse is prevailing, beliefs, intentions, and adoption behavior, at the individual level, may be overruled, and the ongoing diffusion in the network influences the decision to adopt or reject an ICT. Hence, individual adoption decisions are influenced by network level phenomena.

Considering an example of early iPhone adoption (Tscherning and Mathiassen, 2010), the attributes of five individual adopters in a social network, and their beliefs about the iPhone, demonstrate an influence from their social network and the iPhone became an central topic of discussion prior to its release. At different times early after its US release, each individual acquired the iPhone and immediately observed an increasing interest within their common network. Consequently, the iPhone diffused in the network and became the prevalent mobile device. Prior to acquiring the iPhone, the respondents of the study were loyal to either Nokia or Sony Ericsson. The beliefs of the individuals in their social network, regarding required functional and aesthetic value, and not least symbolic value of a mobile device had been overruled by the discourse in the social network.

4 Social Network Theories

The use of social and media networks has reinforced the social nature of interpersonal relationships (Wellmann, 1999). Individuals are organized in social networks, in which they socialize and share ideas and uses of ICT. The current perception is that individuals change their feelings and behaviors as a result of the exerted influence from the network (Rashotte 2007). A combination of social and media networks shape important structures at all levels, and according to van Dijk (2005) the traditional split of the mass media, telecommunications, and data communication has dissolved in the process of media convergence. He uses the metaphor that "*networks shape the nervous system of advanced high-tech societies*" (van Dijk, 2005, pp. 1).

Social network theory has provided considerable insight into network structures, and phenomena occurring at all levels of analysis. However, as shown in section two, only little multi-level research has been conducted in the area of ICT adoption. Monge and Contractor (1988, 2003) have provided an extensive overview and description of social network theories applied in the areas of communication and organizations. Based on their overview, four sub-groups of social network theories are here presented along with examples of application of the theories in IS. The list of theories is not exhaustive, but rather the chosen theories have proven useful in IS research.

4.1. Social Network Analysis

Relations are central to social networks as they affect behavior of all units of analysis. Relations possess a number of important properties, and these and other fundamentals of social networks are described in immense detail in existing literature – see e.g. Wasserman and Faust (1994), Brass (1995), Monge and Contractor (1988, 2003), and Scott (2000). Barnes (1954) was one of the first to use the social network term systematically when he discovered that, though a community shared cultural values, most individuals made decisions with reference to personal contacts. Social network analysis has since been further developed (Friedkin 1980; Burt and Minor 1983; Krackhardt 1987, 1990; Wasserman and Faust 1994) and expanded to other uses including e.g. technological networks and derived effects (Oh et al., 2006).

Researchers typically study either ego-networks, consisting of the ties that specific individuals hold, or complete networks consisting of all ties in a defined population. Brass (1995) and Monge and Contractor (1988, 2003) have summarized the major network measures and divided them into three levels: measures assigned to individuals, measures related to ties among individuals, and measures used to describe entire networks. Measures assigned to individuals include *degree* measures, *centrality* measures, *range*, and *prestige*. Brass (1995) notes that “*it is important to remember that these measures are not attributes of isolated individual actors; rather, they represent the actor’s relationships within the network. If any aspect of the network changes, the actor’s relationship within the network also changes*” (Brass, 1995, pp. 44). Contingent on the network measures each individual holds a role in the network: *stars* are centrally located, *liaisons* connect two or more groups without being a member of either, *bridges* are members of two or more groups, *gatekeepers* mediate between one part of the network and another, and *isolates* have no or few links in the network.

Social network measures that relate to ties between two actors include measures such as *indirect link*, the path between two actors mediated by others, *frequency*, how often a relation occurs, *strength*, amount of time, emotional intensity, intimacy, or reciprocal services, *direction*, and *symmetry* of relations. These measures can all be aggregated and assigned to a particular individual or used to describe the entire network, however, aggregation of tie measures do not provide the complete story of the network. For example, an ego-network might consist of 50%-50% strong-weak ties, and when aggregating the value for the whole network the numbers are 70%-30% strong-weak ties. These numbers provide a general overview of the structure of the network; however, they do not provide details about the significance of the distribution of strong and weak ties.

Finally, the network measures describe entire networks, and include *size* of network, *inclusiveness*, the number of individuals minus the isolates, *component*, the largest connected subset of network individuals,

and relations, where all individuals in the component are connected and have no other relations. *Density* measures the ratio of the number of actual links to the number of possible links in the network and network *centrality* the difference between the centrality scores of the most central individual and those of other individuals in the network. Other measures that describe entire networks include *connectivity*, *connectedness*, *symmetry*, and *transitivity*.

Individuals	Roles	Ties	Networks
Degree measures, range, centrality measures, and prestige.	Stars, liaisons, bridges, gatekeepers, and isolates.	Indirect link, frequency, strength, direction, and symmetry of relations.	Size, inclusiveness, component, density, network centrality, connectivity, connectedness, symmetry, and transitivity.

Table 3. Social Network Measures at Different Levels of Measurement (Summarized from Brass, 1995)

Within IS, Social network analysis is one of the most widely used social network theories. Oh et al. (2006) measure different network constructs in order to understand the characteristics and the role of social influence on the diffusion of user-generated content via the online network YouTube. Onnela et al. (2007) examine the communication patterns of millions of mobile phone users, allowing them to study both local and global structures. They find that a coupling between interaction strength and local structure of the network slows down the diffusion process resulting in dynamic trapping of information in communities, and that weak and strong ties are both simultaneously ineffective when it comes to information diffusion.

Social network analysis analyzes *both* individual level measures and higher network level measures as depicted in figure 7.

4.2. Homophily

Another group of social network theories concern theories of homophily. It is a fundamental principle of human communication that the exchange of information and ideas occur more often between individuals who are similar, and hence researchers attempt to explain network relations on the basis of homophily; i.e. an individual's tendency to select others who are alike (Lazarsfeld and Merton, 1964). Similarity is thought to ease communication, increase predictability of behavior, and promote trust and reciprocity (Brass, 1995, pp. 51; Monge and Contractor, 2003). The consequence is, however, that personal networks become homogeneous with regard to attributes and beliefs. Homophily may accelerate the diffusion process but it limits the spread of innovations to those individuals connected in the immediate network, and therefore has great implications for the information received, the attitudes formed, and the interactions experienced in the network. Homophily is also referred to as assortative mixing.

Two sub-groups of homophily theories have been identified: *social comparison* (Byrne, 1971) and *social identity* (Tajfel, 1974; Schacter, 1959). Social comparison is based on a similarity-attraction hypothesis and supports the premise that similarity on attributes and beliefs will facilitate interpersonal attraction and liking, which in turn reduces the psychological discomfort, and thereby reduces potential conflicts in a relationship that may arise from perceived inconsistency (Monge and Contractor, 2003). Social identity is part of an individual's self-concept, which derives from knowledge of the membership of a social group together with the emotional significance attached to that membership (Tajfel, 1974). Schacter (1959) argues that similarity provides individuals with a basis for legitimizing their own social identity. The way individuals categorize themselves influences the extent to which they associate with others from a same category.

Within IS research, emphasis has been placed on social comparison studies. In an earlier study, Agarwal and Prasad (1999) propose a theoretical model in which the relationship between individual differences and IT acceptance is hypothesized to be mediated by the constructs of TAM. They test the model on 230 users and find that individual differences influence the individual's beliefs about IT innovations. In another study, Gu et al. (2008) analyze individual interactions in virtual communities based on the cognitive dissonance theory. They argue that individual interaction decisions are motivated by the desire to decrease conflict between an individual's own opinion and the opinions of others in the community, and find significant support for the hypothesis about homophily in individual interaction decisions. Finally, Aral et al. (2009) develop a dynamic framework to distinguish homophily with influence-based effects in dynamic networks. They test their framework on data from a global instant messaging network of almost 30 million users, and find that homophily explain more than 50% of the behavioral contagion that occur in the network.

As the above studies show, homophily-driven theories *originates* at the individual level, as social comparison and social identity is based on individual attributes and beliefs (see figure 7). However, homophily impacts network structures, network discourse, and hence diffusion.

4.3 Self-Interest and Collective Action

A third group of social network theories are *self-interest* and *collective action* theories. Theories of self-interest postulate that people make what they believe to be rational choices in order to acquire personal benefits. Theories of collective action focus on mutual interest and the possibility of benefits from coordinated action rather than on individual self-interests (Monge and Contractor, 2003). The logic is that people motivated by self-interest avoid investing resources in a joint attempt leaving others to contribute instead even though all will benefit – this is also referred to as free-riding (Monge and Contractor, 2003). Collective action theories suggest that individuals forego the tendency to free-ride due to social capital

(Coleman 1990; Putnam, 1993, 1995), the strength of weak ties (Granovetter, 1973), and adoption thresholds (Granovetter, 1978; Valente, 1995).

The theory of social capital concerns the resources embedded in one's social network and how access to, and use of, such resources promote an individual's self-interest. Nahapiet and Ghoshal (1998) suggest three dimensions of social capital; the structural, relational, and cognitive dimensions. The structural dimension of social capital refers to the overall pattern of connections between individuals and how they reach each other. The relational dimension focuses on the particular relations people have, such as respect and friendship, that influence their behavior, and the cognitive dimension refers to those resources providing shared representations, interpretations and systems of meaning among parties (Nahapiet and Ghoshal, 1998, pp. 244). Burt's (1992) concept of structural holes suggests that people accumulate social capital, which they invest in social opportunities from which they expect to profit. These investments are motivated by the return individuals expect to get on the social capital they invest. Network holes are the places in the network, where people are unconnected, and consequently, holes provide opportunities where individuals can invest their social capital. They do this by connecting to two or more unconnected others, thus creating indirect ties between the individuals to whom they link. They hence control the information that flows, between others.

Granovetter (1973, 1983) develop the strength of weak ties theory as a counter-theory to the conventional assumption that individuals receive most of their crucial information from others with whom they communicate on a regular basis; instead he find that crucial information is received through weak ties, connections to others with whom they have occasional contact. Accordingly Granovetter (1973, 1983) argue that the weak tie between two individuals becomes a crucial *bridge* between one individual's close network and another individual's close network, as relevant new information travels from one social network to another through this bridge. These weak ties are therefore fundamental to ICT diffusion and adoption. It follows that "*individuals with few weak ties will be deprived of information from distant parts of the social system and will be confined to beliefs and behaviors of their close friends*" (Granovetter, 1983, pp. 202).

Finally, the theory of adoption thresholds has been used to examine adoption of ICT. Thresholds are the proportion of adopters in a social system needed for an individual to adopt an innovation (Granovetter 1978). Adoption thresholds can hence be viewed as an attribute of adopters, and it is argued that the threshold levels of individuals determine whether a group as a whole can achieve the critical mass necessary for rapid and widespread collective action (Markus, 1987; Valente, 1996). An individual's threshold can be based on a norm of reciprocity in the network, which is a sense of mutual indebtedness so that individuals usually reciprocate the benefits they receive from others, ensuring ongoing supportive

exchanges (Shumaker and Brownell 1984). Thus, when there is a strong norm of reciprocity in the network, individuals trust that their knowledge contribution efforts will be reciprocated, thereby rewarding individual efforts and ensuring ongoing contribution.

In IS research, Wasko and Faraj (2005) apply theories of collective action to examine how individual motivations and social capital influence knowledge contributions in electronic networks. They find that people contribute, when they perceive that it enhances their professional reputations, when they have the experience to share, and when they are structurally embedded in the network. Furthermore, they find that contributions occur without regard to expectations of reciprocity from others or high levels of commitment to the network. Chiu et al. (2006) also investigate the willingness to share knowledge in the fostering of a virtual community and integrate the social cognitive and the social capital theories to construct a model for investigating motivations behind knowledge sharing in these communities. Their study supports that social capital influences individuals' willingness to knowledge sharing in virtual communities. Levin et al. (2004) propose and test a model of dyadic knowledge exchange to integrate multiple findings of the significance of strong and weak ties. They find evidence for the existence of knowledge sharing through strong and weak ties and that, especially strong ties, are important for receiving tacit knowledge.

The above studies show that social capital, weak ties, and adoption thresholds influence individual motivations for sharing in the network (figure 7), and thus theories of self-interest and collective action departs at the individual level though individual level motivations stem from network level benefits.

4.4 Contagion

Contagion theories are based on the assumption that networks serve as a mechanism that exposes individuals, groups and organizations to information, attitudes, and behavior of others (Monge and Contractor, 2003). This exposure increases the likelihood that an individual becomes 'contaminated' by their network's beliefs and behavior. Contagion is therefore an outcome of the structural position in the network. Degree centrality calculates the number of direct ties an individual has in the network; a higher number of direct ties result in a greater chance of disseminating and receiving information about ICT's (Granovetter 1973; Burt 1999).

Two network contagion mechanisms are social influence (Fulk et al., 1990; Fulk, 1993) and social cognition (Bandura, 1986). Social influence is a rather broad phenomenon referring to the extent that attitudes and behavior of other people significantly impacts individual behavior regarding ICT use (Fulk, Schmitz and Steinfield, 1990). According to social cognitive theory *watching* others performing a behavior influences the individual's perceptions of their own ability to perform the behavior, or self-efficacy, and what they expect the outcomes of the behavior to be (Bandura, 1986).

IS research on contagion includes a study by Jaspersen et al. (1999). They attempt to develop an understanding of the role, played by social influence on an individual's IT use by examining the pathways through which social influence unfolds and impact IT usage behaviors. They define and examine three appropriation moves. These moves are deliberate actions taken by individual users as they respond to the technology-directed social influence of their peers. They establish that individuals may utilize different modes of responding to social influence with respect to technology use. Compeau et al. (1999) develop a model based on social cognitive theory to test influence of computer efficacy, outcome expectations, affect and anxiety on computer usage. Using longitudinal data from almost 400 users during a one-year period, their overall findings provide strong confirmation that both self-efficacy and outcome expectations impact an individual's affective and behavioral reactions to IT. Burkhardt (1994) also perform a longitudinal investigation using data from a federal government agency, to investigate alternative sources of social influence, the role of interpersonal beliefs, attitudes, and behaviors following a technological change. She finds that individuals' attitudes and use of a recently implemented computer network are significantly influenced by the attitudes and use of others in their communication network. Co-workers, with whom communication occurs directly, influence individuals' perceptions of self-efficacy with new IT - the theoretical mechanism of contagion by cohesion. The attitudes and behaviors of individuals are however more affected by structurally equivalent co-workers. Structural equivalence refers to the degree to which two individuals have similar relationships to other people in their network.

Contagion, hence, originates at the network level and influences the individuals in the network as depicted in figure 7.

5 Discussion

The following is a step toward explaining how research on the dynamics between the individual and the network level influences adoption of ICT. As part of this effort, the problem of solely studying adoption behaviors at the individual or the network level, was accounted for, as it provides an incomplete understanding of behaviors at either level (Firebaugh, 1979). Analyzing ICT adoption at one level is less complicated; however, as previous research has shown individual adoption decisions are influenced by the dynamics of social networks (Lu et al., 2005; Dickinger et al., 2008) and taking a multi-level approach may hence provide additional insight into ICT adoption.

As part of this effort, the Coleman diagram (Coleman, 1990) was adapted into the Multi-level Framework of Technology Adoption (MFTA). The purpose of MFTA is to add to current explanations of human behavior in relation to adoption of ICT, and it conjectures that the degree to which ICT is adopted can be explained based on the interaction of individual (Ajzen, 1975, Venkatesh et al., 2003, Rogers, 2003) and

network level (Shapiro and Varian, 1999; Putnam and Fairhurst, 2001) phenomena for which evidence can be found in existing literature.

Drawing on the view of the society as being the sum of social relationships, this paper provides a description of four social network sub-group theories; *social network analysis*, theories of *homophily*, *self-interest and collective action*, and *contagion*, as these theories have proved useful for explaining adoption in the IS field. As a new contribution to our understanding of the multi-level social network perspective on ICT adoption, evidence in previous research for the application of social network theories, at various levels of analysis, was identified. Table 2 contains an overview of social network theories, references, and level of origin. Social network analysis contains measures assigned at individuals, measures related to ties and measures that describe whole networks and may therefore originate at all levels of analysis. Homophily theories depart from the individual level as social comparison and social identity theories are based on individual attributes. Similarly self-interest and collective action theories show that social capital, weak ties, and adoption thresholds influence individual motivations for sharing in the network, and thus originate at the individual level though individual level motivations stem from network level benefits. Finally contagion theories originate at the network level and may influence individuals directly in their adoption decisions.

Social network group	Theory	References	Level of origin	Influences
Social Network Analysis	Social network analysis	Scott, 1988; Wasserman and Faust, 1995; Brass, 1995; Wellmann, 2001; Monge and Contractor, 1988, 2003; Oh et al., 2006; Onnela et al., 2007	Individual Network	Individual Network
Homophily	Social comparison Social identity	Byrne, 1971; Agarwal and Prasad, 1999; Gu et al., 2008; Aral et al., 2009 Schacter, 1959	Individual	Network
Self-interest and collective action	Social capital Strength of weak ties Adoption thresholds	Coleman 1990; Putnam, 1993, 1995; Wasko and Faraj, 2005, Chiu et al., 2006 Granovetter, 1973, 1983; Levine et al., 2004 Granovetter, 1978; Valente, 1995; Wasko and Faraj, 2005	Individual	Network
Contagion	Social influence Cognitive theory	Fulk, Schmitz and Steinfield, 1990; Fulk, 1993; Jasperson ., 1999 Bandura, 1986; Burkhardt, 1994; Compeau et al., 1999	Network	Individual

Table 4. Social Network Theories and Level of Origin

When applying the above social network theories to the MFTA, it becomes clear to which level the social network theories properly belong and how they influence other levels of analysis.

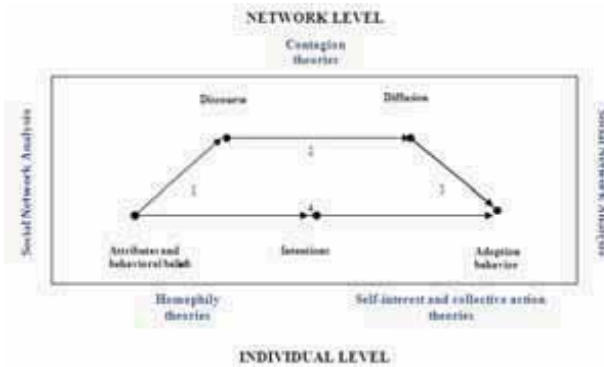


Figure 7. Social Network Theories applied to the Multi-level Framework of Technology Adoption

Figure 7 provides a visualization of the social network theories applied to the MFTA. It shows that homophily as well as self-interest and collective action theories depart at the individual level, whereas contagion theories describe network level dynamics. Social network analysis measures originate at both levels of ICT adoption. In the following the interaction between the individual and network levels are visualized taking point of departure in each theoretical sub-group. The aim is to establish how social network theories affect adoption of ICT's when looking at multiple levels. The originating constructs from the MFTA are highlighted as are the influences.

Homophily

It has been established that similar individuals communicate with each other, as similarity is thought to ease communication, increase predictability of behavior and promote trust and reciprocity (Brass, 1995). Networks may hence become homogeneous with regard to attributes and beliefs, and the discourse particularly preserved. This may act as a barrier to the flow of information and new ICT in the network, which in turn delays the diffusion process as diffusion can only occur through communication links that are somewhat heterogeneous (Rogers, 2003, pp. 306). Homophily can therefore act to slow down the rate of diffusion in a system, and push individuals to reject an ICT.

Self-interest and collective action

While some individuals focus on self-interest and act to acquire personal benefits, the incentive of others is mutual benefit and the possibility of profiting from coordinated action. How they are motivated can be

attributed their belief system and the discourse in their network. If the network structure provides easy access to other individuals in the network as well individuals in other networks through structural hole positions, individuals are exposed to new and relevant information. However, as noted above, a homogenous network deprives individuals of information from distant parts of the social system hence having the opposite effect on information and ICT diffusion. Yet, if individuals' relations to other individuals are based on respect and trust and provide shared representations, interpretations, and systems of meaning, diffusion is enforced, and individuals will accumulate social capital to make use of in their ICT adoption decision-making. Finally, diffusion in a network reveals how large a proportion of the network relations have adopted an ICT and thus constitute the individual's adoption threshold. This attribute partially influences the individual's intention, and hence, subsequent adoption behavior.

Contagion

The contagion effect originates at the network level and serves as a mechanism that diffuses information, beliefs and behaviors of others in the network to individuals. This exposure increases the likelihood of the individual being contaminated as a consequence of the discourse of the network, thereby changing the individual's belief system, intention to adopt and adoption behavior.

Social Network Analysis

Social network analysis is the study of relations among all units of analysis and explains how units influence and are influenced in their adoption decisions and how ICT diffusion takes place. Researchers typically study adoption in ego-networks, consisting of the ties that specific individuals hold, and diffusion of technology in complete networks consisting of all ties in a defined population. Social network measures can hence be assigned to both levels depending on the research question in mind. Structural properties, such as an individual's centrality and prestige and strength of relations to other individuals, may influence diffusion in the network, while network size and density may impact diffusion and hereby an individual's adoption behavior.

The development of the framework and analysis of individual and network level dynamics assisted in informing us in the study of ICT adoption by uncovering interesting dynamics that transpire between the two levels of adoption. Most studies take a quantitative approach showing relationships between different constructs at either level, however exploring constructs in ICT adoption prior to causal analysis may reveal origin of constructs and underlying assumptions that show which constructs in reality influence each other in a particular situation, and if aggregation of constructs may actually provide insight into network behavior.

6 Limitations and Future Research

The focus of this paper has been to substantiate why ICT adoption research performed at multiple levels should be emphasized in IS research. The Multi-level Framework for Technology Adoption was developed for this purpose and showed that different social network theories, applied in the IS field for explaining ICT adoption, originate at different levels depending on the research question, but still influence all levels. The MFTA does however retain certain limitations.

First, the framework shows a simplification of the influences between the individual and the network level. In reality influences may go both ways and cross from constructs at the network level to constructs at the individual level. It is for example possible to imagine that *diffusion* of ICT influences *intention* and then adoption. Also it is widely accepted that network diffusion influences individual adoption of ICT, and individual adoption similarly influences network diffusion of ICT. However, being true to the effects in the original Coleman diagram, and keeping the MFTA simple, makes it possible to explore the dynamics when applying social network theories to adoption of ICT.

Furthermore, only a subset of social network theories is used in this research. The chosen theories have all been applied in the IS field, however the comprehensive list of social network theories used in the field of communication and organization (Monge and Contractor, 2003) could provide new approaches to ICT adoption as well and could hence be applied to the MFTA.

The findings in this paper have implications for academics interested in ICT adoption. It prompts researchers to conduct additional multi-level research in the area of diffusion and adoption. There is however several barriers to conducting multi-level research (Klein et al., 1999). There's a vast amount of potentially relevant research at both the individual and organizational level of adoption that researchers should take into account when developing multi-level models, however, research at the social network level and inter-organizational level is still relatively small. It is necessary to understand the dynamics that take place at either level of analysis when conducting multi-level research. Also researchers may have interest and skills in conducting either micro or macro level research and they may therefore not be interested in taking the view of both levels, and finally the scoping of the research may pose a problem. However when researchers decide to take on multi-level research, benefits will also appear as this paper has clarified; multi-level research describes some combination of individuals, groups, organizations, industries, and societies thus integrating the micro domain's focus on understanding thoughts, feelings, and behaviors of individuals with the macro domain's broader focus on understanding higher levels dynamics resulting in a richer depiction of the adoption process.

7 Conclusion

This paper outlines a multi-level social network perspective on adoption of the ICT. The Coleman diagram (Coleman, 1990) was adapted into the Multi-level Framework for Technology Adoption (MFTA) to explore how different sub-categories of social network theory can be applied in ICT adoption research to explain the dynamics of individual and network level adoption behavior.

The MFTA suggests that the degree to which ICT is adopted can be explained based on the interaction of individual and network level phenomena. An individual level approach to ICT adoption typically contains a variation of the variables: *attributes*, *beliefs*, *intentions*, and *adoption behavior*, whereas a network level approach posits that the relations among individuals in a network affect the behavior of both the individuals and the network. At the network level, a certain *discourse*, based on individual attributes and beliefs, can be observed that may favor or impede *diffusion* of ICT in the network. The rate of diffusion thus influences individual adoption behavior in the network.

Though social network theory has provided considerable insight into network structures, and phenomena occurring at all levels of analysis, limited multi-level research has been conducted in the area of ICT adoption. The application of four different sub-categories of social network theory provides the following results: 1) *Social network analysis* analyzes both individual level measures and network level measures. 2) *Homophily*-driven theories originate at the individual level but impacts network structures, network discourse, and hence diffusion. 3) Theories of *self-interest and collective action* depart at the individual level though individual level motivations stem from network level benefits. Finally 4) *Contagion* originates at the network level and influences the individuals in a network.

The development of the MFTA is an attempt to create awareness of the benefits of applying a multi-level approach when studying ICT adoption. The framework is a simplification of the influences between the individual and network level, however, the insights from this research demonstrate that multi-level research can provide additional insights into adoption behaviors.

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Abbreviations

ICT = Information and Communication Technology

IOIS = Inter-Organizational Information Systems

IS = Information Systems

IT = Information Technology

TAM = Technology Acceptance Model

TPB = Theory of Planned Behavior

TRA = Theory of Reasoned Action

UTAUT = Unified Theory of Acceptance and Use of Technology

VOIP = Voice Over Internet Protocol

APPENDIX D: ARTICLE 4

Article 4: Tscherning, H. and Mathiassen, L. (2011). "Competing Forces Model of Technology Adoption and Assimilation: Explaining Behaviors in a Group of Mobile Device Users". Submitted to *Journal of the Association of Information Systems* with a revise and resubmit decision. An earlier version of the paper will be published in the proceedings of ECIS 2011.

Competing Forces in Information Technology Assimilation: An Investigation into a Group of Mobile Device Users

ABSTRACT

Despite evidence that competing forces shape assimilation of information technologies (IT), there is currently no comprehensive framework available that explains how such forces impact usage of IT. We identify three dimensions of opposing forces - exploration versus exploitation behavior, individual versus social orientation, and utilitarian versus hedonic objectives - and posit that these play key roles in shaping IT assimilation. On this basis, we develop the Competing Forces Framework (CFF) and validate it by analyzing how a group of fifteen iPhone users assimilated mobile services over a period of seven months. In doing so, we draw on data about the antecedent conditions at the time of iPhone adoption, about interactions within the group and its wider social network, and, about individual usage patterns. Based on the analysis, we describe and explain how the iPhone was assimilated into the group. As a result, we offer two distinct contributions to the literature. First, we present the CFF and related propositions to support further investigation of how assimilation is shaped as social groups adopt new ITs. Second, we offer new insight within the forces that shape assimilation of mobile technology into a social group of users.

Key words: IT assimilation, Competing Forces Framework, mobile device technology

1. INTRODUCTION

Users increasingly access information through mobile devices, and these devices have evolved into becoming an invisible ready-at-hand extension of most human beings. Today's advanced devices combine communication and computing into one multipurpose gadget that provides users with a considerable variety of information technology (IT) services (Bergman 2000). As mobile devices have a one-to-one binding with the user, offer ubiquitous access, and provide a set of both utilitarian and hedonic functions (Hong and Tam 2006), they are rarely separated from their owners, and are in use, or ready for use, at all times. As a result, mobile devices are used for both work and leisure purposes, and users' experiences with them can therefore be inconsistent.

Lang and Jarvenpaa (2005, pp. 7) note "*the positive and negative impacts of mobile technology are conceptually inseparable and grow in strength with new releases*". Mobile technology provides communication options that did not previously exist, thereby creating a condition where everyone is close and far away at the same time (Arnold, 2003). Similarly, users of mobile devices often find they are confronted with conflicting consequences, such as new freedoms and new forms of enslavement, experience of control and experience of chaos, feelings of being intelligent and efficient as well as feelings of ignorance or ineptitude (Mick and Fournier, 1998). These paradoxical consequences of mobile technology demonstrate how opposite conditions of usage can exist simultaneously (Quine, 1966).

Hence, users of mobile technology often experience circumstances that prompt them "*to take actions whose consequences clash with their original intentions or expectations*" (Lang and Jarvenpaa, 2005, pp. 9), and such opposing experiences obviously influence their assimilation of these technologies. However, despite competing forces often have been used to study organizational behavior and change in general (Poole and van de Ven, 1989; Cameron, 1986), only little research has been conducted to examine how they influence the behavior of mobile technology users (Mick and Fournier, 1998). Specifically, we identified no research that can help understand how competing forces shape assimilation of IT in general and mobile technology in particular. On this basis, we draw on Quinn and Rohrbaugh (1981, 1983) to develop a Competing Forces Framework (CFF) of how IT assimilation is shaped over time. The framework is validated through a detailed analysis of how its three dimensions of opposing forces - exploration and exploitation behavior, individual and social orientation, and utilitarian and hedonic objectives - shaped fifteen observed users' assimilation of the iPhone over a period of seven months.

In the next section, we review the literature on assimilation and use of IT and mobile technology. We then develop the CFF of IT assimilation and present the underlying research design. Finally, we apply the model to analyze our data from the field study and close by discussing contributions and implications for theory and practice.

2. ASSIMILATION AND USE OF INFORMATION TECHNOLOGY

IT adoption is the result of a decision-making process in which an individual, group, or organization considers using a particular innovation (Rogers, 2003). High adoption rates of an IT indicates considerable impact, however, the long term innovative effects and benefits occur when users subsequently assimilate the IT, make it their own, and embed it within their lives. Assimilation refers broadly to the process of incorporating and absorbing new ideas into an existing cognitive structure. In information systems (IS) research, assimilation is usually constrained to “*the effective application of IT in supporting, shaping, and enabling firms’ business strategies and value chain activities*” (Armstrong and Sambamurthy, 1999, pp. 306). While the IS literature traditionally has maintained this focus on IT assimilation in organizational contexts, Solo (1966) has provided a theoretical explanation of the capacity to assimilate advanced IT into societies. Moreover, the pervasive access to IT has led to an increased focus on IT assimilation by consumers. Following this logic, the extant literature can be summarized distinguishing between IT in general and mobile device technology in particular and between assimilation in organizational contexts and assimilation by consumers (see Table 1).

Focusing on organizational assimilation and use, researchers have for some time known that a new IT may be widely acquired, but only sparsely deployed. Fichman and Kemerer (1997) were, however, the first to introduce the assimilation gap concept and develop a general operational measure derived from the difference between cumulative acquisition and deployment patterns. Purvis et al. (2001) later confirmed that there often exists a significant gap between the adoption and actual assimilation of complex IT. The broader literature on organizational assimilation and use of IT focuses on understanding and explaining outcomes (DeLone and McLean, 1992; Jaarvenpaa and Ives, 1991; Mahmood and Soon, 1991). It is structured into two main research streams; one examining factors influencing assimilation and another developing theoretical frameworks to explain assimilation outcomes. Factors that influence high levels of IT assimilation are quality of senior leadership, sophistication of IT infrastructures, and organizational size (Armstrong and Sambamurthy, 1999) as well as top management championship, strategic investment rationale, and the extent of coordination (Chatterjee et al., 2002). Current theoretical approaches seek to provide predictors of success or failure of IT (Purvis et al., 2001; Fichman and Kemerer, 1997; Gallivan, 2001), and in general offer explanations rooted in the assimilation process from antecedent conditions to assimilation outcomes (Raho et al., 1987; Meyer and Goes, 1998; Wong et al., 1998; Bajwa et al., 2004; Zhu et al. 2006). Sabherwal and King (1991) found that most of these frameworks are rooted in generic business strategies and value chain activities (Porter, 1985, Porter and Millar, 1985). While research on assimilation and use of IT in organizational contexts is comprehensive, assimilation of mobile device technologies in organizations is nearly absent in the literature. One notable exception is Leclercq (2008),

who investigates benefits brought by mobile devices within ten organizations and highlights different factors, such as the role of management, employee empowerment, and personal advantages for employees that favor mobile device appropriation by individuals and thereby lead to organizational effectiveness benefits.

Turning to consumer oriented research, Venkatesh and Vitalari (1987) discuss how households adapt to an emerging IT at the time; personal computers (PC). Interestingly they find that computing at home involves a high degree of work-related emphasis as well as a high degree of child-related usage. In a more recent study, Delaney et al. (2008) attempt to seek common ground among existing theories of technology appropriation in IS research through exploration of the philosophical roots of appropriation based on Marx’s theories and socio-cultural perspectives. While we know little about consumers’ assimilation of IT in general, researchers have recently started to study consumer behavior related to mobile device technologies, including factors affecting assimilation and use of mobile services during the post-adoption stage (Lee et al. 2009), motivations and circumstances surrounding mobile device adoption and use (Sarker and Wells 2003), and enabling and inhibiting criteria for young people’s appropriation of mobile devices (Carroll et al. 2002). Understanding these behavioral traits, researchers have more broadly argued that appropriation of IT is part of the design process and that the design of an IT is only completed through users’ appropriation of it (Carroll et al. 2002). The flexibility of mobile computing can hence be seen as a function of the following appropriation process characteristics: users’ motives, conditions of use, and IT design features (Wiredu 2007). Finally, Bar et al. (2007) review existing theoretical approaches to IT appropriation, re-consider them within the Latin American cultural context, and propose a theoretical framework of the social, economic, and political impact of mobile devices in that context.

Table 1. Literature on Assimilation and Use of Information Technologies		
	<i>General Information Technology</i>	<i>Mobile Device Technology</i>
<i>Use in Organizations</i>	Armstrong and Sambamurthy (1999), Bajwa et al. (2004), Chatterjee et al. (2002), Fichman and Kemerer (1997), Gallivan,(2001), Meyer and Goes (1998), Purvis et al. (2001), Raho, 1987; Sabherwal and King (1991), Wong et al., 1998; Zhu et al. (2006)	Leclercq (2008)
<i>Use by Consumer</i>	Delaney (2008), Venkatesh and Vitalari (1987)	Bar et al. (2007), Carroll et al. (2002), Carroll (2004), Lee et al. (2009), Sarker and Wells (2003), Wiredu (2007)

Overall, there is agreement in the literature that assimilation and use of IT and mobile device technology is an important area of investigation for IS researchers and important insights have started to emerge. Still, there are important gaps in current knowledge. First, we know little about how social contexts

impact mobile device technology usage; Harrington and Ruppel (1999) and Sarker et al. (2005) are among the first to shed some light on this important subject. Second, little research has been conducted on how groups and individuals assimilate IT in organizational contexts. An exception is Wong et al.'s (1998) study revealing that assimilation is significantly higher when multidisciplinary and multifunctional teams are involved. Third, we only found one study focusing on assimilation of mobile device technology in organizational contexts; Leclercq (2008) highlights different factors, such as the role of management, employee empowerment, and personal advantages for employees that favor mobile technology assimilation by individuals. Fourth, while research into consumer adoption of IT is well developed, we still know little about consumer assimilation of mobile device technologies.

Engaging to address these gaps, it is interesting to observe that extant research suggests many competing forces influence assimilation of IT and mobile device technologies. Nippert-Eng (1996) emphasizes the impact of the divide between work and leisure and Palen et al. (1996) study the tensions between work- and leisure-related functions specifically related to mobile devices. In fact, the utilitarian and hedonic functions of contemporary mobile devices create paradoxical intentions of use and these may impact assimilation outcomes. Similarly, mobile device technology creates the paradoxical notion of colleagues and friends being close and far away at the same time (Arnold, 2003), and users of these technologies may more generally find themselves confronted with conflicting consequences, such as new freedoms and new forms of enslavement, experience of control and experience of chaos (Mick and Fournier, 1998). It is therefore not surprising that users of mobile device technologies often experience conflicting situations in which their actions collide with their original intentions or expectations (Jarvenpaa and Lang, 2005). Interestingly, however, there is no research that can help us understand how competing forces shape users' assimilation of IT and mobile device technology.

On these grounds, this research was designed to contribute to IT assimilation research with the dual objective of 1) increasing our knowledge about consumer assimilation of mobile device technology in particular, and 2) developing a model that can help us understand how competing forces shape IT assimilation behaviors and outcomes in general.

3. DEVELOPMENT OF COMPETING FORCES FRAMEWORK

To examine how competing forces shape assimilation of IT, we draw on Quinn and Rohrbaugh's Competing Values Framework (CVF) (1981, 1983). The framework was developed from research conducted on the major indicators of effective organization leading to the conclusion that sustained success of firms had more to do with their values than market forces. The CVF operates with three dimensions of competing values. The first dimension relates to organizational focus and differentiates between an internal emphasis on the well-being and development of people in the organization, and an

external emphasis on the well-being and development of the organization itself. The second dimension relates to organizational structure and represents the contrast between stability and control as opposed to flexibility and adaptation. The third dimension relates to organizational means and ends with emphasis on processes and final outcomes.

While each of the three dimensions involves values that are logically inconsistent, they also highlight empirically co-existing forces that represent recognized dilemmas in organizational life (Aram, 1976). The focus dilemma, people versus organization, argues, on one hand, that individuality should be disregarded because an organization's ultimate goal is getting tasks accomplished; on the other hand, an organization depends on individuals with unique skills and feelings that need to be taken into consideration. The structure dilemma concerns how some social theorists have emphasized authority, structure, and coordination while others have stressed diversity, individual initiative, and organizational adaptability. The third dilemma reflects how organizational means, such as long-term research and development, may conflict with the aim of reaching an end, such as short-term high profit.

This competing values approach offers a useful and robust model for understanding a wide variety of organizational and individual phenomena, including organizational effectiveness (Quinn and Rohrbaugh, 1983), leadership competencies (Yukl, 1989), shared leadership in self-managed teams (Yang and Shao, 1996), organizational culture (Cameron and Quinn, 1999), leadership roles (Parker, 2004), and, approaches to thinking, behaving, and organizing human activity (Quinn and Rohrbaugh, 1981). However, the framework has never been applied to assimilation of IT. Still, the long history, wide applicability, and robustness of the CVF suggest it has potential to explain how competing forces shape assimilation of IT by both organizations and consumers.

In the following, we therefore adapt the CVF to the IT assimilation domain. The purpose of the resulting CFF is to add to current explanations of human behavior in relation to assimilation of IT. The CFF posits that the degree to which IT is assimilated can be explained based on three sets of competing forces for which, we have found evidence in the literature on IT and mobile device technologies as elaborated in the following. The values related to organizational structure have been adapted to IT usage behavior, distinguishing between exploration and exploitation. The values related to organizational focus have been adapted to the shaping of IT usage, distinguishing between individual and social orientation. Finally, the values related to means and ends have been adapted to the objectives of using IT, with a distinction between hedonic and utilitarian objectives.

3.1 EXPLORATION AND EXPLOITATION BEHAVIOR

The first dimension of forces is related to IT users' exploration and exploitation behavior. A central concern in studies of organizational learning is the balancing of exploration of new possibilities and the

exploitation of old certainties (March, 1991). March suggests that exploration involves search, risk taking, experimentation, play, flexibility, discovery and innovation; whereas exploitation involves refinement, choice, production, efficiency, selection, implementation and execution. The dilemma of balancing exploration and exploitation is revealed in distinctions made between learning about new or refining usage of an already known IT. Exploration is a long-term process, with a risky, uncertain outcome, and exploitation by contrast is short-term, with immediate, relatively certain benefits. Organizations and their members face the problem of allocating resources between exploration and exploitation of IT (Baum et al., 2000, Gupta et al., 2007). The same holds true for consumers possessing new IT as they constantly face the choice of exploiting current technologies and services or exploring new technologies or new services related to existing technologies. Giving priority to exploitation over exploration users will stagnate in technological capability, while overly emphasizing exploration will likely lead to high learning costs with little consequence for practical IT use.

The literature reveals several examples of how exploration and exploitation of IT are conducive for organizational growth. Lee et al. (2003) examine under which conditions exploration of a new, incompatible IT drives growth and find that exploration of new IT are more likely to increase growth when there are a significant amount of power users or when an IT is introduced before an established IT takes off. Kane and Alavi (2007) investigate the effects on exploration and exploitation in organizational learning when introducing IT enabled mechanisms, such as email, knowledge repositories of best practices, and groupware.

3.2 INDIVIDUAL AND SOCIAL ORIENTATION

The second dimension of the forces that impact IT assimilation is related to individual and social orientation. Individual orientation refers to assimilation forces resulting from individual behavior within or related to a social group. In contrast, social orientation refers to assimilation resulting from social behavior within or related to a social group. Individual and social orientation has been a research interest in the social psychology field for decades, since researchers (Bovard, 1951; Deutsch and Gerard, 1955) found that individual psychological processes are subject to social influences. Social influence has generally been regarded as the agreement with a visible majority (Jahoda, 1959). Deutsch and Gerard (1955, pp. 629) distinguish between two types of social influence: informational and normative. They refer to informational social influence as “*the influence to accept information obtained from another as evidence about reality*”. Katz and Lazarsfeld (1955), similarly, apply the term information transfer. Deutsch and Gerard (1955, pp. 629), furthermore, refer to the term normative social influence, which covers “*the influence to conform to the expectations of another person or group*”. Normative pressure is also covered by Coleman et al. (1966). Two additional types of social influence are competitive concerns

(Burt 1995), which are expressed through competitive assimilation and usage behaviors, and social learning, which occurs through the observation of neighbors' choices (Tarde et al. 2008).

There are several examples in the literature of how individual and social orientation shape use of IT. It has for example been established that individual adoption within an organization is impacted by the individual's use context; i.e. as employee, as professional, as private user, or as member of society (Scheepers and Scheepers, 2004). In the mobile device technology literature, Tscherning and Mathiassen (2010) show how an individual's social network may influence an individual's decision to adopt mobile devices at a very early stage. Also, Lu et al. (2005) acknowledge that social influences and personal traits, such as individual innovativeness, are potentially important forces. They model and test these relationships in non-work settings relating constructs such as intention to adopt and social influences, and find that social influences significantly contribute to adoption and use of mobile technology. Cambell and Russo (2003) find that through collective sense-making, perceptions and uses of mobile devices are socially constructed in close personal networks, and are more similar within the networks than for the individuals constituting the entire sample. Overall, the literature suggests that when social forces on assimilation of a technology are maximized, the individual intention to behave independently may be reduced; and, when individual forces on assimilation of a technology is maximized, the emphasis may shift away from the social norm.

3.3. UTILITARIAN AND HEDONIC OBJECTIVES

Analyses of IT assimilation must also take into consideration the objectives of users and the means through which they sustain themselves and attain the objectives (Georgopoulos and Tannenbaum, 1957). The third dimension of forces is, hence, related to objectives with an emphasis on the different qualities of assimilation outcomes. Dahlbom and Mathiassen (1993) suggest three quality dimensions of user experience: functional quality, aesthetic quality and symbolic quality; Hassenzahl et al. (2000) identify three similar quality layers: objective quality, subjective quality, and behavioral and emotional quality for consumers; and, based on a literature study, Creusen and Schoormans (2005) identify six quality dimensions: functional, aesthetic, and symbolic quality as well as ergonomic, attention drawing, and categorization quality.

Objectives can also be regarded as productivity-oriented, utilitarian, or pleasure-oriented, hedonic (van der Heijden, 2004). The terms hedonic and utilitarian trace back to the 1950's when motivational studies were a core field in consumer research (Deci, 1975; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982). As argued by van der Heijden (2004), hedonic usage of IT provides self-fulfilling rather than instrumental value to the user, is strongly connected to home and leisure activities, focus on the fun-aspect of using devices, encourage prolonged rather than productive use, and, is intrinsically

motivated. Utilitarian usage of IT provides instrumental value to the user, which implies there is an objective external to the interaction between user and device, such as increasing task performance, and, it is extrinsically motivated (van der Heijden, 2004). In their study, Venkatesh and Brown (2001) observe that decisions driving adoption and non-adoption of personal computers are significantly different; adopters are driven by utilitarian, hedonic and social outcomes from adoption and non-adopters are influenced by changes in technology and fear of obsolescence. Whakefield and Whitten (2006) find that cognitive absorption and playfulness are important antecedents of user beliefs and intention to use mobile devices and, hence, put emphasis on hedonic usage objectives, and finally, Kim et al. (2007) find that mobile users use mobile internet more often for hedonic rather than utilitarian purposes, though the usage divide was fairly small. Table 2 provides an overview of the constructs used in the CFF.

Table 2. Constructs in the Competing Forces Framework

<i>Dimension</i>	<i>Construct</i>	<i>Definition</i>	<i>References</i>
Behavior	Exploration	Learning behaviors that involve search risk taking, experimentation, play, flexibility, discovery and innovation.	March (1991), Baum et al. (2000), Lee et al. (2003), Gupta et al. (2007), Kane and Alavi, (2007).
	Exploitation	Learning behaviors that involve refinement, choice, production, efficiency, selection, implementation and execution.	March (1991), Baum et al. (2000), Lee et al. (2003), Gupta et al. (2007), Kane and Alavi, (2007).
Orientation	Individual	Assimilation forces resulting from individual behavior within or related to a social group during a considered time period.	Bovard, (1951), Burt (1995), Coleman (1966), Deutsch and Gerard (1955), Jahoda (1959), Katz and Lazarsfeld (1955), Lu et al. (2005), Scheepers and Scheepers (2004), Tarde et al. (2008), Tschering and Mathiassen (2010).
	Social	Assimilation forces resulting from social behavior within or related to the social group during a considered time period.	Bovard, (1951), Burt (1995), Coleman (1966), Deutsch and Gerard (1955), Jahoda (1959), Katz and Lazarsfeld (1955), Lu et al. (2005), Scheepers and Scheepers (2004), Tarde et al. (2008), Tschering and Mathiassen (2010).
Objective	Utilitarian	Objectives providing instrumental value to the user, are external to the interaction between user and device; e.g. increasing task performance, and are extrinsically motivated.	Deci, (1975), Hirschman and Holbrook (1982), Holbrook and Hirschman (1982), Kim et al. (2007), Van der Heijden., (2004), Venkatesh and Brown (2001), Whakefield and Whitten (2006).
	Hedonic	Objectives providing self-fulfilling value to the user, are connected to home and leisure activities, focus on the fun aspect, encourage prolonged use of devices, and are intrinsically motivated.	Deci, (1975), Hirschman and Holbrook (1982), Holbrook and Hirschman (1982), Kim et al. (2007), Van der Heijden, (2004), Venkatesh and Brown (2001), Whakefield and Whitten (2006).

3.4 FOUR ASSIMILATION PROCESSES

In the CVF, Quinn and Rohrbaugh (1981, 1983) synthesize the opposing values of organizational focus, organizational structure and means-ends into four epitomes of culture that represent different organizational value profiles. Any given organization can be characterized as having a particular mix of these four archetypical cultures. Similarly, we synthesize the opposing forces of assimilation behavior, assimilation orientation, and objectives in the CFF into four epitomes of assimilation processes. Inspired by Crossan et al.'s (1999) 4-I theory of how exploration and exploitation takes place in organizational learning through intuiting, interpreting, integrating, and institutionalizing, we characterize the four assimilation processes as investigating, interacting, improving, and integrating. Using the CFF we can then depict assimilation of an IT as a particular combination of one or more of the four processes,

however, not necessarily sequential, over time. As detailed in the following (see Figure 1), investigating and improving are individually oriented, while interacting and integrating are socially oriented; investigating and interacting are exploratory, whereas improving and integrating are exploitative; finally, all four processes can have both utilitarian and hedonic objectives.

Investigating is an individually oriented explorative IT assimilation process. Investigating engages individuals in learning about new technological possibilities and is an expression of entrepreneurial behavior (March, 1991). When individual users investigate a new technology, they play with the technology without having specific intentions in mind, they search for new functionalities to meet specific needs, they experiment with known functionalities, and they innovate by adding new functionalities or tailoring the IT to particular situations and needs. Generally, investigating is an open and flexible process in which the IT is present-at-hand (Heidegger, 1927) as the user assesses available and future options. Different users will investigate IT based on individual perceptions and experiences, and the process may, therefore, evoke different types of meaning and lead to different assimilation outcomes for each user (Walsh, 1988).

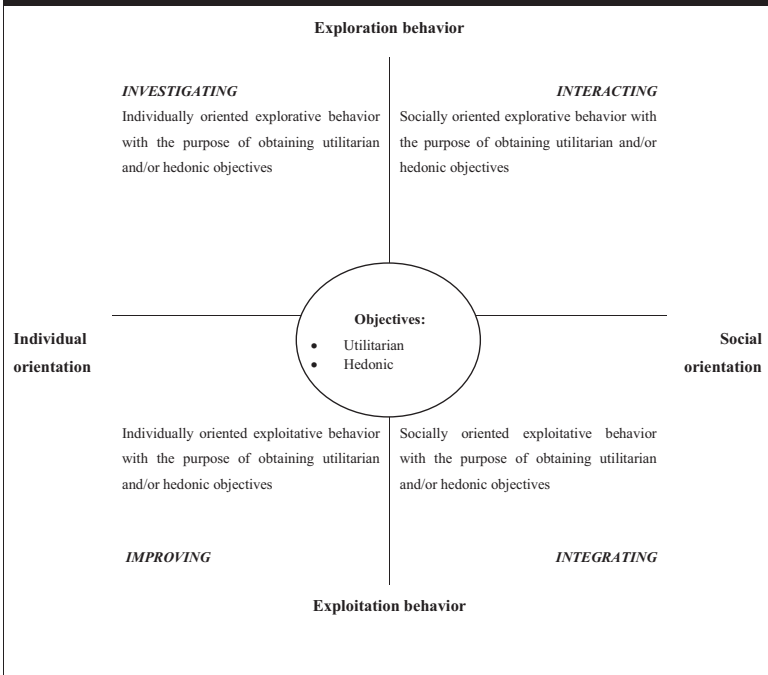
Interacting is also an explorative IT assimilation process, although socially oriented. Users, thus, learn about new technological possibilities through social interaction with other users. Users may interact to find answers to specific questions, or, they may engage socially without any clear intent of learning thereby allowing new possibilities to emerge through conversation or observation. The process involves search, experimentation, play, and learning in social contexts (March, 1991) and experience and knowledge of other users become important sources of learning. Hence, when users interact they do not simply exchange meanings of IT; they also coproduce new meanings attached to the social context of interaction, which may eventually modify their IT assimilation. Interactions between users may, as a result, influence the involved individuals' assimilation of IT in different ways (Walsh, 1988).

Improving is an individually oriented exploitative IT assimilation process. Improving engages individual users in making better use of old certainties (March, 1991) as they routinize technological capabilities through practice. When individual users improve their usage of an IT, they select certain functionalities as targets, they refine the use of these through actual usage, and their intention is to execute the functionalities efficiently and effectively as part of their active repertoire of capabilities. Generally, improving is a dedicated implementation process in which the IT moves from being present-at-hand to being ready-to-hand (Heidegger, 1927). As users engage in improving their use of an IT, outcomes can be expected to vary depending on each users intentions, their actual needs, and the efforts they put into the process.

Integrating is a socially oriented exploitative IT assimilation process. This process integrates the IT into the individual's social context by developing a shared understanding in the context and by assimilating the IT through coordinated action, coherent selection, refinement, and implementation (March, 1991). Hence, a shared practice and a collective mind (Weick and Roberts, 1993) develop and the IT becomes an integrated continuation of the social context.

It is interesting to note that IT users, in the investigating and interacting processes may view it as present-at-hand (Heidegger, 1927) as they are conscious about the IT and explore it with the sole purpose of discovery, experimentation, and play. In the improving and integrating processes, users exploit well-known functionality individually and incorporate it in their social context and the IT becomes ready-to-hand as it withdraws and becomes "*something in order to*" obtain an objective (Heidegger, 1927, pp. 97). While users in all investigating and interacting processes do not view the IT as present-at-hand and users in all improving and integrating processes do not experience the IT as ready-to-hand, the line of reasoning is that many consumer ITs have become incorporated in the everyday lives of users who are no longer cognizant about them. Figure 1 offers a visualization of the CFF.

Figure 1. The Competing Forces Framework



4. RESEARCH METHODOLOGY

To validate the CFF of IT assimilation, we conducted a field study. A field study is useful, when researchers wish to apply scientific methods to examine an intervention in naturally occurring environments rather than in the laboratory (Harrison and List, 2004). The reported study was part of a larger project investigating the future of mobile devices and services involving two PhD students, one postdoc, and one professor.

4.1 RESEARCH DESIGN

The study was conducted in Denmark to understand how fifteen mobile users assimilated an iPhone over time. Denmark is among the leading countries in use of mobile technologies (Economist Intelligence Unit, 2008) and therefore an appropriate venue for studying assimilation of the iPhone. The iPhone had just been introduced on the Danish market and the novelty factor was expected to engage the subjects. Furthermore, the iPhone combines multiple gadgets into one and represents an ideal mobile device for

studying assimilation behaviors. Purposive sampling provided access to rich data about the participants, their interactions with each other, and their usage behavior. Purposive sampling is primarily used in qualitative studies to select individuals based on a specific purpose associated with answering the research question (Teddlie and Yu, 2007) and extending emergent theory (Eisenhardt 1989). In this study, the aim was to gain access to a group of individuals that were part of the same social group to examine how competing forces influenced assimilation of the iPhone over the considered time period.

We selected participants based on evaluation of 44 students enrolled in the same master's program at a Danish University. All potential participants completed a survey on the topic and on specific diversity criteria. The selected fifteen participants consisted of seven males (47%) and eight females (53%) ranging from 22 to 51 years of age. The participants also represented differences in family demographics, income level, Scandinavian nationality, and experience with mobile devices. Overall, this opened for examination of individual variations in attitudes, experiences, and habits related to assimilation of the iPhone.

Selecting participants from the same social group allowed us to examine the impact of social forces. The group consisted of master students in the same program that took the same courses over a period of two years, who had started their studies two months prior to the beginning of the study. The fifteen participants were given a free iPhone for the duration of the study, including a subscription plan with the network provider. If they chose to use the phone outside the subscription plan they would have to finance it themselves. The reason for this decision was to mitigate false usage by prompting participants to think about usage as if they were to pay themselves. Table 3 summarizes the demographic variables of the participants.

Table 3. Demographics of Participants			
<i>Demographic construct</i>	<i>Variable</i>	<i># of participants</i>	<i>% of participants</i>
Sex	Female	8	53%
	Male	7	47%
Age	< 30 years	10	67%
	30 > < 40 years	4	26%
	40 > < 51 years	1	7%
Income	< 6000 DKK	5	33%
	6000 DKK > < 10000 DKK	5	33%
	10000 DKK > < 15000 DKK	4	27%
	No reply	1	7%
Nationality	Danish	13	86%
	Norwegian	1	7%
	Swedish	1	7%

4.2 DATA COLLECTION

Data collection took place from mid-September 2008 to end of March 2009. In order to get rich insights into the assimilation process, the study was cross-sectional with multiple snapshots (Orlikowski and Baroudi, 1991), including thirty semi-structured interviews, three surveys, three focus group interviews, and fifteen 24-hour diaries. Furthermore, data from the network operator were collected in order to analyze actual usage behavior. The resulting opportunities for data triangulation provide strong support in the investigation of the research objectives (Eisenhardt 1989). The triangulation of data had several advantages: the interviews, diaries, and focus groups increased the likelihood of capturing the users' subjective connotations and their constructed reality to uncover how and why they created meaning and to what they gave status. The three surveys conducted during the period provide insight into beliefs, intentions, and usage behavior and the changes that occurred over time. Table 4 provides an overview of our data collection during the seven-month period.

<i>Data collection method</i>	<i>Participants</i>	<i>Time (MM-YYYY)</i>	<i>Duration (H:M)</i>	<i>Content</i>
Semi-structured interviews #1	15	11-2008	0:20	Adapted user interface of the iPhone, functions and applications used.
Semi-structured interviews #2	15	02-2009	0:20	Usage behaviors.
Survey 1: pre-study	15	08-2008	0:39	Demographics, emotions, social network, PC usage, mobile device usage, the iPhone.
Survey 2: mid-study	15	12-2008	0:35	
Survey 3: end-of-study	15	03-2009	0:50	
Focus group #1a	4	11-2008	1:45	Functional, social, emotional, epistemic, and conditional value. Ranking of values.
Focus group #1b	5	11-2008	1:45	
Focus group #1c	5	11-2008	1:45	
Diaries	15	11-2008	24:0	Usage within a 24 hour period.
Actual usage data	15	08-2008 – 03-2009	Whole period	Call, text messaging, and access to mobile internet.

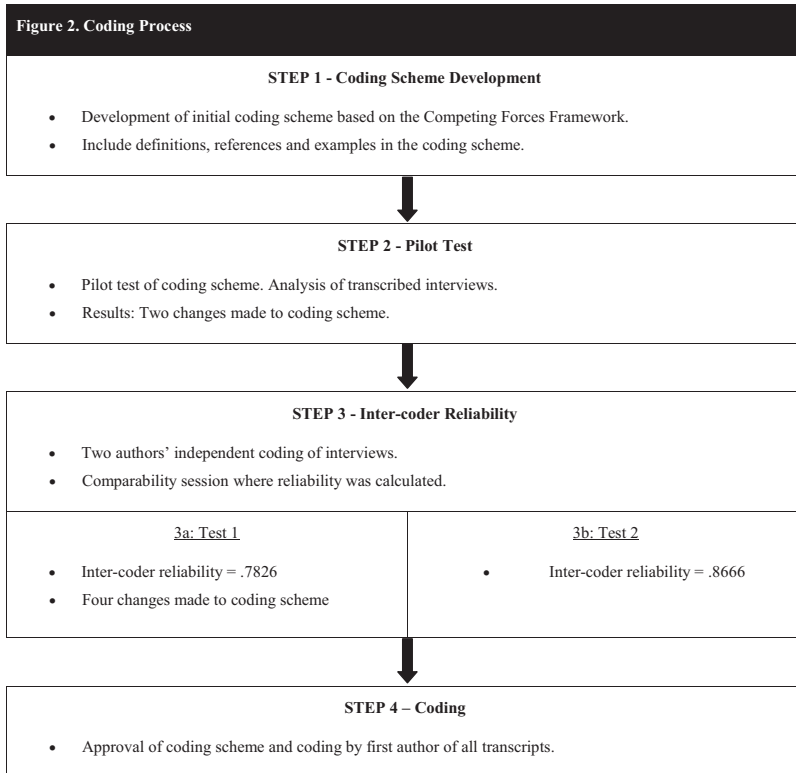
The first survey was paper-based to decide which respondents were offered participation in the study, while the second and third surveys were available to respondents via the survey web site *SurveyMonkey*. All interviews were tape-recorded with the permission from the respondents and were then transcribed. The interview guides included different contents of interest to individual researchers and relevant theories (see Table 4). Interviews lasted approximately 20 minutes and the focus group interviews lasted between 90 and 120 minutes. During the interviews, one researcher was leading the interview and discussions, while one researcher was taking notes. The data collection was organized into three phases; the probing phase from September to November 2008, the informed phase from December 2008 to January 2009, and the proficient phase from February to March 2009. This division allowed us to detect changes in assimilation patterns. Table 5 shows the type of data collected over time.

Table 5. Timeline of Data Collection							
	09 2008	10 2008	11 2008	12 2008	01 2009	02 2009	03 2009
<i>The probing phase</i>							
Survey 1: pre-study	x						
Diaries		x					
Semi-structured interview #1			x				
<i>The informed phase</i>							
Focus group #1a			x				
Focus group #1b			x				
Focus group #1c			x				
Survey 2: mid-study				x			
<i>The proficient phase</i>							
Semi-structured interview #2						x	
Survey 3: end of study							x
Actual usage data	x	x	x	x	x	x	x

4.3 DATA ANALYSIS

Data were analyzed using *Atlas.Ti*. Specific coding principles were adopted to establish common ground before coding began; quotes had to be specific for the chosen code, and therefore not all quotes should necessarily be coded; and, consistency in the coding was required and for certain top-level codes one or more sub-level codes should be coded as well. A coding scheme was then developed based on the following four-step procedure as illustrated in Figure 2.

Figure 2. Coding Process



First, the two authors identified, discussed and agreed upon an initial coding scheme based on the developed CFF. This scheme was based on the dimensions, constructs, and definitions in Table 2 and included exemplar quotes as illustrations of each code. Second, a pilot was conducted. During this pilot, one author independently coded one interview. The coded interview was reviewed by the second author and discussed to resolve any differences; as a result, the coding scheme was revised to increase clarity, conciseness, and applicability. Third, an inter-coder reliability test was conducted (Tinsley and Weiss, 1975, 2000). As observed by Singletary (1993, pp. 294) “*if the coding is not reliable, the analysis cannot be trusted*”, and inter-coder reliability is the most well-known measurement for determining whether independent coders evaluate a text and reach the same conclusion. It measures “*the extent to which different coders tend to assign exactly the same rating to each object*” (Tinsley and Weiss, 2000, pp. 98). The inter-coder reliability test involved the two authors independently coding interview transcripts and comparing results based on Neuendorf’s suggestion (2002) that “*coefficients of 0.90 or greater would be*

acceptable to all, .80 or greater would be acceptable in most situations, and below that, there exists great disagreement” (pp. 145). The inter-coder reliability for the first test was measured to .7826. The authors then resolved any differences and revised the coding scheme. The inter-coder reliability in the second test was measured to .8666. Fourth, the coding scheme was approved, implemented into *Atlas.Ti*, and, the first author then coded all transcripts. The coding resulted in 1293 coded quotes from the analyzed interview, focus group interviews, diaries, and surveys – with some quotes covering more codes. Table 6 shows an overview of coded quotes per user.

Table 6. Coded Quotes

Dimension	<i>Behavior</i>		<i>Orientation</i>		<i>Objectives</i>		<i>Number of Codes</i>
	<i>Exploration</i>	<i>Exploitation</i>	<i>Individual</i>	<i>Social</i>	<i>Utilitarian</i>	<i>Hedonic</i>	
A	12	23	10	7	13	17	82
B	10	26	10	7	16	17	86
C	13	18	22	7	18	22	100
D	5	10	7	1	5	5	33
E	11	34	21	5	17	27	115
F	18	23	23	10	20	19	113
G	21	41	33	8	35	24	162
H	6	6	10	2	6	7	37
I	11	25	22	3	14	10	85
J	8	20	9	3	8	15	63
K	10	18	15	1	7	14	65
L	22	35	25	9	24	26	141
M	13	31	10	1	9	34	98
N	3	16	6	6	11	8	50
O	10	20	6	6	7	14	63
<i>Number of Codes</i>	173	346	229	76	210	259	1293

5. RESULTS

In the following, we present two separate analyses of the data. First, we provide aggregate results along the three dimensions of competing forces identified in the CFF - behavior, orientation, and objective –

and reveal changes in assimilation patterns across the probing, the informed, and the proficient. Second, we analyze how users engaged in the four identified assimilation processes – investigating, interacting, improving, and integrating.

5.1 ANALYZING COMPETING FORCES

5.1.1 OBJECTIVES: UTILITARIAN VERSUS HEDONIC

The analysis of the fifteen iPhone users suggests that their utilitarian objectives can be categorized into standard functionality, network, work, and other (see Table 7). *Standard* functionality is an integral part of the iPhone and was used frequently by the observed users. These are the call function, text message function (SMS), calendar, email, and browser. *Network* covers basic communication functionality for utilitarian purposes, e.g. Skype for conducting inexpensive calls and modem for accessing the Internet. *Work* refers to functions that improve work-related use of the iPhone, such as the remote desktop, which allows users to access their desktop computer at home, file sharing, using Microsoft Office to access documents associated with work, and, finally dictionaries or translators. *Other* covers additional functionality that can be used for utilitarian purposes, such as maps, alarm clock and password saver.

The analysis of hedonic use of the iPhone was mainly related to music, entertainment, Web 2.0, camera, and other (see Table 7). *Music* includes listening to music on the integrated iPod and listening to information-related content, such as radio, podcasts and audio books. Other downloaded applications provide the possibility of controlling the stereo at home or of recognizing music tunes intercepted at any location. *Entertainment* objectives cover pure entertainment, such as watching YouTube clips or downloaded movies, as well as downloading TV guide applications and games. *Web 2.0* technologies include Facebook as the most popular application, LinkedIn and Twitter. Also, Skype and Messenger were used to chat with friends, and information was accessed through Web 2.0 websites – including Wikipedia and del.icio.us. Furthermore, the *camera* function was widespread and several users downloaded a video camera application. The last category covers other applications, such as health related applications, e.g. for run-tracking and food monitoring.

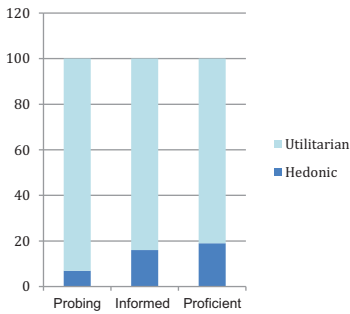
Table 7. Mobile Use Objectives			
<i>Utilitarian Objectives</i>		<i>Hedonic Objectives</i>	
<i>Standard</i>	<ul style="list-style-type: none"> • Call • Short Message Service (SMS) • Calendar • Email • Browser 	<i>Music</i>	<ul style="list-style-type: none"> • iPod music playlists • Information: Radio, podcasts, audio books • Functionality: Stereo remote, music recognition
<i>Network</i>	<ul style="list-style-type: none"> • Voice over Internet Protocol (VoIP) • Modem 	<i>Entertainment</i>	<ul style="list-style-type: none"> • TV: YouTube, movie download, TV guide • Games: Puzzles, adventure, sports • Reading (non-work)
<i>Work</i>	<ul style="list-style-type: none"> • Remote desktop client • File Sharing • Microsoft Office • Reading (work) • Dictionaries 	<i>Web 2.0</i>	<ul style="list-style-type: none"> • Social media: Facebook, LinkedIn, Twitter • Chat through Messenger, Skype • Information: Wikipedia, del.icio.us
<i>Other</i>	<ul style="list-style-type: none"> • Maps • Password Saver • Alarm • Subway map 	<i>Camera</i>	<ul style="list-style-type: none"> • Camera • Camera zoom • Video camera
		<i>Other</i>	<ul style="list-style-type: none"> • Sport • Food

The surveys provided access to how perceived functional usage changed during assimilation of the iPhone, revealing that users mainly used their mobile device for utilitarian purposes though they used it increasingly for hedonic purposes over the three phases of assimilation. However, when asked how much of their mobile device usage was for personal or social activities and how much for work- or school-related activities they responded that their usage was mainly for personal activities – see Table 8. This result implies that even though the actual usage data reveal users primarily used their mobile device for utilitarian purposes, their perception was that they only used it for work approximately twenty five percent of the time over the seven-month period.

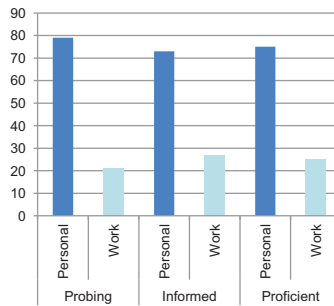
Table 8. Mobile Usage Over Time

<i>Utilitarian Usage</i>				<i>Hedonic Usage</i>			
Phase	<i>Probing</i>	<i>Informed</i>	<i>Proficient</i>	Phase	<i>Probing</i>	<i>Informed</i>	<i>Proficient</i>
Standard	85%	67%	67%	Music	1%	1%	3%
Communication	0%	1%	3%	Entertainment	2%	6%	6%
Work	1%	5%	2%	Web 2.0	1%	5%	7%
Other	7%	11%	9%	Camera	3%	4%	3%

Actual Usage over Time

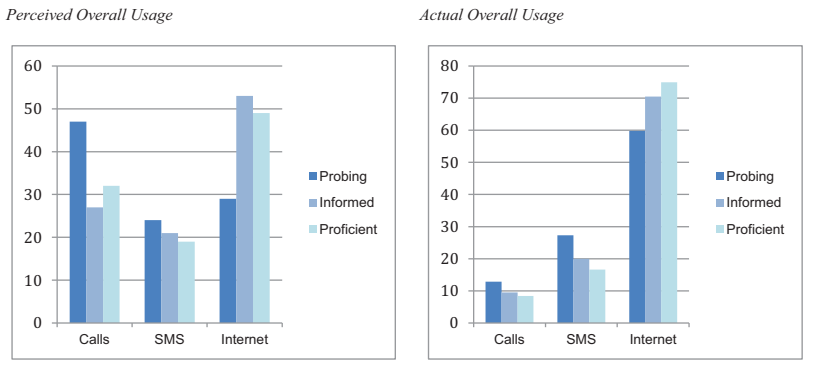


Perceived Usage over Time



The actual usage data and perceived usage data allow for a comparison of the primary functions of phone calling, text messaging and Internet access. As the iPhone is a new type of mobile device that allows easy access to the Internet through the large touch screen as well as the App store with several hundred thousand third party applications, it is of interest to observe whether Internet usage changed over time and how overall usage changed over time within these core functions. As summarized in Table 9, the results show that the users perceived their overall usage to be high in the probing phase, to decline in the informed phase, and, then to increase again in the proficient phase. The actual usage pattern, however, shows that over time phone calls, text messages and Internet access increased. The observed mobile users, hence, embraced the new utilities offered by the iPhone extensively and beyond their own perception of usage level over time.

Table 9. Overall Mobile Usage Over Time



5.1.2 ORIENTATION: INDIVIDUAL ORIENTATION VERSUS SOCIAL

As expected, individual orientation was observed most often with users. As the mobile device is very personal, and mobile use is rather individual, assimilation of the iPhone occurred according to users' beliefs and immediate use objectives. However, as the iPhone is a new type of mobile device with countless possibilities, social orientation was observed regularly. Social orientation was observed at different levels and individual users also experienced they influenced others.

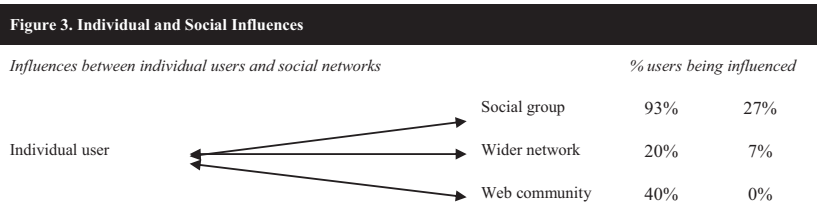


Figure 3 shows the observed individual and social influences. Individuals could be influenced by the group of fifteen users, the wider network of relationships outside the group, and, through web communities. Similarly, individuals could themselves influence the social group and their wider network. The analysis reveals 93% of the users asserted they were influenced by the group of fifteen in their usage behaviors, while only 27% claim to have influenced other members of the group; 20% of the users were influenced by their wider network, while 7% maintain they influenced their wider network; and, 40% of the users were influenced by a web community, while none of the users believe they influenced a community.

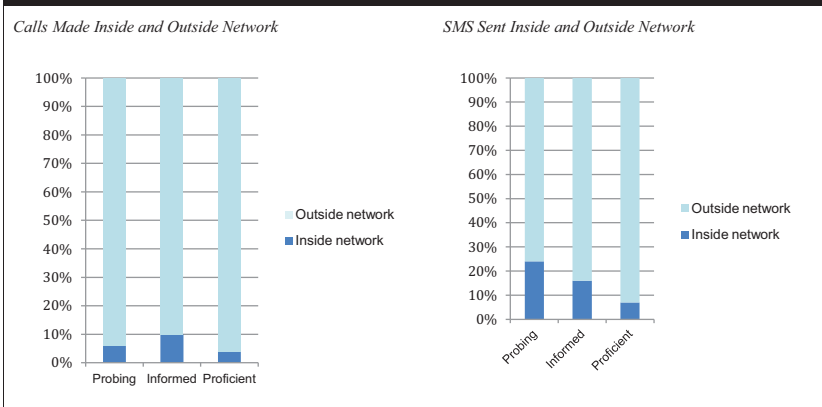
Table 10. Social Orientation

<i>Social Influence</i>				<i>Group Behavior</i>	
<i>Informational</i>	<i>Normative</i>	<i>Competitive</i>	<i>Learning</i>	<i>Fact finding</i>	<i>Entertainment</i>
93%	0%	53%	27%	27%	33%

When looking closer at the types of social influence experienced by the users, it is evident that almost all of them – 93% – experienced informational influence, 0% experienced normative influence, 53% considered competitive concerns, and 27% were subjected to social learning. While these social influences of individual group members are interesting, it is also relevant to consider group situations where the iPhone was used with two or more users involved. We found evidence of such group usage among the fifteen users, as 27% explicitly stated they used the iPhone as a fact-finding tool when discussing with the group or wider network. 33% of the users noted they listened to music, watched YouTube or TV, or played games together with other members of the group or wider network.

Apart from the above results, the data provide insights into mediated interactions with other group members during the assimilation period. The actual phone usage over time reveals how often the fifteen users interacted with each other through phone calls and text messages, and how large a percentage of their calls and text messages were sent within the group. These numbers could reveal whether the strength of the ties in the group changed over time or whether changes in assimilation behavior could be attributed to the stronger relations within the group. The actual network data – see Table 11 - reveal that a very small percentage of calls occurred within the social group; the percentage of calls within the group resembles a bell curve: in the probing phase, on average 6% of all calls were made within the group and 94% of all calls were made to people outside the group. In the informed and proficient phases, 10% and 4% respectively of all calls were made within the group. While a higher number of text messages were sent within the group, these still represent a rather small and declining percentage of all messages; in the probing phase, 24% of all sent text messages were sent inside the network, and in the informed and proficient phase, the numbers had declined to 16% and 7% respectively.

Table 11. Call and SMS Inside and Outside Social Network Over Time



The call data, furthermore, reveal that as many as 33% did not call anybody in the group at all during the assimilation period; 33% called others in the group only 1% of the time; and, 33% called others in the group approximately 7-8% of the time. For text messaging, the data show that 33% did not text any of the others in the group during the considered assimilation period. Of these 33%, 27% overlap with those that did not call others either. Hence, 27-33% primarily interacted with the rest of the social group through email or through face-to-face interactions while on campus.

5.1.3 BEHAVIOR: EXPLORATION VERSUS EXPLOITATION

The analysis of the usage behavior of the fifteen users reveals different types of exploration and exploitation behaviors with the aim to create a relevant mobile device with instant access to personalized information and functions – see Table 12. While exploring the iPhone, users conducted different types of explorative behavior. 27% jailbroke the iPhone, which refers to the removal of usage and access limitations, imposed by the network provider. While the jailbreak of the iPhone allows users to download all types of applications and personalize the iPhone to a large extent, it is a process that takes skill and effort. 7% stated they were looking into the development of applications themselves. The development of applications requires programming skills and the ability to use the software development kit (SDK) provided by Apple. Other explorative activities observed were the downloading from the App Store, which all users did and some users decided to import private content to the device, and 67% of users conducted proactive investigative behavior to make the iPhone fit their needs even more.

Exploitation behaviors, local search, experiential refinement and reuse of existing routines, were displayed through the set-up of email accounts. All users had set up their iPhones to contain their personal

email account while the majority of users had several accounts including personal email, school email and work email. Furthermore, all users had transferred music from their computers to the iPhone and whereas 47% used their iPhone to listen to music in the probing phase, 87% used in the informed phase, and 100% used the iPhone as their mp3 player in the proficient phase. Finally, several users had changed the look of the wallpaper and the buttons according to themes inspired by e.g. movies.

A barrier for further exploration and exploitation was, however, observed. As the users would have to deliver the iPhone back to the project after the study period, several users perceived this as an impediment to pay for applications – even though they had encountered applications they were willing to pay for.

Table 12. Exploration and Exploitation Behaviors

<i>Exploration</i>				<i>Exploitation</i>			
	<i>Probing</i>	<i>Informed</i>	<i>Proficient</i>		<i>Probing</i>	<i>Informed</i>	<i>Proficient</i>
iPhone jailbreak	20%	7%	0%	Mail set-up	100%	0%	0%
Development of apps	0%	7%	0%	Add music	100%	67%	33%
App Store downloads	100%	100%	100%	Changing interface	100%	33%	33%
Import of private content	7%	0%	0%				
Investigative behavior	67%	47%	0%				

When asked, users explained that they were playing frequently with the iPhone and exploring opportunities in the probing phase, however, in the later stages they were using the iPhone they had configured, and they only occasionally frequented the App Store and changed the interface and functionality of the device.

5.2 ANALYZING ASSIMILATION PROCESSES

The fifteen users were prompted to adopt the iPhone, and subsequently assimilated it following different behavioral patterns. In the following, we analyze how the users activated the four types of assimilation processes as they started to use the iPhone. Table 13 summarizes observed ways in which users engaged in the four assimilation processes.

Table 13. Types of Assimilation Processes

<p><i>Investigating</i></p> <p>Individually oriented explorative behavior with the purpose of obtaining utilitarian and/or hedonic objectives.</p> <ul style="list-style-type: none"> • Application download • Jailbreaking • Application development 	<p><i>Interacting</i></p> <p>Socially oriented explorative behavior with the purpose of obtaining utilitarian and/or hedonic objectives.</p> <ul style="list-style-type: none"> • Interaction as a mean for learning • Learning through interaction
<p><i>Improving</i></p> <p>Individually oriented exploitative behavior with the purpose of obtaining utilitarian and/or hedonic objectives.</p> <ul style="list-style-type: none"> • Personalization of device • Refine settings • Executing existing functionalities 	<p><i>Integrating</i></p> <p>Socially oriented exploitative behavior with the purpose of obtaining utilitarian and/or hedonic objectives.</p> <ul style="list-style-type: none"> • Integration in social contexts • Non-integration in other social contexts

5.2.1 INVESTIGATING PROCESS

During the three phases of assimilation, users engaged in extensive investigative behavior. They demonstrated immense interest in playing with the iPhone individually with no specific intentions in mind. As one user expressed, he “*just wanted to sit and play with the iPhone to see what it was capable of*” (E: male user). The most common investigative behavior focused on the possibilities offered through the device itself and the App Store; users downloaded numerous free applications from the App Store, deleted them again, downloaded new applications, repositioned applications to be able to find the most often used applications on the first page and the lesser used applications on the last page. These applications had both utilitarian and hedonic purposes. This behavior was very evident in the probing phase of the observed assimilation, but it declined in the informed and proficient phases as users became confident with the device. A user asserted “*my investigation of new possibilities with the device has leveled off. In the beginning I was searching and playing. Now [six months into the observed assimilation] I mostly investigate functionalities, and download apps, if I hear or read about something interesting – no more than once every two weeks*” (C: female user). Moreover, based on their established cognition, each user investigated the iPhone differently, and some users engaged even further into the exploration of new possibilities of the iPhone; they jailbroke their iPhones as they were “*tired of the restrictions imposed by Apple*” (H: male user) on the device. Others again considered jailbreaking the iPhone but didn’t as the device was “*government property*” and jailbreaking would therefore be inappropriate (L: male user). Finally, one user with proficient technical skills was “*looking into the development tools to learn how to develop apps for the iPhone*” (G: male user). The analysis of investigative processes reveals that users were consciously exploring the iPhone as a present-at-hand device to learn about the new technological possibilities it offers.

5.2.2 INTERACTING PROCESS

While users engaged into individual investigating processes, they also displayed social interaction within and outside the social group throughout the assimilation of the iPhone. Two noticeable interacting processes were observed frequently between users: interaction with a clear intent to learn about specific functionalities of the iPhone; and, interaction without any intent of learning specific functionalities, but where new uses emerge through the interaction process. Users experienced several minor problems trying to learn to use the new interface, as the iPhone was different from previous devices. Some users struggled with music transfer options, as they were not able to transfer music directly from their computer to the iPhone without creating a playlist first, and others struggled with the text messaging function, as they were not able to find the appropriate letters on the keyboard when they had to write in Danish. These users interacted with other users from the group to solve minor problems and in most cases with success. As one user explained: *“I used the keyboard on the iPhone, but I couldn’t get the Danish æ, ø, or å to become visible. I asked [G] who I knew had been using a Danish keyboard, and he showed me how to use it”* (K: female user). Transmission of iPhone uses also emerged through interaction with users who had not considered the iPhone to be used for that specific purpose; e.g. *“Somebody recommended the e-reader to me, so I could always have certain e-books with me, such as an English grammar rule book, which is useful. The e-reader on the iPhone isn’t the convenient way to read, but for this particular purpose, I found it very useful”* (D: female user). The above examples of the interacting process show how social interaction enabled new uses of the iPhone as supplements to users’ individual investigation.

5.2.3 IMPROVING PROCESS

During the observed assimilation, users engaged in improvement processes to exploit known functionality on the iPhone. Improvements of known functionality were evident in all phases of assimilation. Improving the iPhone was considered quite easy, but a *“strenuous task as the device is so personal. And it is becoming even more personal the longer I use it. It contains my whole life”* (B: female user). One user decided to import movies to the iPhone to show his kids when commuting: *“I tried changing some DVD’s to mp4 format adding them to the device [...] I was curious and wanted my kids to enjoy it as well”* (H: male user). In the two later phases, users had configured the iPhone to fit most of their needs, and they, hence, spent more time on refining settings and implementing small changes to the interface, such as deleting old unused applications, moving existing applications around, and executing applications on the device; e.g., playing games to improve the game score or adding their home address to the maps application. One user explained: *“I moved the four applications that I use most often to the bottom of the front page. I find that to be the most logical place for them.[...] The four most used applications are the call function, SMS, notes, and the iPod”* (L: male user). In most cases, the improving process enabled

users to evolve and embrace a personal device that fitted each individual user's needs: "*I use maps quiet often. When adding people I see often to my contact list, I add their address as well – then by clicking two times in the maps function, the route from my current location to my target location is estimated right away*" (O: female user).

5.2.4 INTEGRATING PROCESS

The integrating process manifested when users incorporated the iPhone into their social context to share usage practices with other users. Several users expressed how the iPhone became integrated into their social context. As a result, shared understanding and practice of use developed late during the observed assimilation. A user explained: "*When I socialize here in Copenhagen, I do not experience that much attention any longer when I bring out my iPhone [six months into the observed assimilation], however, when I visit my family and old friends in Aalborg, I am the center of attention because I have an iPhone*" (A: female user). The user further explained: "*When I am socializing with my girlfriends and we are discussing a topic, where we end up disagreeing, we bring out our iPhones and look up the correct answer to the question being discussed. We do this while staying together at the table, we don't have to leave to turn on the computer, and within minutes, we move on to something else*" (A: female user). Here, the user addresses two social contexts she's involved in. In one context, the iPhone was an interesting technology, which drew attention to her as the owner. In another, the iPhone had become an integrated part and was used without further consideration. Another user stated the iPhone was always with him: "*When I go out I bring it, and I use it everywhere – at the university when discussing assignments, at work when I'm in a meeting and get bored, and even when I do my laundry in the evening - then I use it while I'm waiting for my laundry to finish*" (L: male user). While the iPhone might not have become an integrated part of all users' social context, most users embraced it and felt "*terrible*" that they had to hand in the device after the study period.

5.3 ASSIMILATION PROCESS PATTERNS

The iPhone users can be categorized into low, medium, or high assimilation users as a reflection of the number of different services they used on average (considering the services in Table 7). The user, who assimilated the lowest number of different services in one phase, assimilated three services and the user, who assimilated the highest number of different services in one phase, assimilated thirteen services. The user with the lowest average assimilation of different services across the three phases assimilated five services on average, and the person with the highest average over the three phases, assimilated ten. Based on the average numbers, we have identified four low assimilation users, seven medium assimilation users, and four high assimilation users. Based on these distinctions, Table 14 shows how the three user groups engaged over time.

Table 14. Number of Users Engaging into Assimilation Processes Over Time

	<i>Probing</i>		<i>Informed</i>		<i>Proficient</i>	
	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
<i>Assimilators</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Investigating	All	All	All	All	All	All
Interacting	Most	Few	None	Few	None	None
Improving	All	Most	Most	All	Most	All
Integrating	None	None	None	None	None	Most

These data reveal several noticeable assimilation patterns. First, all users engaged in the investigating process in all phases of the observed assimilation. That is, all users explored the iPhone individually to obtain new knowledge and achieve objectives from when they adopted the iPhone and throughout the assimilation process. Investigation activities, however, declined so that users engaged more often in the probing phase than in the informed and proficient phases. Second, most low assimilation users engaged in an interacting process with other users in the probing phase, whereas medium and high assimilation users engaged modestly in interacting in the probing and informed phases, and none of the users engaged in the interacting process in the proficient phase. This implies that those users with higher confidence in using the iPhone needed less social interaction than those with lower confidence. Also, there was less social interaction over time across all users as they became more confident with the device; everybody seemed to have reached a confident level of using the iPhone in the proficient phase. Third, all users carried out some improving activity in all phases of assimilation. This indicates that advanced technologies, such as mobile devices with considerable personalization features, will be improved continuously over time as the needs of users change. Fourth, only the high assimilators achieved integrated usage of the iPhone within their social context and this only occurred in the proficient phase. This implies that it took time – even for a pervasive technology – to become socially integrated.

These four distinct assimilation patterns observed in the group of iPhone users provide evidence for how the four assimilation processes were activated over time and by different types of users during assimilation of the technology. While the processes were not activated during all phases and in a specific sequential order, most iPhone users engaged in all four processes at some point following distinct patterns that reflected their assimilation levels and needs.

6. DISCUSSION

Assimilation and use of IT is an important area of investigation for IS researchers. While important insights have started to emerge, little research has been conducted on how groups and individuals

assimilate IT in organizational contexts, and we still know little about how social contexts impact mobile device technology usage across organizational and consumer contexts. Engaging to address these gaps, we observed that extant research suggests competing forces influence assimilation of IT and mobile device technologies (Arnold, 2003; Jarvenpaa and Lang, 2005; Mick and Fournier, 1998; Nippert-Eng, 1996; Palen et al., 1996). Interestingly, however, we found no research that can help us understand how competing forces shape users' assimilation of IT. On these grounds, this research was designed to contribute to IT assimilation research with the dual objective of 1) increasing our knowledge about consumer assimilation of mobile device technology in particular, and 2) developing a model that can help us understand how competing forces shape IT assimilation behaviors and outcomes in general.

6.1 CONSUMER ASSIMILATION OF MOBILE DEVICE TECHNOLOGY

In response to the first objective, we offer new insights into the forces that shape assimilation of mobile device technology into a social group of fifteen iPhone users. Based on a cross-sectional field study with multiple snapshots (Orlikowski and Baroudi, 1991), we analyzed iPhone assimilation over a seven month time period to explore how three dimensions of competing forces shaped individual assimilation outcomes. We thereby add to the few studies (Harrington and Ruppel, 1999; Sarker et al., 2005) about how social contexts impact mobile technology use and to the few studies on consumer assimilation of IT and mobile device technology (Bar et al., 2007; Carroll et al., 2002; Carroll, 2004; Delaney, 2008; Lee et al., 2009; Sarker and Wells, 2003; Wiredu, 2007). Confirming the important role played by social contexts in users' assimilation of ITs, our study is the first to show how assimilation behaviors and outcomes are shaped in complex interactions between users' learning behavior, their orientation within the social context, and their objectives.

Specifically concerning objectives, our study reveals that while users perceived most of their iPhone usage had utilitarian objectives, the iPhone was mainly used for personal purposes. Hedonic objectives increased during the assimilation process, while the level of personal versus work-related use remained the same. Van der Heijden (2004) found that for hedonic IT, perceived enjoyment and perceived ease of use are stronger determinants of intention to use than perceived usefulness. As the iPhone is an IT with a vague boundary between utilitarian and hedonic use objectives, users seemed to value both enjoyment, ease of use, and usefulness of the device. The results furthermore show diversion between users' perception of their iPhone usage compared with their actual usage patterns; while users perceived their call, SMS, and Internet usage to be high in the probing phase, decrease in the informed phase, and then increase again in the proficient phase, their actual usage reveals an increase in usage over time. Hence, the users' perceptions of iPhone usage do not correspond to their actual usage both in terms of objectives and volume.

Concerning assimilation orientation, our study reveals an individually oriented dominance in usage patterns. Users take on the iPhone as a personal device integrated into their lives and as such it needs to fit each user individually. However, users experienced informational influence by the social group and their wider networks, competitive concerns, and to some extent learning. Interestingly, none of the users experienced normative influence. In several theories used to explain adoption of technologies, such as the Theory of Reasoned Action (Ajzen and Fishbein, 1980) and the Theory of Planned Behavior (Ajzen, 1985), subjective norm as independent variable help explain behavioral intention to adopt. Our results suggest that following the adoption decision, individuals assimilated according to personal beliefs, while social influences and group behaviors were proactively sought out in regard to specific uses of the device.

Finally, in regard to assimilation behaviors, our results show that all users engaged in explorative behavior during the observed assimilation, as they searched for applications through the App Store, played with the iPhone to configure it to fit their needs, and experimented by jailbreaking the iPhone to uncover even more possibilities that the iPhone had to offer. Users also exploited existing functionalities of the iPhone during assimilation, enhancing functionality by setting up email accounts, adding music to the iPod and subscribing to podcasts that were downloaded automatically when the iPhone was connected to iTunes. They rearranged applications on the interface and deleted applications they did not use any longer. As organizations face the problem of allocating resources between exploration and exploitation of IT (Baum et al., 2000; Gupta et al., 2007), the iPhone users decided to engage more heavily into exploration of the iPhone in the early stages of assimilation to create the device of their choice. Although they continued to explore throughout the observed assimilation, over time they focused less on exploration. Instead, they continued to exploit the iPhone by conducting minor refinements regularly.

6.2 COMPETING FORCES OF IT ASSIMILATION

In response to the second objective, we have developed the Competing Forces Framework (CFF) to support further investigation of how IT assimilation is shaped amongst individuals in social contexts. Drawing on Quinn and Rohrbaugh's CVF (1981, 1983) and grounded in the literature on IT use and assimilation, the CFF suggests that assimilation processes and outcomes are shaped through three dimensions of competing forces: exploration and exploitation behavior (Baum et al., 2000; Gupta et al., 2007; March, 1991), individual and social orientation (Bovard, 1951; Burt, 1955; Coleman, 1966; Deutsch and Gerard, 1955; Katz and Lazarsfeld, 1955; Tarde et al., 2008), and utilitarian and hedonic objectives (Deci, 1975; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982; van der Heijden, 2004, Venkatesh and Brown, 2001). Based on analogical reasoning with the the CVF's (1981, 1983) dimensions of organizational structure, organizational focus, and organizational means-end, and because learning behavior, social orientation, and usage objectives are documented as factors shaping IT

assimilation, we posit that these three dimensions of competing forces offers strong explanatory power for future investigation of IT assimilation behaviors and outcomes.

Furthermore, inspired by Quinn and Rohrbaugh's archetypical organizational cultures in the CVF (1981, 1983) and Crossan et al.'s (2004) 4-I model of organizational learning, the CFF synthesizes the competing forces of learning behavior and social orientation into four epitomes of IT assimilation processes; investigating, interacting, improving, and integrating. Applying the CFF to describe and explain how the group of fifteen iPhone users assimilated mobile device technology over a period of seven months, we characterized the observed behaviors as different combinations of the four assimilation processes. Based on analogical reasoning with the four archetypical organizational cultures of the CVF (1981, 1983), and drawing on our empirical analyses, we posit that the four identified assimilation processes offers strong descriptive power for characterizing patterns of IT assimilation behavior over time and across different types of users.

Specifically considering the objectives of using IT, the literature suggests that assimilation and outcomes are driven by utilitarian and hedonic objectives (van der Heijden, 2004; Venkatesh and Brown, 2001). Prior research has mainly focused on utilitarian use, e.g. the well-known Technology Acceptance Model (Davis, 1989), which established how perceived ease of use and perceived usefulness impacts the intention to use an IT. However, recently researchers have started to also focus on hedonic use of IT (Kim et al., 2001; van der Heijden, 2004; Whakefield and Whitten, 2006). Our results show that while the observed users mainly used their mobile device for utilitarian purposes during the three phases of assimilation, hedonic objectives became more evident over time. And while users primarily used their mobile device for personal purposes they also used it for work-related purposes. Still, the transitioning between utilitarian and hedonic objectives remains complex as the boundaries between utilitarian and hedonic as well as between personal and work purposes have long been and are increasingly eradicated (Venkatesh and Vitalari, 1987; Nippert-Eng, 1996; Palen et al., 1996). These insights from the CFF, its theoretical grounding, and our preliminary empirical results, suggest the following proposition about the role of competing objectives in IT assimilation:

Proposition on Objectives: *Assimilation of IT is increasingly shaped through utilitarian as well as hedonic objectives. When individuals can readily transition between and combine utilitarian and hedonic objectives, they will likely increase learning and reduce the assimilation gap.*

Turning to orientation in users' assimilation behavior, it is not surprising that individual orientation was observed most often with the iPhone users as the mobile device today has a one-to-one binding with the user and is rarely separated from the owner. However, the iPhone has a vast amount of usage possibilities, and to reap the benefits of the device, users oriented themselves through their social network. Recently,

the role of social networks has gained increased attention, and social influence studies have shown that the context in which users find themselves has significant impact on their individual adoption of IT (Scheepers and Scheepers, 2004, Tscherning and Mathiassen, 2010). While, information transfer, learning, competitive concerns, and normative influence have proved influential in making adoption decisions (Bovard, 1951; Deutsch and Gerard, 1955, Burt, 1995, Tarde et al., 2008), we found that normative influence did not have any influence during the assimilation process. Finally, our results suggest that users assimilate and use IT differently depending on social interactions; when social forces on assimilation of a technology are maximized, the individual intention to behave independently may be reduced; and, when individual forces on assimilation of a technology is maximized, the emphasis may shift away from the social norm. These considerations suggest the following proposition about the competing forces in users' orientation during IT assimilation:

Proposition on Orientation: *Individuals' assimilation of IT is shaped through interactions with the social context. Stimulating socially oriented behavior will likely contribute to increased learning and reduction of the assimilation gap. However, emphasizing socially oriented behavior at the cost of individually oriented behavior will unlikely lead to sustained learning and an effective level of usage.*

A central concern in studies of organizational learning is the balancing of exploration of new possibilities and the exploitation of old certainties (March, 1991), and, balancing exploration and exploitation efforts in assimilation of IT is likewise a central problem in the IS field. In fact, giving priority to exploitation over exploration users will stagnate in technological capability, while overly emphasizing exploration will likely lead to high learning costs with little consequence for practical IT use. A general issue of exploration versus exploitation pertains to ambidexterity versus punctuated equilibrium (Benner and Tushman, 2003; Burgelman, 2002; Gupta et al., 2007). Whereas ambidexterity refers to the simultaneous pursuit of both exploration and exploitation to obtain effective assimilation, punctuated equilibrium refers to temporal differentiation and suggests that cycling through periods of exploration and exploitation is a more viable approach. Gupta et al. (2007) conclude that "*When analysis is confined to a single domain (i.e., individual or subsystem) and exploration and exploitation are conceptualized as two ends of a common continuum, logic dictates that punctuated equilibrium be viewed as the appropriate adaptation mechanism for balancing the need for both exploration and exploitation*". While our results showed that different user groups balanced their exploration and exploitation behaviors differently over time, most users were able to readily shift between both behaviors within the same phase of assimilation. IT assimilation behaviors may, therefore, express both forms of balancing, although our study did not allow for more conclusive evidence. Based on these considerations, we propose:

Proposition on Behavior: *Effective assimilation of IT requires maintaining an appropriate balance between exploratory and exploitative behaviors. When users emphasize exploration while ignoring exploitation their efforts will unlikely lead to an effective level of usage. Conversely, when users refine exploitation more rapidly than exploration they will arrive at an effective level of usage in the short run, but sustain an assimilation gap in the long run.*

7. CONCLUSION

This paper has developed the CFF and related propositions as a foundation for future research into how competing forces shape IT assimilation in social contexts. We used the field study method to validate the framework and explore how a social group consisting of fifteen individuals assimilated the iPhone over a seven month period. The findings provide evidence for how three dimensions of competing forces shaped assimilation of the iPhone; assimilation objectives were both utilitarian and hedonic, assimilation orientations were both individual and social, and, assimilation behaviors were both explorative and exploitative. In addition, the empirical findings demonstrated how users adapted four types of assimilation processes – investigating, interacting, improving, and integrating – into different patterns of assimilation to reap the benefits of the iPhone.

The central contribution of this work, though, is the CFF and related propositions. It is our aspiration that this framework will stimulate a discussion in the IS community on the competing forces associated with adoption, assimilation, and use of IT in both organizational and consumer contexts. Such discussions should consider the forces created by the IT itself, such as freedom-enslavement, control-chaos, and efficiency-inefficiency (Mick and Fournier, 1998) as well as the forces users' face when confronted with the IT, such as exploration-exploitation behavior, individual-social orientation, and utilitarian-hedonic objectives.

At this point of development, our research has some potential limitations. One is that the field study was conducted with a single group of users in one specific context. Some of our findings may not generalize to other groups in other settings, though we conjecture that competing forces provide strong explanatory power for explaining variations in IT assimilation behaviors and outcomes. In addition, the number of users was limited to fifteen and the considered IT was the iPhone and its services. A higher number of users in the study could have revealed more distinct usage patterns and more distinct variance over the observed users. Similarly, other types of IT would likely lead to different insights, most notably related to assimilation objectives. Finally, the CFF contains three specific dimensions of competing forces; however, other dimensions of competing forces may as well have an impact on IT assimilation patterns.

There are two particular areas of research that could help advance the framework. The first focuses on understanding each of the three dimensions in the CFF more deeply in relation to adoption, assimilation,

and use of IT. While exploration and exploitation has been widely discussed in relation to organizational effectiveness and learning, more research on IT user exploration and exploitation efforts is needed. Furthermore, the tensions and dynamic interactions between individual and social orientation in IT adoption, assimilation, and use studies needs to be emphasized instead of focusing on either opposite from a more static perspective. Finally, many ITs, such as mobile devices and laptops, are used for utilitarian and hedonic purposes, and studies should consider the tensions between the dual-objective of such different ITs. The second area of research that could further advance the CFF is to apply it to empirical investigation across different organizational contexts to verify the validity of the framework in this context as well. Such investigations, could apply the CFF to different types of social contexts, i.e. to permanent teams, to ad-hoc configurations in projects and task forces, to organizations at large, as well as to inter-organizational use of IT. Also, they could explore different types of IT usage by applying the CFF within different industries as well as different types of process.

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APPENDIX E: LIST OF PAPERS DURING PHD PROJECT

Table 21: List of Papers during PhD Project

Authors	Title	Outlet	Comment
Tscherning, H. and Mathiassen, L. (2011b)	“Competing Forces Model of Technology Adoption and Assimilation: Explaining Behaviors in a Group of Mobile Device Users”		Submitted to Journal of the Association of Information Systems, January 2011.
Tscherning, H. and Mathiassen, L. (2011a)	A Dialectical Analysis of Mobile Device Assimilation within a Group of Users, <i>European Conference in Information Systems 2011</i> , Helsinki Finland.		Conference paper, peer-reviewed. Previous version of Tscherning and Mathiassen (2011b).
Tscherning, H. (2011)	“A Multi-Level Social Network Perspective on ICT Adoption,” in Dwivedi, Y. K., Wade, M. R. and Schneberger, S. L. (Eds.) <i>Information Systems Theory: Explaining and Predicting Our Digital Society</i> (2011, forthcoming).		Book chapter.
Tscherning, H. and Mathiassen, L. (2010b)	“Early Adoption of Mobile Devices: A Social Network Perspective,” <i>Journal of Information Technology Theory and Application</i> , (11:1), 2010b, pp. 23-42.		Further development of Tscherning and Mathiassen (2010a).
Tscherning, H. and Mathiassen, L. (2010a)	“The Role of Social Networks in Early Adoption of Mobile Devices,” In IFIP International Federation for Information Processing (288), <i>Human Benefits Through the Diffusion of Information Systems Design Science Research</i> , eds. Pries-Heje, J., Venable, J., Bunker, D., Russo, N., and DeGross, J. (Boston: Springer), 2010.		Conference paper, peer-reviewed. Won Best Paper Award at the combined IFIP 8.2+8.6 conference
Hedman, J. and Tscherning, H. (2010)	“Emotions and Intention to Buy: Applying Neuro-Informatics on The Adoption of the iPhone,” Presented at the 'NeuroPsychoEconomics / CONNECS' Conference at the Copenhagen Business School, June 2010.		Conference paper, peer-reviewed.
Hedman, J. and Tscherning, H. (2008)	“Emotions, Possession and Willingness to Pay: The Case of iPhone,” In <i>Collaboration and the Knowledge Economy: Issues, Applications, Case Studies</i> (5), eds. Cunningham, P. and Cunningham, M. (Amsterdam, IOS Press), 2008, pp. 1304-1312.		Conference paper, peer-reviewed.
Tscherning, H. and Damsgaard, J. (2008)	“Understanding the Diffusion and Adoption of Telecommunication Innovations: What We Know and What We Don't Know,” In IFIP International Federation for Information Processing (287), <i>Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion</i> , eds. León, G., Bernardos, A., Casar, J., Kautz, K., and DeGross, J. (Boston: Springer), 2008, pp. 41-62.		Conference paper, peer-reviewed.

APPENDIX F: IUSE DATA COLLECTION

Table 22: Overview of Researcher Responsible for Data Collection

	Three surveys	1 st semi-structured interview	Transcription	2 nd semi-structured interview	Transcription	Three Focus groups	Diaries	Network data
Boedker, M.	X	X		X			X	
Gimpel, G.	X					X		
Hedman, J	X	X		X			X	
Tscherning. H.	X		x		X			X

APPENDIX G: OUTLINE OF CASE STUDY INTERVIEWS

- 1 Introduction
 - 1.1 Background of project
 - 1.2 Confidentiality and permission to record
 - 1.3 Name of respondent
- 2 Demography
 - 2.1 Age
 - 2.2 Occupation
 - 2.3 City
- 3 Mobile device history
 - 3.1 When did you buy your first mobile phone?
 - 3.2 How often have you changed your phone (how many mobile phones until now)?
 - 3.3 Which phone do you have now?
 - 3.4 When did you buy it?
 - 3.5 Which phone did you have before this one?
 - 3.6 Why did you choose these phones?
 - 3.7 Which functions on your phone do you use?
 - 3.8 What is your experience with other Apple products – and for how long?
- 4 iPhone history
 - 4.1 What makes the iPhone attractive to you?
 - 4.2 How did you know what would make the phone work (in regard to jailbreaking and unlocking it)?
 - 4.3 What will you do if Apple finds a way to prevent future jailbreaking and unlocking of the iPhone?
 - 4.4 Which technology is the next you wish to acquire?
- 5 Social network - General
 - 5.1 How well do you know the four other persons in this study? Friends or acquaintances?
 - 5.2 How often do you meet?
 - 5.3 How many people do you have in common with these persons (check via Facebook)?
 - 5.4 How many 'friends' do you have on Facebook?
 - 5.5 How many people in your social network have an iPhone?
- 6 Social network – Theoretical Constructs
 - 6.1 Was it important for you that others in your network had acquired the iPhone prior to you?
 - 6.2 Who do you know that had an iPhone before you?

- 6.3 How did you receive information about the iPhone?
- 6.4 Was there a specific person that introduced you to the iPhone?
- 6.5 Does somebody in your network stand out as being someone who you associated with the iPhone before you acquired it?
- 6.6 Describe the general attitude toward the iPhone before you acquired it?
- 6.7 Describe the level of knowledge you had prior to obtaining the iPhone?
- 6.8 During your decision period, did you observe other people's choices and behaviors before you made your decision?
- 6.9 Prior to acquiring the iPhone, did you interact with your social network to consult others about their adoption decisions and be guided by them?

7 Adoption decision

- 7.1 How were you introduced to the iPhone? Media, friends?
- 7.2 What influenced your decision to buy the iPhone? Media, friends, something else?
- 7.3 Why did you buy the iPhone before it came to Denmark?
- 7.4 What value does it give you?
- 7.5 What was the benefit of owning the iPhone before it was available through traditional supply chains?
- 7.6 The benefit of owning it before friends?
- 7.7 Did the iPhone change the way you use your computer, iPod, TV or other technological device?

8 Other

- 8.1 Is there anything else you can tell me that influenced your decision to buy the iPhone or anything we did not touch upon that could be of interest to me?

APPENDIX H: PRIMARY DATA

CASE STUDY DATA

SEMI-STRUCTURED INTERVIEWS

Respondent	Title and Industry	Interviewer	Date and Place
LC, male, 36 years	Head of Promotion, Music Industry	Heidi Tscherning	15-4-2008, Copenhagen
CF, male, 33 years	Financial Advisor, House Financing	Heidi Tscherning	16-4-2008, Copenhagen
WQ, male, 33 years	Music Performer	Heidi Tscherning	23-4-2008, Copenhagen
PZ, male, 34 years	Controller, Public Institution	Heidi Tscherning	30-4-2008, Copenhagen
HC, male, 33 years	Financial Analyst, Telecom Industry	Heidi Tscherning	8-5-2008, Copenhagen

ARCHIVAL DATA

	<i>Discussion forum data</i>	<i>Apple – iPhone data</i>	<i>Press data</i>
<i>Data</i>	30 posts 928 replies 39300 views	Press releases	Search for keywords: iPhone, jailbreak, unlock, iPhone Denmark etc.
<i>Analysis</i>	Content of posts and replies from particularly the participating case study respondents.	Statistics	Search for press information based on input from respondents.

Time Period	No. of iPhone Posts	No. of Replies	No. of Views
5 Aug 06 - 31 Dec 06	2	18	820
1 Jan 07 - 31 Dec 07	16	423	19,888
1 Jan 08 - 10 Jul 08	12	487	18,592

FIELD STUDY DATA

Respondent	Sex and Age	Data Collected	Data Collected by
Dan A.	Male, 1983	Pre-study survey, Sep 2008	Bødker, M., Gimpel, G., Hedman, J, and Tscherning, H.
Philippe B.	Male, 1986	24 hour diary, Oct 2008	
Jose C.	Male, 1973	First semi-structured interview, Nov 2008	Bødker, M. and Hedman, J.
Bettina C.	Female, 1971		Bødker, M. and Hedman, J. Transcribed by Tscherning, H.
Aukse H.	Female, 1980	Focus groups, Nov 2008	
Claus I.	Male, 1978	Mid-study survey, Dec 2008	Gimpel, G.
Camilla J.	Female, 1981	Second semi-structured interview, Feb 2009	Bødker, M., Gimpel, G., Hedman, J, and Tscherning, H.
Rikke J.	Female, 1983		
Randi K.	Female, 1981	Post-study survey, Mar 2009	Bødker, M. and Hedman, J. Transcribed by Tscherning, H.
Niels L.	Male, 1977	Network provider data, Sep 2008 – Mar 2009	
Silje O.	Female, 1985		Bødker, M., Gimpel, G., Hedman, J, and Tscherning, H.
Pernille P.	Female, 1982		
Camilla S.	Female, 1986		Tscherning, H.
Janus S.	Male, 1957		
Claes W.	Male, 1983		

APPENDIX I: TOPICS FOR FIELD STUDY DATA COLLECTION

<p>Surveys</p>	<p>Demographics Feelings/Emotions in regard to the iPhone Social network relations (in the group and outside) Social network communication (in the group and outside) Technology background (IT and mobile phones) Technology usage (where, when, how, how often)</p>
<p>First semi-structured interview</p>	<p>User interface changes App downloads and removals Paid apps versus free apps Objectives (work, school, home) Influences (network, media etc.) Usage behaviors Positive and negative impacts of the iPhone</p>
<p>Second semi-structured interview</p>	<p>Usage pattern Change in overall technology usage behavior after receiving the iPhone Changes in usage objectives of the iPhone Changes in usage behaviors of the iPhone Response from surrounding environment Overall evaluation of iPhone usage</p>
<p>24-hour diaries</p>	<p>Technology usage during a 24-hour time period. Which technology, and for what purpose.</p>
<p>Focus groups</p>	<p>Consumption values; functional, social, emotional, epistemic, and conditional values of the iPhone</p>

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