Mobile Data Services
Shaping of User Engagements

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Research Summary

The research motivation for this study is to improve the understanding, scholarly and my own, of wireless service adoption *as* services enters and leaves users' hands and minds. Wireless devices and services are enabling an unprecedented intertwinement of human actions and information systems in everyday life. Current IS research has so far paid scant attention to studying technologies which transcends the organizational domain. Little emphasis has also been provided beyond the absolute point of acceptance and adoption of artifacts. Nevertheless, many new wireless services transcend traditional use spheres. With this emerges the strong need to follow the *shaping of user engagements with new mobile data services.* This is the key phenomenon of interest in this dissertation. Three research questions are asked: (1) *How is user understanding of new mobile services shaped during early mobile service experiences and engagements?* (2) *What characteristic properties, gratifications and adoption/rejection behaviors shape around new mobile data services?* (3) *How do service specifications, properties and gratifications enable and/or constrain user engagements with new mobile data services?* Understanding about the phenomenon of interest and answers to the research questions derive from iterations between a pre-understanding, secondary literature and results from a mixed method field study. The field study followed groups of interacting individuals during 14 weeks of their initial acquaintances with new mobile services. The data set consist of 988 essay type responses to open ended questions and 15 hours of group interviews, 9,616 quantitative entries to 263 closed ended questions, items, and statements during the 14 weeks, and complete backlog data on the participants actual service use. In the theorizing I align primarily with constructivist assumptions and seek primary compliance to the key principles Klein and Myers (1999) outline for interpretive field studies.

Results and conclusions appear in four published research papers. Moreover, the final chapter of this dissertation presents a synthesized understanding of insights from the papers, the field study and the pre-understanding generated from current literature in Chapter 2. Four key results and contributions can be highlighted. First, the findings suggest the nature of mobile service adoption to be a process comprised of *cognitive engagements* and *behavioral engagements*. The conceptualization contrasts several dominant assumptions of current theory; hereunder, clarity of adopter knowledge, stability and endurance of adoption, and notions of

absolute point of acceptance. It is found that service adoption and use differ from high-involvement decision making and adoption and is better described and explained in terms of explorative behavioral engagement, recurring engagement and disengagement.

Second, the research offers a systematic approach to research how users characterize services according to their instrumental, aesthetic and expressive *properties* and associated content, process and social *gratifications* of both hedonic and utilitarian types. In this way we avoid to focus on services as 'proxies' or generalized artifact and can perform analyses applying a more nuanced typology. The results show how services with strong expressive properties, such as SMS and mobile e-mail, play special and dominant roles in thrusting data-service use and innovation in Norway and Japan to higher levels along divergent paths.

Third, the research complements current adoption theory by delineating service behaviors beyond the typical notions of adoption versus rejection. Explorative behavioral engagement, recurring engagement and disengagement are suggested to better describe the type of adoption behaviors and use outcomes unfolding for mobile data services. As opposed to rational decision making and high-involvement products typically studied in current literature it is observed that mobile service behavior is not necessarily driven by a clear set of expectancies or well formed cognitions about service properties and obtainable gratifications. Instead it is often serendipitous and intuitive. Together with the nuanced service characteristics the type of behaviors will aid in determining what frequency we should expect regarding recurring engagements for a specific service and help determine when behavior is explorative or more finite and enduring.

Finally, the research illuminates how properties and gratifications institutionalize around infrastructural specifications that not only shape service use, but in turn also feed back to affect the further innovation and service use in wireless service ecologies. A novel finding is how properties and gratifications take manifest and institutionalize as people extensively use certain services and subsequently both enable but also constrain further service use and innovation in the larger service arena. In particular SMS and mobile e-mail, two services with strong expressive properties, are identified as services of which seemingly minor artifact differences in underlying service and/or infrastructural specifications play a crucial role in enabling and constraining further service innovation and use. The above findings are in Chapter 6 bound together in an overall Service Engagement Framework.

Chapter 1: Introduction

This chapter introduces the study conducted during the PhD project. I present initial observations of gaps between projected and realized mobile data service use. Central challenges for theoretical undertakings aiming to explain mobile data service adoption and use are outlined. These initial literary inputs form a pre-conception for specifying the phenomenon of interest, defining research questions for the study and for positioning the research. The chapter introduces the reader to the Mobiconomy project under which the study has been conducted. An outline of the dissertation structure is also presented.

1.1 Background and Purpose

The advent of data transmission over mobile phones is currently advancing a replacement of the term mobile telephony. Terminology such as mobile and wireless communications increasingly penetrates our communications and signifies the extension of traditional voice telephony to also cover digital data exchanges over wireless networks. At heart of this turn are *mobile data services*. In this dissertation a mobile data service is defined as: *a service available over mobile devices utilizing asynchronous or synchronous wireless data connectivity for their obtainment and/or functioning*. Voice over IP (VoIP) telephony is covered by this definition. However, synchronous voice telephony is not studied in this dissertation. Focus is placed on typical telecom oriented mobile Internet services provided via mobile Internet sites and portals[1] as well as messaging services such as short messaging services (SMS), multimedia messaging services (MMS) and mobile e-mail.

Some mobile data services, in particular SMS, have already become ingrained in the practices of everyday life for millions of people worldwide. Alongside this, new services are touted and predicted to become incorporated in our future living. We have already progressed far towards the realization of elements in Osborne's 1954 prognosis (as described by Ling,

[1] Please note that services available via "regular" Internet (by the use of a mobile Internet browser) can well be covered by this definition. "Regular" internet browsing via a mobile phone is out of scope for this research. The reason is that both the research project (Mobiconomy) and our partners focused on services especially adapted for mobile phones. Moreover, regular internet browsing has been more oriented towards PDAs and distinct installable mobile phone browsers such as Opera. While "regular" internet browsing has grown during the course of this dissertation work and we are seeing signs of convergence, it was at the time research commenced not much championed by telecommunication carriers.

2004). He proposed a future where any person would be equipped with a phone number for life and given a watch-like device enabling communication with others in audio and video. We are also, as suggested in the 1980s by Weiser (1991/1999) at IBM's Palo Alto research center, moving towards an ubiquitous computing (sometimes referred to as *ubicomp*) environment where micro-chips are embedded in wide range of artifacts we encounter – consciously or unconsciously – and will interact with in everyday life interactions. We now find micro-chips embedded in or tagged onto packages, tickets and ticketing devices, refrigerators, cars, access cards, payment cards and groceries. MIT Technology Review predicted in 2005 that the number of devices that *can* be networked will grow from hundred of millions to tens of billions with the networking of mobile devices and vehicles. And moving towards invisible computing – adding micro-chipped machinery, home appliances, pallets and cases and consumer items to the account – there will be trillions of networkable artifacts (Thompson, 2005). With the booming wireless infrastructure, the billions[2] of mobile phones users will face a plethora of mobile data services. One may say that a chimera of the wireless future is in the breeding; a creature of reality and fantasy for us to acquaint and, perhaps, domesticate into everyday life practices.

Profound developments and progression in mobile service and computing technologies, e.g. architectures for short messaging services (SMS), multimedia messaging services (MMS), mobile e-mail, and portal based m-services (e.g. over WAP) have for some time enabled a socio-technical transformation of everyday life communications and transactions. In the moment of writing someone is experiencing initial contact with mobile telephony; sending her or his first text message; wirelessly surfing the mobile Internet; making the first purchase with a mobile device; using the a mobile airplane check-in service, or browsing the mobile Internet while crossing continents some 40,000 feet above our planet[3]. Radio signals are substituting tethered wires and the physical and virtual worlds become amalgamated across traditional time and space boundaries. This is all happening in previously unimagined ways. Almost paradoxically, we become disconnected but stay connected. With this our ways of communication and our technologies change. We go from mobile phones and mobile telephony

[2] According to ITU there were more than 1.8 billion mobile phones in circulation in 2004.
[3] Scandinavian Airlines System offered from 2005 wireless (WiFi – 802.11b) Internet connectivity on intercontinental flights. Moreover, WiFi enabled mobile phones are emerging in the market (see more in Chapter 2)

to mobile devices and mobile communications. Operators, content providers and device manufacturers will heed the change by offering new mobile data services to the market.

The novel combinations of practices and technology in emergence constitute the fundamental elements set to bring forth a ubiquitously connected and transacting society (e.g. Fano & Gershman, 2002; Jessup & Robey, 2002; Lyytinen & Yoo, 2002; Weiser, 1991/1999). Much predicated is how the *e* of the dot-com arrival is now becoming oriented toward *m* and *u*; from *electronic* to *mobile* to *ubiquitous*. M-services, as mobile data services are commonly abbreviated, will be essential constituents in enabling electronic communications and commerce to transition beyond the tethered Internet.

In many parts of the world, however, the turn towards ubiquitous computing environments has neither unfolded as dramatically nor as fast as touted during the dot-com eruption a few years ago. Rapid progress is made in technologies enabling material and virtual change. However, and to wide industry disappointment, many of the technologies fail in becoming rapidly adopted. In many places we see what Fichman and Kemerer (1999) call an assimilation gap, i.e. a lag between what is being envisioned and what is being realized.

Despite isolated success cases[4], such gaps have caused plenty of revisions to be made to prognoses concerning use of m-services over portals based on network architectures such as WAP (e.g. Sigurdson, 2001) and UMTS (Yoo, Lyytinen, & Yang, 2004)[5]. As will be further described in this dissertation a current asynchrony seems to exist as a bar between the pace of technological changes and the adaptation of human social behavior. Forecasts predicting 40-70% of worldwide wireless subscribers would access data applications in 2002 (Hung, Ku, & Chang, 2003) are still utopia. Hence, when looking at other regions in which evidence of such adaptation do exist, e.g. Japan and South Korea (Funk, 2001; Sharma & Nakamura, 2003; Yoo et al., 2004), we become inclined to ask why the adoption and use of mobile data services, except SMS, has been generally overrated.

[4] E.g. with an approximate 2 million Blackberry subscribers in 2004 (according to Research in Motion, RIM, press release of November 17, 2004) Blackberry is a success case for mobile e-mail. Nevertheless it is a segment focused success (business e-mail) with less than 1% penetration among mobile phone subscribers in the U.S.

[5] WAP and UMTS are explained in Chapter 2. PTS of Sweden, referring to estimates by OVUM compared two forecasts, one from 2001 estimating around 40 million 3G subscribers in Europe by the beginning of 2005 and a revision from 2002 estimating 4-5 million for the same point in time. In hindsight we see that the latter prognosis seem to be more aligned with reality as the 15 million mark was, according to the European Commission report for 2005, reached in September 2005.

A set of puzzling and partly paradoxical questions and issues have been driving my quest to find out why mobile data service adoption and use has been slow in Denmark and Scandinavia[6]. The different developments vis-à-vis the success stories of Japan and South Korea made me wonder why mobile data services had not gained momentum despite the population being among the leading adopters of mobile phones. The technologies were present and new data services had been offered for some time. Voice telephony and short message exchange flourished, but user engagement with more advanced mobile data services available over WAP portals such as news and information services, entertainment services, and infotainment services was largely missing. Entering the field of information systems (IS) with a prior education in marketing and strategy I could imagine several joints to the compound and complex chain of explanation – e.g. technology, industry, culture, user demographics, user behavior, and perceptions. In order to clearly specify the phenomenon of interest, justify the theoretical rationale for the study, and thereby achieve precision and focus in the research and findings, a brief visit to current theory is needed.

1.2 The theoretical rationale for the study

An initial journey into the literature offering explanations of mobile data service adoption and use made it clear that new insights regarding why people continue or discontinue use of new mobile services is needed. In particular, modest scholarly attention is given to how and why use emerges and the further shaping taking place when new technologies are trialed against the contexts, behaviors and interactions of everyday life. Research tend to focus on either static *pre*-adoption perspectives centered on predicting the likelihood of service adoption (e.g. Hung et al., 2003; Teo & Pok, 2003) or on mapping the social consequences of technologies from the longitudinal *post*-adoption perspectives of domestication research (e.g. Haddon, 2001; J. E. Katz & Rice, 2002; Ling & Haddon, 2001). It became clear that scholarly encouragements to focus on the processes contiguous to "absolute" acceptance and "decisive" points of adoption were common. However, empirical studies and theorizing on how adoption and use unfold *during* new acquaintances with technology were almost indiscernible.

Diffusion of innovation (DoI) (e.g. Rogers, 2003) and *technology acceptance* (TA) (e.g. Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Venkatesh, 2000; Venkatesh, Morris, Davis,

[6] The slow uptake of mobile data services is not only limited to Denmark and Scandinavia. Mobile Internet use outside of Japan and South Korea has generally been progressing slowly (e.g. Funk, 2001; Srivastava, 2003)

& Davis, 2003; Ziamou, 2002) are streams in current IS research of principal importance in guiding understanding of adoption, acceptance and rejection of new technological artifacts. They are used for research on acceptance, adoption and innovation-decision process of individuals and organizations (Gallivan, 2001; Shaw & Jarvenpaa, 1997). Research from these streams contribute valuable scholarly understanding about specific variables (e.g. relative advantage, observability, ease of use, performance expectancy etc., cf. Rogers, 2005) and attributes of successful innovations in mandatory as well as voluntary adoption and use settings. Together with a strong supporting methodological apparatus this has given the theories strong scholarly manifest and acceptance (Venkatesh et al., 2003) among IS and marketing researchers.

But also much controversy surrounds DoI and TA research. In *organizational* IS research their underlying assumptions, especially views held concerning the user, receive direct and indirect critique (Lamb & Kling, 2003). This critique is often directed at inadequacies to handle temporal change and the tendency to provide oversimplified accounts of human behavior and human engagement in technology use processes (e.g. Gallivan, 2001; Lamb & Kling, 2003; Orlikowski, 2000). Similar contentions have made scholars suggest that the relevancy and applicability of these dominant approaches can be fertilized by incorporating ideas and constructs from research which is more consumption, process and socially oriented – such as uses and gratifications research (U&G) and domestication research (Pedersen & Ling, 2003). Likewise, Sarker and Wells (2003) warn that researchers should *not* merely apply existing theories in a new context as this may potentially hinder the discovery of aspects unique to mobile devices and services. What is missing in current approaches, the argue, is "a clear understanding of the motivations and circumstances surrounding mobile device use and adoption from the perspective of the consumers themselves" (ibid.:35).

The literature revealed that this does not only apply to *devices* but also for mobile data services. With the exception of domestication research, to which I return in Chapter 3, current research orientation is strongly oriented towards predictive-modeling based on variance approaches and not on understanding the unfolding, emergence and shaping of user understanding relative to adoption processes over time.

Current research tend to approach technology acceptance, adoption and use with assumptions and methods most strongly associated with the (post)positivistic[7] paradigm (Guba & Lincoln, 1994; Lincoln & Guba, 2000). A central characteristic of this research, maintained from the heritage of Fishbein & Ajzen's (1975) seminal Theory of Reasoned Action (TRA), is how certain latent and personal difference variables are estimated to predict either intention to use and/or actual use of a certain technology. Herein lies a tendency to also presume the presence of an unambiguously defined artifact, a clearly defined adopter population, and an idiosyncratic and clearly defined context of use (Lyytinen & Damsgaard, 2001; Rogers, 1995; Wolfe, 1994). These assumptions are relevant when both developers and users can clearly articulate the innovation and when contexts of deployment are known as when researching the intention to use a specific function of an information system for a particular task in a given and known organizational setting. However, faced with the uncertainties the ubiquitous computing landscape which m-services contribute in bringing about (Jessup & Robey, 2002; Lyytinen & Yoo, 2002; Sarker & Wells, 2003), IS researchers' pursuit of understanding adoption and use is now facing at least three challenges – compoundness, multi-sphere crossings and temporal dynamics. I next outline these challenges in order to establish theoretical and methodological preconditions for the conduct of my study.

1.2.1 Challenge: Compoundness

Mobile phones have become wireless information and communication and computing devices. They increasingly appear as what we have labeled *compound product-service offerings* (Knutsen & Overby, 2004). That is, they are hybrid artifacts offering access to voice and a range of data services (Sarker & Wells, 2003). The offering arrive in the marketplace as a compound package consisting of a physical hardware artifact on which numerous of software components are embedded or available online. The services offered can both be complements and substitutes for the user and in the marketplace and the 'total' end offering is often brought together by interdependent firms which may collaborate and compete over user patronage in the marketplace (Knutsen & Overby, 2004).

[7] I write (post)positivistic to demarcate the difference between the modified and 'soft-version' of positivism which today explicitly or implicitly is represented in research; i.e. the tendency among scholars to hold ontological assumptions more correspondent with critical realism rather than naïve realism (see for instance Guba & Lincoln, 2003; Lincoln & Guba, 2000)

Much like a food court scenario the multitude of mobile data services lie dormant on the menus of mobile phones and portals awaiting users' appetite. User experience will not only vary from service to service but also across devices and networks. As a result, attributing user experience to distinct features and qualities of the physical artifact (i.e. the mobile phone, device, handsets etc.) and the virtual artifacts (i.e. services, applications etc.) embedded on devices and provided by the different players can be nebulous. The increasing complexity of this product-service intertwinement makes it hard to clearly define the artifact of study, its context of use and its appropriate population of users. Consequently, the typical targets of current research, e.g. people's *intentions to use* and *attitudes* towards a mobile data services, can be far from unanimous and clear; and not straightforward to account.

Adding complexity to this is also how the increasing speed of new product and service launches offer expanded opportunities for substitution and complementation within and between technologies. This is particularly evident for services where substitutes and complements can exist on the same delivery architecture as well as on related PC/Internet service delivery systems. Locking research focus on a predefined set of attributes and features of a specific service may blind us to the effects imposed by technologies within the same technology cluster[8] and to which properties, benefits and value may be of strong proximity and even complementary to the user. Consequently, what is perceived as valuable or less valuable from using a mobile service may not be attributable to the service alone but also to an enabling physical artifact, other technologies in the technology cluster, as well as the network(s) enabling the service.

From a design or technical point of view each part constituting the product-service offering can of course be broken down and be analyzed rather autonomously. User experience with such product-service offerings, on the other hand, is not componentized and divisible in the same manner. Several value-enabling components in software and hardware may differ, overtly or covertly, in how they facilitate overall user experience. For instance, a feature considered valuable may not only be valuable because of the specifications of the service, but because of specifications co-enabled by networks, software, devices and even other users (e.g. network effects). Resulting is what may be defined as *compoundness*; i.e. the degree of

[8] A technology cluster refers to a group of products that use different technologies to accommodate a basic set of needs and gratifications (see for instance Lloyd, 2001).

indivisibility of artifact qualities caused by configuration interdependences in the substances and forms of components constituting the artifact and associated uses of the artifact. Like Wittgenstein (according to Wolniewicz, 1982) sees compoundness to arise from the configuration of objects that are not fully decomposable, we are in the world of mobile services seeing how material and virtual artifacts (services) are configured by different players in the value chain which, *along with the indirect effects of the uses artifacts*, enable user experiences which are not fully decomposable to particular substances or forms of the artifact itself. This form of complex indivisibility makes it challenging for researchers and users to clearly define the artifact and its particular qualities. Researchers are therefore forced to pay particular attention to the artifact and the larger ecology, i.e. the totality of relations between the artifacts and their environment, in which it exists and is used.

1.2.2 Challenge: Multi-sphere crossings

Another challenge which research in m-services must confront is what can be described as multi-sphere crossings. Today we see how certain products and services are used across spheres of life which we traditionally keep separate in our analyses. As identified and discussed in relation to research on computers by Aune (1996) the traditional divide between artifacts directed at leisure and work can on several accounts evaporate as they increasingly target accommodation of pervasive everyday uses. For instance, short messaging (SMS), multimedia messaging (MMS), and mobile e-mail are all services not restricted to use in one certain activity domain. Thus, we have services which may be useful, easy to use and valuable for some people in certain domains but not so in different domains. This means that the clarity of the defined adopter population and the delineation of situated use contexts needed for conducting variance based acceptance studies face challenges by a contextual ambiguity and thus factors of impact first observable as people encounter the services during use.

Most technology acceptance models known in IS research have been developed primarily for application in organizations (e.g. Davis, 1989; Venkatesh et al., 2003) and not for leisure and voluntary technology-use settings. Also the technologies under scrutiny have most often been very explicit with respect to organizational functionalities and application areas (see for instance Gallivan, 2001; Markus, 2005). The characteristics of the settings of (potential) use in voluntary and leisure oriented technology domains may be very different from those of organizations and work. For instance, leisure oriented technology-use settings will leave

(potential) users far more emancipated in their choices as there are less prominent structures of power and domination exerting commanding and/or programmatic influence on use than in organizational ICT settings. So called, contingent adoption decisions will be less pertinent as mostly informal social structures of domination (Giddens, 1984) will be at play.

Under these circumstances the fit between technology and performance is not necessarily work or task determined. Therefore the gains from technology may not be solely directed at instrumental ends and efficiency, but can be more oriented towards hedonistic aspects such as entertainment, play and joy (e.g. Höflich & Rössler, 2001; Leung & Wei, 2000). Also, and as opposed to organizational settings where technological comprehension can be promoted by offering technology training programs, such training is much more problematic in the world of private consumption. Rather than training people's technological self-efficacy mobile device and service literacy may more often emanate from lessons of life transpiring along the flow of everyday interaction and communication.

The overarching challenges arising from multi-sphere crossing is the variation caused by people attributing different qualities and gains relative to the purpose and context the service is used. SMS is a key example of a service where the pure variety in application areas, from interpersonal messaging to m-commerce (Trosby, 2004), and use contexts can render a great diversity in the qualities and gains people attribute to the service. To account this, researchers will need to more carefully attend to the social learning unfolding under contexts where people and new mobile services interface; i.e. during the process people interact and shape understanding of service qualities and their value. Thus, we will often need explorative studies in relevant contextual domains prior to performing confirmatory modeling and large scale empirical validations.

1.2.3 Challenge: Temporal dynamics

The third challenge concerns the assumption of clarity and stability in user perceptions regarding the innovation itself and the adoption and diffusion context. Fishbein and Ajzen (1975) highlighted in the original formulations of the TRA model, upon which many TA models are founded, how the models reliability depend upon (1) clarity of the object, (2) clarity of the act the respondent is to perform, (3) clarity of the time frame within the act is to be performed, and (4) clarity of the context the act is set to occur within. This seems straightforward was it not for the challenges discussed in the two former sections. The central

question is: Can we expect clarity in (potential) users' minds when we ask people to rate our items of latent variables such as ease of use, social influence, attitude, relative advantage etc., at a point where everyday life encounters and experiences with new services (or other new technologies) by most people are not yet gained, their conception of these services are still embryonic, or services are merely encountered by chance? How reliable are these measures? And can we continue to rely on the measures as experienced is gained?

Acceptance measurements of IS systems in organizations are usually carried out after features of the systems introduced by management are explained to the potential users (Venkatesh et al., 2003). Creating such understanding among potential users of mobile services in leisure and voluntaristic use settings is more problematic. Unless respondents receive training, can try devices and services, or use is brought to natural contexts where experience and understanding of services is gained over time, developers and marketers can be left with estimates and predictions anchored in (prospective) users' intuitive juxtapositions. The potential adopters we target with perception and attitude measurements may just not know or may simply apply intuition when they are faced with questions pertaining to these constructs. Moreover, *a priori* imaginaries and expectations can of course change as experience is gained. As Kant has written: "we can know a priori of things only what we ourselves put into them" (Kant, 2003:23). And as Sophocles stated in 400 B.C.: "One must learn by doing the thing, for though you think you know it, you have no certainty until you try" (cited in Rogers, 2003:168).

Alterations to imaginations, expectations, beliefs may unfold vividly as initial conceptions are reconstructed diachronically. Sociologists have emphasized how people can change their conceptions temporally as a result of reflexive monitoring of own and others actions over time (Giddens, 1984; Goffman, 1983). While too often neglected in technology studies, social learning perspectives sensitive to temporal dynamics and change have nevertheless long been called for in the diffusion of innovation literature (Rogers, 2003). Changes to overt behavior may appear consciously or unconsciously from the observation of behavior and communications during social interaction. This is important for mobile services as some, e.g. messaging services, can mediate new forms of communication and conduit changes to cognition and behavior as a result of social interactions over time. Thus, we can not afford to disregard these aspects in our research. Bluntly trusting user expectations and imaginaries based on initial measurements may tempt us to generalize upon cognitions-in-head

(Lave, 1988) which may have been 'valid' prior to experience, but which neither reflect the cognitions-in head nor cognitions-in-practice (ibid.) *as* experience is gained.

Generally underlying technology acceptance models is the assumption that people's intention to use a technology is strongly correlated with actual use (Venkatesh et al., 2003). This assumption tends to define use as something which is clearly defined and temporally rigid. Consequently, we may be lead to conclude that behavioral intention can be equated with actual use and even continued use of an artifact. If so, we will risk downplaying the *axial dimensions of use* (that multiple dimensions of use exist) and rely too much on (potential) users expectations and imaginations. This jeopardizes reliability if respondents in our research have not obtained adequate grip of what the technology is, what it can do or what it can bring about.

Current theory offers modest attention to the dimensions of use and how cognition and behavior can alter temporally as experiences and knowledgeability shape in the wider service "consumption" process. With this we risk leaving out essential parts of the process. As Leslie Haddon (2004:17) reminds us, several more fine grained questions warrant consideration: Are we in the process of adopting? Have we cognitively but not behaviorally adopted? To what extent have we adopted or not adopted? Are we former users or drop-outs? Haddon further argues that "we need to be careful not to read into adoption figures any over-optimistic assumptions about the frequency of use and about the importance of ICTs in people's lives".

Merely focusing on the precedents affecting likelihood of acceptance/adoption at an absolute point of acceptance and at a point where user understandings are believed to have shap*ed* is not sufficient. We may risk neglecting the shap*ing* which may occur to user understanding as experience is gained and thus ignore or downplay the sense-making occurring as artifacts are objectified and incorporated into everyday life interactions. We also run the risk of targeting espoused and endorsed (what is supported and supposed to be) rather than the procedural (what is actually being enacted) and the axiomatic (why it is so). To understand these aspects we need to be more open to interpretative, mixed method and longitudinal research on adoption and use. This line of thoughts is also eloquently presented by Kari Kutti (2001) in his reflections over the developments from early instrumental perspectives of the user towards conceptualizations of users as active and reflective consumers: "One perspective that is very important but badly neglected is the perspective of learning and dynamics in the situation of use" (Kuutti, 2001:unpaginated). In sum, the central challenge for end-user

research is to better account for temporal alterations along with the social learning aspects unfolding as new services are encountered. Ambiguity of the artifact, contextual ambiguity and temporal dynamism reflect terminology reverberated in arguments used to justify interpretive and mixed method research; i.e. research aimed at second-level understanding upon which third-level understanding with model verification and falsification can be more rigidly made (Lee, 1991). Further explication of the underlying methodological choices relative to the above challenges is presented in detail in Chapter 4.

1.2.4 Opportunities for theoretical contributions

The challenges above highlight several opportunities for which theoretical contributions can be made.

First, to understand why people engage with mobile services we need not only put potential users' initial perceptions of mobile services under scrutiny; as is the prevailing approach in technology acceptance and diffusion of innovation studies. We need to investigate this shap*ing* over time as people acquaint new services. Also, as mobile service use often entail or facilitate social interactions, we need to seek knowledge about how own and other's knowledgeability and use can enable and constrain *initial* as well as *continued* use (e.g. as use spans space and time). This can contribute new theoretical understanding about how temporal changes can impact the course of mobile service use beyond explicit acceptance/rejection *decisions*.

Second, adoption and use of networked services should not be limited to studying individuals' decision-making processes (e.g. like the innovation decision process, cf. Rogers, 2003). Diffusion of service use, as seen from the history of SMS (Trosby, 2004), may depend on both the history and contemporary use of services by a certain person as well as use by other people. Therefore research should seek to be sensitive to the role of social interaction and experiences from these interactions over time. This can further theoretical understandings of the social structuring and institutional impacts of service use and its temporal evolution.

Finally, the multi-sphere crossing and versatile application areas of today's mobile artifacts render contextual impacts more important (see e.g. Haddon, 2001; Mennecke & Strader, 2003). Higher versatility will imply more complex shaping of user cognitions and behaviors. There are simply more unacknowledged conditions than in a single task specific application domain. For a more field realistic view to be offered to the shaping of mobile

service understanding and use we must thus follow the artifacts into their application contexts. This is necessary for exploring and discovering insights to theory about how adoption and use not only can change with context, but can also generate contexts which in turn impact mobile service understanding and use (e.g. network effects).

In sum, to understand how and why users start to, continue and discontinue their engagements with mobile services we need to study the phenomenon among interacting people over time as the services and the situated contextual conditions of use are encountered.

1.3 Phenomenon of interest and research questions

Different paradigmatic traditions vary in preferences towards whether or not specific questions should a priori be rigidly or more loosely defined (Lewis & Grimes, 1999; Lincoln & Guba, 2000). In more orthodox deductive approaches it is often argued that a specific question needs to be set before embarking on the further inquiries. Others argue this is not particularly suitable for exploratory and inductive approaches. The latter suggest instead to define the phenomenon of interest rather than a (set of) specific question(s) as this will allow discovery of pertinent questions and issues as research progresses (Lewis & Grimes, 1999). As the research direction taken in this dissertation is of exploratory rather than the confirmatory intent, it should follow that the latter position should be adopted. At the same time I do acknowledge the value of research questions in exploratory studies for establishing focus in a disciplined rather than blinding manner. Therefore, the phenomenon of interest is stated and followed by three interrelated questions. The questions delimit, but not in finite terms, the phenomenon investigated in the collection of papers constituting this dissertation.

1.3.1 Phenomenon of interest

From the above theoretical challenges it is possible to more specifically outline the phenomenon of interest and associated questions which will guide the further inquiries in this dissertation. True to the title, the phenomenon of interest of this dissertation is:

Shaping of user engagements with new mobile data services

Three delimitating aspects are set in the phenomenon of interest. First, it focuses on the shap*ing* of engagements pertaining to mobile services. Shaping reflects here a social shaping of

technology perspective (Bijker, Hughes, & Pinch, 1987; Mackay & Gillespie, 1992; Rohracher, 2003) and refers to an ongoing flow of interactions between humans and service technologies during which service engagments are shaped and reshaped over time. Of key interest is to reveal characteristic *cognitiv*e engagements. Focused is on the interpretations users construct and re-construct around the properties (features and qualities) and gratifications (value and fulfillments) rendered during user engagements with mobile services in real life contexts and in the contexts emerg*ing* with variations in frequency of service use.

Second, the phenomenon of interest is focused on the shap*ing* of behavioral mobile service engagements. This acknowledges the existence of different dimensions of use, e.g. type of behavior and its frequency under different use contexts. As opposed to most research focusing on a point of acceptance/adoption, shap*ing* of use recognize continuation and discontinuation as dimensions of use.

The final delimitation of the phenomenon of interest concerns temporal span signified with the word *new*. With exception of paper three which takes a diachronic perspective, focus is placed on the early period of user acquaintances with new mobile data services; that is, the immediate weeks following when a certain set of people are enabled to use new mobile services.

1.3.2 Research Question 1

Contributions to our understanding of mobile service use and adoption are needed beyond the static perspective of acceptance and rejection decisions. We need to know more about the shaping of cognitions and behavior as a process and about the characteristic cognitions and behaviors emerging during adoption and use. The first research question centers on the nature and process of how user understandings are shaped during "early adoption". This involves the shaping of perceptions and meanings during users' early experiencing of technology. The first research question is formulated to address this process perspective:

How is user understanding of new mobile services shaped during early mobile service experiences and engagements? (Paper 1 and 2)[9]

[9] Each of the four research papers part of this dissertation is given a number (1-4). The number(s) within the parentheses subsequent to each of the research questions refer to the respective number(s) of the paper(s) where the questions are further investigated.

1.3.3 Research Question 2

The above question seeks conceptual understanding of the shaping of user understandings of mobile data service adoption and use. However, as particularly emphasized in social cognitive theory (Bandura, 1986, 1999) and in works using Giddens' (1984) structuration theory (e.g. Orlikowski, 2000; Orlikowski & Baroudi, 1991), cognition and behavior are inextricably linked. By studying the shaping of cognitions relative to behavior it is possible to delineate the particular interpretative frame domains (Orlikowski & Gash, 1994) and forms of behavior displayed by users, i.e. typified and characteristic interpretations of service facets and characteristic adoption/rejection behaviors. Of interest here are particularly the *typical service qualities* – what Orlikowski (2000) call properties – and the *typical hedonic and utilitarian value aspects* (what is called gratifications, e.g. Blumler & Katz, 1974; Leung & Wei, 1998) that may emerge around and become attributed to a particular mobile data service. As also different types of behavior e.g. adoption and rejection (Rogers, 2003) and dimensions of use also may emerge, it becomes natural to explore:

What characteristic properties, gratifications and adoption/rejection behaviors shape around new mobile data services? (Paper 3, 4, and synthesis in Chapter 6)

1.3.4 Research Question 3

Prior research postulates and confirms strong relations between advantages of an artifact and its use (Rogers, 2003; Venkatesh et al., 2003). However, it is seldom explicated how user understanding of particular technical specifications of an artifact can enable and constrain further service adoption. In fact, the specificities of the artifact are often neglected (Markus, 2005). Underlying artifact specifications, and certain perceived qualities and use outcomes may enable, facilitate and even augment use of a certain service while others may act as constraints. This influence may also exist across services for which specifications, properties or gratifications are shared, substitutes or complements. It may also be so that these effects can be more prevalent for some services than others – and even be more salient for services used by groups or throughout social systems. Understanding how certain of these aspects act for or against use and can yield variations in the type of user behavior displayed thus becomes an issue of concern. The final research question of this dissertation is thus:

How do service specifications, properties and gratifications enable and/or constrain user engagements with new mobile data services? (Paper 3 and synthesis in Chapter 6)

1.4 Research context and project: Mobiconomy

While my eagerness and motivation to embark on the study of why m-services become used or not used matured, so did the hurdles to overcome for such research to be possible. A research context opening for investigating how people cope with new mobile data services as they meet and interface in everyday life practices and social interactions was needed. Beyond the usual requirements such as volunteering participants and adequate data generation tools, the research would require access to groups of interacting people that would be sufficiently supplied with the relevant technology. Thus, this research would not be possible without organizations supplying mobile devices, services, and network connectivity and data collection methods capable of exploring the issues in a real life setting.

The Mobiconomy[10] project at Copenhagen Business School (CBS) opened an arena for conducting this type of research. In the Mobiconomy project a consortium of technology providers (Nokia and Hewlett-Packard, TDC Mobil), content providers (DR – Danish Broadcast Corporation, Børsen - Financial Daily and FI - Danish Consumer Information) have collaborated to develop and research new mobile services. The constituents are all associated with Crossroads Copenhagen[11], a network of research institutions, private companies and public organizations, aiming to facilitate and strengthen the co-operation between companies and universities within culture, media and communication technology. The geographical area of focus was the new Ørestad North city region of Copenhagen where approximately 20,000 people will live and work when fully developed. Besides new residential buildings, already established in Ørestad North is the humanistic branch of the Copenhagen University, the IT University, and the National Consumer Agency. The Danish Broadcast Corporation joined with headquarters in 2006. The different research initiatives of Crossroads Copenhagen, including content developments for new technology platforms, location-based services (LBS)

[10] Mobiconomy is an abbreviation of the words mobile and economy.
[11] www.crossroadscopenhagen.dk

and technologies and economics of new mobile data services, all utilize the area as a 'living lab' for research on technology and their uses by individuals and groups of individuals.

The aim of Mobiconomy was to research and develop new mobile services, hereunder location-based (LBS) services. Key themes have been to understand economic, strategic and market related issues during early market developments and innovation. This has demanded considerable resources to be directed from all the members of the consortium. In addition to human resources, several technology resources have been put in place. New mobile data services have been provided by the content providers and by TDC, the Danish incumbent mobile operator, over the Fly service delivery platform. TDC has provided access to their mobile network architecture from both a supply and demand perspective. They have facilitated the enabling of services from content providers over the network architecture and the use of services from mobile handsets over their network (via GPRS[12]). TDC has also amiably provided pre-charged SIM-cards to our research participants as well as supplied the raw data of the network traffic registered on these. With respect to handsets, Nokia has graciously supplied more than 80 advanced mobile handsets to Mobiconomy and Crossroads Copenhagen during the project period. Together the above resources and efforts offered an arena of research where CBS researchers could perform investigations.

1.5 Outline of the integrative summary

The five remaining chapters constitute an integrative summary of four selected research papers. The papers[13] crafted during the course of the PhD project have been published in academic journals or accepted in the proceedings of international conferences. Full versions of the papers are found in Appendix 1.

The integrative summary is structured as follows. In the chapter following next I present technologies employed in the mobile service provisioning in Denmark along with a statistics on these. In Chapter 3 I construct a pre-understanding by reviewing predominant theoretical perspectives and scholarly approaches to the study of adoption and use of m-services. This chapter also extends contemporary efforts to integrate between different streams by also attending to process oriented theories. Chapter 4 presents the methodological

[12] GPRS – General Packet Radio Service (enable 'always-on' connectivity and data transfer over cellular phones at theoretical speeds of up to 115,200 Kbps.

[13] The papers are both single-author and co-author papers. I use the pronoun we when referring to papers that has been co-authored and I for the single-authored paper.

considerations and explicate in detail the methodological approach designed and employed in the research papers. Also criteria for evaluation are here discussed. The research question(s) addressed, research findings, theoretical contributions and limitations of the four papers are presented and discussed in Chapter 5. The final chapter of the dissertation, Chapter 6, presents overall limitations of the research, implications for theory and practice, and key conclusions.

2 Chapter 2: Mobile service technologies and use in Denmark

This chapter serves two main purposes in an integrated manner: *(1) present the reader to important mobile services and enabling technologies enabling; (2) provide overview of their adoption and use in Denmark.* The chapter provides a picture of the 'state of m-service affairs' relevant up to and around the period where the field study and key research of this dissertation commenced; that is, from the millennium change until the start of 2004. Lingo and neologisms associated with mobile data services and enabling technologies are introduced and explained. For each service and technology presented I offer statistics on their use for so to pinpoint which of these were facing tailwind or headwind in Denmark in early 2004. Here, official statistics provided by the National IT and Telecom Agency in Denmark[14] together with data collected in a survey by the Mobiconomy project's researchers under the MUSE I[15] study are drawn upon (see Appendix 2 for a presentation of this survey's method). *It is important to underline: the statistics of MUSE I are drawn upon for descriptive purposes in this chapter only.* Data from the field study, MUSE II are applied in the four research papers. As only a descriptive summary of MUSE I findings is presented below it should be mentioned that papers presenting the research method and results from this survey in more detail have been published in conference proceedings and in two journal papers (Constantiou, Damsgaard, & Knutsen, 2004c, 2004d, 2005, 2006, 2007). The key purpose of this chapter is to present services, technologies and their use *as a baseline for justifying the further theoretical and empirical scrutiny* which follows in later chapters and in the papers constituting the research body of this dissertation.

2.1 Interpersonal communication services

Interpersonal communication services refer to mobile services which mediate communication between two or more people via digital mobile devices and infrastructure. While mobile voice telephony is outside the definition of a mobile data service offered in § 1.1, it should not be

[14] The Danish Ministry of Science and Innovation publishes bi-annual statistics reported by the telecommunications providers in Denmark (www.si.dk).

[15] MUSE (abbreviation of Mobile USe Exploration) consisted of an online survey of mobile service use in Denmark in 2003 to which 1129 valid respondents replied. The survey used convenience sampling. This means that no claims can be made that this study is representative for the Danish population. See appendix 2.

forgotten that this is the interpersonal communication service from which mobile communications gestated[16] and which still generates the most digital traffic across mobile networks in Denmark and most places elsewhere. Thus, the inclusion of voice telephony in the statistics below is for descriptive purposes. With the transition from first generation (1G)[17] to second generation (2G)[18] digital cellular networks, which came with the introduction of GSM in Denmark, the range of mobile data services enabling digital interpersonal communication have expanded from simple short messaging services (SMS) to multimedia messaging services (MMS). Also mobile e-mail and chat services are interpersonal communication services introduced during the GSM era.

2.1.1 Mobile Voice Telephony

Official mobile operator statistics (cf. Table 2-1) show that an average of about 2.4 daily mobile voice minutes were registered on the 4.8 million mobile subscriptions registered in Denmark[19] for 2003. In the MUSE I survey we found that almost 50 percent of the respondents used less than 5 mobile phone minutes per day and close to 80 percent used less than 15 minutes per day.

Table 2-1: Daily mobile voice minutes

Voice minutes per day	%
0-5 minutes	49.6
5-15 minutes	29.1
15-30 minutes	13.9
30-60 minutes	5.6
More than 60 minutes	1.9

[16] At first this was introduced as analogue communications in the Nordic Mobile Telecommunications (NMT) systems. With the introduction of GSM (Group Systémé Mobile) in 1992, voice telephony over mobile networks became digitalized.

[17] The cell structured systems we know today first emerged with the advances in multiplexing systems. In particular frequency division (e.g. FDMA), and cell frequency reuse put forth the foundation of first generation (1G) analogue cellular networks such the Advanced Mobile Phone Service (AMPS) in the USA, the Total Access Communications System (TACS) in Europe, and the Nordic Mobile Telephony (NMT) system (Dornan, 2002) With these advances and the arrival of phones sufficiently small to be carried around (e.g. the Motorola DynaTac in 1983), the only mobile services available at that time, voice telephony, reached 10 million mobile users in 1990. Today, however, most of these cellular phone systems have been phased out, and users have migrated to second generation, or even third generation (e.g. WCDMA or CDMA-2000 based), cellular systems.

[18] There are multiple standards of 2G. Multiplexing technologies such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) have provided significant impact in the move towards digital cellular networks. The first, TDMA, became dominant as it became a standard used in GSM networks around the world (2/3 of all mobile systems). Other standards using TDMA was the Personal Digital Cellular (PDC) system solely deployed in Japan by J-Phone and NTT DoCoMo, and the proprietary iDEN networks developed by Motorola and deployed by Nextel in the US and Tellus Mobility in Canada, as well as in the air interface in D-AMPS (IS-136) deployed in the Americas. CDMA on the other hand, which uses spread spectrum coding as opposed to time division in multiplexing was pioneered by Qualcomm and deployed mainly in the Americas and in Asia to establish the proprietary system known as cdmaONE (Umar, 2004; Dornan, 2002).

[19] Mobile phone penetration in Denmark was calculated at 88.8% at the end of 2003. Caution should be used when interpreting penetration rates as the numbers do not account for multiple subscriptions per person and inactive subscriptions. This also implies that the average number of voice minutes can be somewhat misleading relative to the actual number of minutes used by active subscribers.

2.1.2 SMS

SMS, an abbreviation for Short Messaging Service, refer to a 160 character digital short message with payload of up to 140 bytes[20]. The service has been an embedded part of the original GSM architecture where it utilizes the control radio channel rather than the traffic channels for transmission of operator originated and user originated messaging traffic. SMS has been called the "the strange duckling of GSM" (Trosby, 2004:187) because, contrary to anticipations among technology providers strong beliefs in mobile fax and modem, it became the first 'killer application'[21] of mobile data communications. Contrary to many popular beliefs, however, the nascence of SMS was not a mishap but a professional engineering development effort under the standardization work with GSM (ibid.). However, the success of SMS was not predicted in thorough market analyses and profit analyses. Its rapid growth and institutionalization during the enormous growth of mobile device take up was in fact largely unanticipated.

In recent years the Danes have become among the most edacious SMS users in the world. In 2003 the number of SMS sent via Danish GSM networks surpassed the number of outbound voice minute traffic in Denmark. The official statistics[22] of average weekly SMS traffic in is provided in Table 2-2. On the average subscription it was registered 5 SMS per week in 2000. During the first half of 2004 this had grown to 23.5 SMS per week. The average annual growth rate from 2000 to 2003 has been 34.9%.

Table 2-2: SMS Traffic Denmark 2000 - 1st h. 2004[1]

2000	2001	2002	2003	2004 1st half
5.0	7.0	9.2	16.5	23.5

The findings regarding person-to-person SMS use from the MUSE 1 survey conducted in February 2004 are presented in Table 2-3. More than a quarter of the respondents of this survey use SMS more than 20 times per week and almost a third use 6-20 SMS weekly. Near a third of the

Table 2-3: SMS Use (person-person)

SMS per week	%
Do not use SMS	6.8
Use SMS Now and then	29.1
Use SMS up to 5 times per week	13.9
Use SMS 6-20 times per week	31.5
Use SMS more than 20 times per week	25.2

[20] Combinations; 160 7-bit characters, 140 8-bit characters, or 70 2-byte characters – metadata and routing data excluded.
[21] See paper 3; Knutsen & Lyytinen (2008)
[22] Caution should be taken when reading these numbers as they can include operator originated messages (e.g. information and commercial messages) and are therefore not necessarily limited to person-to-person SMS.

respondents use SMS on a more occasional basis. Of the 1129 valid respondents only 6.8% do not use SMS. SMS is thus approaching pervasive awareness and use among the survey respondents and appear to have become strongly ingrained as a habitual tool for peer-to peer communication. The survey statistics reveal that this is especially so among the younger age groups (Constantiou et al., 2006). The two sets of statistics point to SMS as being the 'killer application' of mobile data services in Denmark (Knutsen & Lyytinen, 2005a).

It needs to be mentioned that SMS can today also be used for chatting. SMS chatting is a service where chat-rooms exist either live on the TV screen or on text-TV. However, among the respondents of the MUSE 1 survey this type of inter-personal service use seems to be almost non-existent.

2.1.3 MMS

Enabled by the combination of SMS and the protocols of WAP (explained below), multimedia messaging (MMS) adds multimedia features to mobile messaging. MMS enables exchanges of a range of content, e.g. text, pictures, animations, audio, and video, between devices and networks[23]. MMS greatly extends the payload confinements of SMS. It supports messaging both to phone numbers (the E.164 standard) as well as e-mail addresses (the RFC 2822 standard). However, the payload of MMS is currently restricted by specifications of handsets and networks. At the time of writing, for instance, TDC customers in Denmark are restricted to payloads of up to 100kb. While not restricted to pictures, MMS is in Denmark is commonly referred to as "billedbeskeder" which literally translates to 'picture messages'.

There has been growing use of MMS in Denmark. However, it is far from replicating the bursting growth witnessed with SMS. The official statistics from the National IT and Telecom Agency in Denmark show that only 0.01 MMS was registered on the average subscription per month in 2002. In 2003 this had increased to 0.04 and to 0.15 for the first half of 2004. Among the 'advanced users' in the MUSE I survey we found that close to half (46%) of the respondents had never tried to send MMS to other people's mobile phones. While 3% did not know of MMS, 25% had used it a few times, 23% were using it now and then, 2% used it less than five times per week and a scarce percentage of the 'advanced users' used it more than six times per week. As with SMS it is the younger generations using MMS the most

[23] MMS supports the following formats: Text, MPEG4, HTML, Gif / Animated GIF, JPEG, WBMP, PNG, MP3. It uses either WAP WSP stack or HTTP/TCP/IP WAP push for transmission.

(Constantiou et al., 2006) There seems thus to be a sharp divide between the use of SMS and MMS in Denmark[24].

2.1.4 Mobile e-mail

Mobile e-mail basically provides e-mail as we know it from computers, though in a scaled down version, to be used on mobile phones. It uses a wireless data connection (either circuit switched or GPRS in GSM networks) to connect to a mail server where messages can be downloaded and sent through. As opposed to Japan where mobile e-mail is the predominant technology for mobile messaging (Ishii, 2004; Ito & Okabe, 2003a; Mizukoshi, Okino, & Tardy, 2001), mobile e-mail appear not to have gained much use among the respondents in the MUSE I survey. Half of the 420 'advanced users' have not tried mobile e-mail, while 15% have tried it a few times and 22% use it now and then. In contrast, we find that 90% of the respondents use e-mail via personal computers on a daily basis. Relative to SMS, which 93% of the respondents were using, this underlines how two distinct messaging technologies have become anchored around two separate computing environments and modalities of use (stationary vs. mobile). There are no official statistics on mobile e-mail use in Denmark.

2.2 Content Oriented Mobile Data Services

A range of other mobile data services have appeared as a result of technological advances of the late 90s. In contrast to the above, which is centered on services mediating human originated communication and messaging, the content and communication characterizing these services originate from professional service providers. Below, the most central of such data services offered in the Danish market are described both with respect to enabling technologies and their use.

2.2.1 Premium SMS

While the above paragraphs on SMS focuses on the most common use as a service for interpersonal message exchanges, the innovations around SMS have also enabled a range of other uses of this technology. Innovations have made SMS also into a medium for ordering and receiving content (e.g. information content, phone ringing tones, backgrounds, logos, screensavers etc.). As mentioned under interpersonal communication services, also chatting

[24] It may be noted that the price of an MMS is between 10-15 times as expensive as a regular SMS.

online or via TV-based chat rooms (e.g. text-TV), and participating in competitions and votes (e.g. competitions in TV and radio shows etc.) is now offered as a premium SMS service. The terms often used to describe such enhanced SMS possibilities are either value-added SMS services, content-charged SMS services, or premium[25] SMS (PSMS) services. There are no official statistics provided regarding the use of premium SMS in Denmark. However, the MUSE I survey provides some insights on the extent of use regarding these services. Out of the 1129 respondents, 709 individuals (62.9%) answered 'no' to using other services than voice and simple SMS. Among the remaining 420 'advanced users' premium SMS services appear not to be used to a great extent. Around 50% of the 'advanced users' do *not* use SMS to order and receive information content, or to participate in votes and competition or to purchase ringtones, backgrounds, logos, games or screensavers. There are only marginal shares of respondents using the services more than on a now and then basis.

Table 2-4: Premium SMS Use

	% of the 420 'advanced users'				
Description	Do not use this	Use it now and then	Use it up to 5 times per week	Use it 6-20 times per week	Use it more than 20 times per week
SMS to receive information content (e.g. news, finance information etc.)	58.8	34.5	3.6	2.1	0.1
SMS to vote and participate in competitions (e.g. for TV shows etc.)	48.1	49.8	1.9	0.2	0
SMS to receive ringtones, backgrounds, logos, games and screensavers	54.0	44.8	1.0	0.2	0
SMS Chat (e.g. in relation to Text-TV)	95.2	4.0	0.5	0	0.2

2.2.2 Portal services via WAP

WAP, short for Wireless Application Protocol, warrants some extra explanation. This is not only because WAP the portal services investigated in this research are based on the second generation of WAP standards. WAP is also very interesting because it, contrary to business expectations of its immediate success, largely failed in the marketplace (De Marez & Verleye,

[25] The term premium here refers to the premium charge which is added to the ordinary charge of an SMS.

2004; Sigurdson, 2001). In fact, for no other mobile technology have we witnessed a similar differential between the degree of hype and degree of realized use.

WAP encompasses an application environment, a stack of protocols and a device embedded microbrowser which together enables creation, presentation and delivery of data services to mobile phones and other WAP enabled wireless devices. Very succinctly put, WAP enables encoding and decoding of data content for transmissions between network infrastructure and handsets. Typical categories of contents available via WAP are news services, entertainment services (also infotainment), downloads of ringtones, backgrounds, logos and screensavers, and map and location services. The contents obtainable via WAP span the range from plain text to various multimedia formats. Most often the contents and services are provided in part or full by third party content and application providers which receive a share of the revenues generated from the content sales or subscriptions to their services.

The different versions of WAP have been the primary technologies to enable provisioning and use of mobile services. It functions much like 'regular' Internet pages and services but is optimized for small-screen mobile phones environments. It is used in GSM based network architectures but also in CDMA based networks in North America and Japan[26]. WAP was developed by the WAP Forum, initially consisting of Ericsson (now Sony-Ericsson), Unwired Planet, Nokia and Motorola, as a license-free standard for wireless devices to utilize the Internet and the World Wide Web (WWW). Subsequent to its release (v. 1.0) in April 1998 (Sigurdson, 2001) the WAP Forum grew to more than 100 players and came to include giants such as Microsoft, IBM, Intel, and, ironically, as this company sought to standardize its proprietary i-mode architecture, Japanese NTT DoCoMo[27].

However, and as opposed to the proprietary siblings of i-mode (NTT DoCoMo) and J-Sky (J-Phone[28]), the initial mobile service portals around WAP largely failed to achieve extensive use by mobile phone users. Even after WAP became a standard embedded in basically all new mobile phones, its use remained scarce. Two of the often highlighted issues have been lack of WAP content[29] (Funk, 2001; McGinity, 2000) and security gaps (Dornan,

[26] KDDI, using a CDMA based network, deployed WAP for their *au* portal services. However, both J-Phone and NTT DoCoMo developed proprietary architectures for their J-sky and i-mode service delivery platforms.
[27] Although NTT DoCoMo did not come to deploy WAP, they held a seat at the board of the WAP Forum.
[28] Now under majority ownership by Vodafone.
[29] The former probably results from the use of the specialized wireless mark-up language (WML) which forced content developers to learn a new mark-up language rather than make minor adjustments to HTML, the de-facto

2002). In order to improve on the difficulties of the initial version and to take advantage of the network packet switching technologies of 2.5G (GPRS[30]), 2.75G (EDGE[31]) and 3G (W-CDMA[32]) networks, the WAP Forum released a second version of WAP (v. 2.0) in January 2002. Constituting a fundamental specification reissue, this version provided support for HTTP and TCP/IP for secure end-to-end HTTP transactions between web-server and devices. Maybe as importantly, support for XHTML[33] brought the development and delivery of WAP content closer to the procedures developers were used to from content creation on the 'regular' Internet. Although support for WAP1.x is maintained, the 2.0 version largely replaces the thick WAP gateway by a proxy translating back and forth between web-servers and WAP 2.0 (Umar, 2004). The second generation also opens for using XML content with stylesheet adaptation to wired as well as wireless devices (Dornan, 2002).

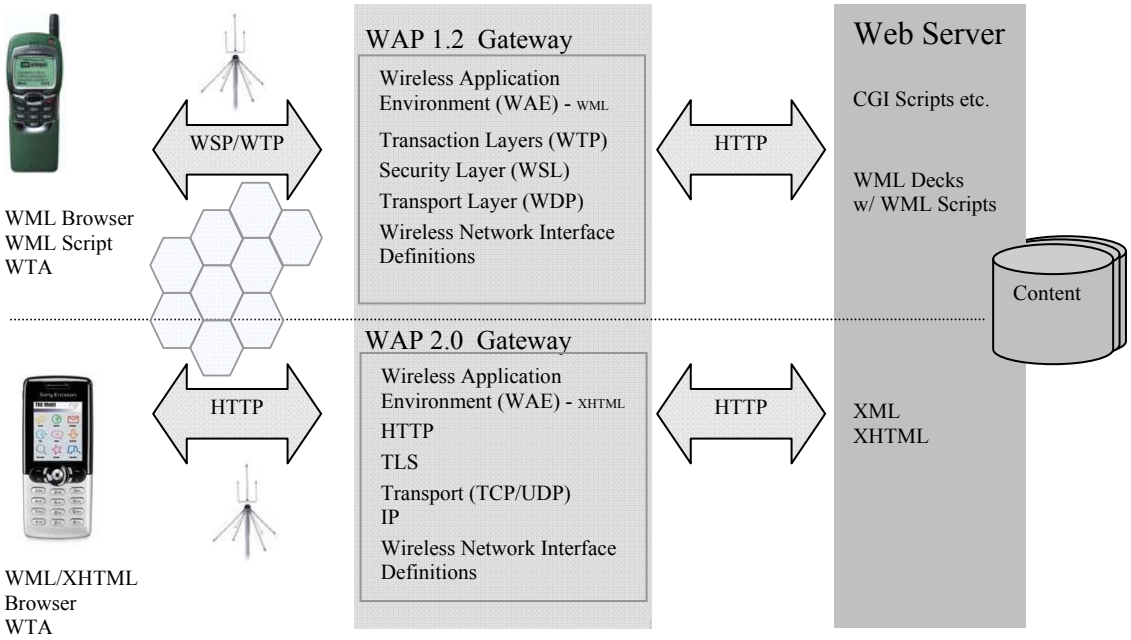

Figure 2-1: WAP Architecture and Atack 1.2 vis-à-vis WAP 2.0. Adapted from Umar (2004) and WAP Forum's Wap 2.0 Whitepaper.

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standard of the regular Internet (Funk, 2001; Ratliff, 2002; Sharma & Nakamura, 2003). Furthermore, the language was not scalable, not open, and did not come to be consistently implemented.

[30] General Packet Radio Service: a packet oriented data transmission service for GSM.

[31] Enhanced Data rates for GSM Evolution allowing increased data transmission speeds in GSM networks.

[32] Wideband Code Division Multiple Access is a type of 3G cellular network.

[33] XHTML – Extensible Hypertext Markup Language is an extensionof HTML which is stricter in that content must be well-formed. This facilitates functioning across a broader range of devices and browsers. XHTML is an application of the metaformat of XML used to create special purpose mark-up languages. A main feature of XHTML is the use of cascading style sheets which enables separation of content and style.

Improvements in the second generation of WAP have lead several mobile operators to engage in efforts to revitalize WAP[34] on the path towards a transition to 3G services. TDC's launch of MobilFly in Denmark in the fall of 2003 is one example of such an attempt to revitalize WAP. This and similar focus on mobile WAP services took place at the moment when the data for the MUSE I survey was collected. However, as is evident from the data, frequent use of WAP services seem to remain diminutive.

Among the 'advanced users' we found that less than 10% were using WAP services on a weekly basis. While a third of the 'advanced users' respondents said to use WAP services now and then, the combined share of 'advanced users' having either tried it only a few times or not tried at all was close to 55%. Among the 'basic users' we found that 63% have heard about mobile services over WAP but not tried. Only 24% of the 'basic users' had tried such services. Similar numbers are also found for both groups with respect to browsing of regular Internet pages (not over operator portal) via a GPRS connection.

Few of the 'advanced users' used WAP services to download personalized contents such as games, pictures, ringtones, and backgrounds. Not a single respondent used any of these services on a weekly basis and 2-3 per cent had never heard of such services. With respect to downloading of games, 65% had never tried downloading games via WAP portal services, 21% had tried it a few times and 11% used it now and then. Downloading of pictures over portals had not been used by 51% of the 'advanced users' while 31% had tried it a few times and 16% used it now and then. The percentages with respect to downloading of backgrounds are almost identical with that of picture downloads (+-1%). However, and higher than for the

[34] It is interesting to note that while WAP has been developed by large consortium of different players with the aim of establishing a global standard to jointly promote the advent of the mobile Internet, the intention of unity did in most places not result in as integration between value players around the architectures, e.g. MNOs, third party content providers, handset manufacturers etc. In many instances, and as opposed to what seems to be the case for Japan (Funk, 2001), this led to a fragmented launch of constituent parts and atomistic products and/or services rather than a compound product-service offering (Knutsen & Overby, 2004). Notably, the authors of a European Commission report released in 2003 suggest: "Standards and coordination seem to be crucial in the early stages, in order to start the ball rolling… It may be wiser to coordinate the delivery of fully functional solutions based on available technology rather than allow uncoordinated delivery of non-fully functional system parts, as has happened in Europe (WAP/GPRS etc.)" (Bohlin et al., 2003:28). Tighter overall architectural integration has, however, in more recent years been attempted by MNOs in Scandinavia in launches of redesigned mobile gateway portals such as MobilFly by TDC in Denmark and Entry from Telenor in Norway. Here, handsets with preinstalled configuration setups to provide an m-service portal access soft-key (like the i-button which i-mode handsets were equipped with upon launch in 1999) are signs of collaborative efforts to revitalize WAP in the transition towards 3G.

other download services, 41% had downloaded ringtones a few times and 20% were using such services now and then. We found that 36% had not tried to download ringtones via WAP.

All in all the figures above show that there has been some use of WAP portal services, but that the frequency of use is minimal. This is also reflected in the official statistics on data traffic over GPRS in Denmark where only 4kb of GPRS traffic per week in 2003[35] was registered on the average GSM subscription. In light of the massive use of interpersonal communication services and the daily use of regular Internet services, this further underlines the need to understand why some services are used and why some are not used. However, before embarking on a further investigation of this there is a need to offer the reader an introduction to mobile Java and 3G.

2.2.3 Mobile Java

In recent years, most mobile device manufacturers as well as many mobile operators in Europe and elsewhere have started supporting and provisioning of MIDlets. MIDlets are Java (J2ME[36]) applications for embedded devices which can run on all wireless devices which has installed the J2ME run time environment called KVM (Kilo Virtual Machine) (Umar, 2004). Being a so called 'develop once, run on all' solution, J2ME is Sun Microsystems' attempt to remedy and bridge the increasing fragmentation which has been characteristic for mobile service provisioning (e.g. no end-to-end integration of different specifications from handset providers, content providers and network operators). Moreover, as J2ME is not only tailored towards embedded devices. It is also fully functional with the use of applets on high end devices and SmartCards. A MIDlet, also called an applet, is a small program that runs in the context of a larger program, but rather than running on KVM it is designed to run on either on a compact virtual machine (CVM) or as JavaCard Applets in smart cards (e.g. SIM card). Thus, the span of J2ME and JavaCard enable 'create once, run on all' for personal computers, mobile devices as well as microchips. One of the most common uses of J2ME is for programming and provisioning games to mobile devices. While we in MUSE I obtained some data on the downloading of games, we do not have specific data on Java applications and games.

[35] Calculated based on the official statistics provided by the National Telecommunications Agency in Denmark (www.si.dk) for 2003 (1.1 million GPRS MB and 4.7 million registered.

[36] Java is a proprietary standard of Sun Microsystems. J2ME is short for Java 2 platform Micro Edition. It enables emulation of applications and games on computers which can be transferred to mobile phones.

2.2.4 3G

Third generation network architectures were primarily developed in order to provide mobile broadband and thereby overcome the bandwidth limitations of the second generation networks. 3G provides a platform for new and more advanced mobile data services and thus an expanded range of revenue opportunities for mobile operators and content providers. In Denmark the first third generation (3G) cellular network (out of four total licensed in Denmark[37]) was opened by the operator '3' in November, 2003.[38] All operators in Denmark are deploying the W-CDMA[39] protocol set which is also currently deployed by more than 60 MNOs in 25 different countries[40]. This is the 3G multiplexing technology and protocol set underlying UMTS (Universal Mobile Telephony System) which is a particular type of 3G service delivery architecture.

Utilizing a pair of the 'broad-spectrum' 5Mhz downlink and uplink channels, theoretical transfer speeds of UMTS is close to 2Mbit/s (1920 kbit/s). However, the realistic speeds are at the moment of writing 64 kbit/s in uplink and 384 kbit/s in downlink. This is 'sufficient' bandwidth for enabling real-time video streaming, video-telephony and broadband Internet multimedia transfer. With future upgrade to High Speed Downlink Packet Access (HSDPA), the downlink speeds can potentially reach 14.4 Mbit/s (this is sometimes referred to as 3.5G).

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[37] In September 2001, four[37] 3G spectrum licenses were auctioned to Danish mobile operators at a cost of approximately $ 472 million (950 mill. DKK per license).

[38] Please note that TDC, the MNO we collaborated with during the project period, did not open their 3G networks until November, 2005.

[39] The air interface of W-CDMA is also used in the proprietary FOMA 3G service architecture of NTT DoCoMo in Japan. The other is CDMA2000 and the various extensions of it which has gained manifest in countries with pre-existing CDMA networks[39], e.g. network operators of South Korea (Yoo et al., 2004), KDDI of Japan and several MNOs in the US. Also, included among the International Telecommunications Union's IMT-2000 specification is a less known third standard called TD-SCDMA which is set for deployment in China during 2005 (Dornan, 2002) W-CDMA resulted as joint development between ETSI (European Telecommunications Standards Institute) and NTT DoCoMo and was accepted as an IMT-2000 3G standard in 1998[39].

[40] The UMTS Forum. (www.umts-forum.org). Accessed January 24, 2005.

While the evolution towards 3G has been most promising in Japan[41] and South Korea[42] (Yoo et al., 2004), the scores of unenthusiastic publications up until second half of 2004 sketch out a contrasting picture almost consistently pointing to the question of why developments have been so slow (Schenker, 2004). At the end of 2003 the National IT and Telecom Agency of Denmark reported of 3.425 3G subscriptions in Denmark (cf. Table 2-5). A year later, 3G subscriptions only constituted 2.4 percent of the total cellular subscriptions in Denmark. Yet, during 2004 '3' gained 121,249 new subscribers, becoming the MNO with the fastest subscriber growth in Denmark; at speeds approximately twice to that of Telmore and TDC. In strong correspondence with the official Danish subscriber statistics from the first half of 2004, 1% of the respondents in the MUSE I survey (conducted in March 2004) were currently 3G subscribers[43].

Table 2-5: 3G Subscriptions in Denmark 2003-2004

	2. h. 2003	1. h. 2004	2. h. 2004
3G subscriptions	3.425	50.359	124.674
% of all cellular subscriptions	0.07	1.03	2.41

2.3 Summary

Three central developments can be highlighted above. First, use of mobile data services beyond SMS has in Denmark, as in most GSM-countries, been embryonic and developed contrary to initial hypes about immediate success. Second, WAP services have been available for some time, but have failed to attract usage and mass. This is in stark contrast to developments in Asian countries such as Japan and South-Korea where similar services have received far greater use. Finally, third generation (3G) mobile telephone systems are currently being rolled out and an increasing number of users are being exposed to data services via mobile phone at speeds closer to what is known from the regular internet. It can thus be concluded that technical infrastructure is in place, but services are awaiting users' hands.

[41] After a tenuous onset there has been strong gains in 3G uptake in Japan. At the end of 2003 18% of the 66.1 million mobile phone subscriptions were 3G enabled (incl. CDMA2000) according to Japans Telecommunications Carriers Association (http://www.tca.or.jp/eng/database/daisu/index.html; accessed November 11, 2004)

[42] Ministry of Information and Communication (MIC), South Korea. Korea Internet Whitepaper 2004. (http://www.mic.go.kr/down.jsp?filePath=/board/eng_data/res_pub_db/&fileName=res_pub_kwp_2004.pdf; accessed November 11, 2004). At the end of 2003: 74 percent of the total 33.6 million cellular subscribers were 3G (CDMA2000 1x EV-DO) enabled.

[43] The number of respondents is not sufficient for statistical analyses. However, out of the 11 3G subscribers we see indications that attractive prices on phone and subscription together with mobile broadband and e-mail possibilities as the primary reasons for these 11 to choose 3G.

3 Theoretical perspectives: Developing a pre-understanding of mobile service adoption and use

The former chapter presented how use of mobile data services beyond SMS and extensions to SMS has not gained the expected momentum. From this outline of mobile service technologies and the indications on their use it is now relevant to review theories and research perspectives which seek to predict, describe and explain their adoption and use. In this chapter I present the ex-ante *pre-understanding*. It formed by reviewing literature of different research perspectives central to the phenomena of interest and corresponding research questions stated in § 1.3. By pre-understanding I mean an intentionally constructed theoretical understanding of the research phenomenon which acts as a frame and theoretical reference for my research that is subject to re-construction, modification, refinement and expansion (see the Service Engagement Framework of Chapter 6). The theories I draw upon do not come from a single well structured and coherent body of literature. Rather, as interest in technology adoption in general, and mobile service adoption and use in particular, intrigues researchers from several disciplines, the review visits four different domains of relevance. This includes central perspectives from scholars with orientations towards IS, anthropology, sociology, psychology, media and communication, innovation and marketing. I find this crossing natural as the current status of research largely reflects what Weiser predicted over a decade ago:

> "As we start to put tabs, pads and boards into use, the first phase of ubiquitous computing should enter its most productive period. With this substrate in place we can make much more progress both in evaluating our technologies and in choosing our next steps. A key part of this evaluation is using the analyses of psychologists, anthropologists, application writers, artists, marketers and customers. We believe they will find some features work well; we know they will find some features do not work. Thus we will begin again in the cycle of cross-disciplinary fertilization and learning. (Weiser, 1993:84)

The pre-understanding presented in this chapter derives from a *review of and integration* between constructs and themes from *four* related bodies of theory and research on adoption and use of mobile services. The pre-understanding was established based on the body of research available in *2003-2004*.

3.1 Four central streams of research

Publications in IS research have so far been heavily oriented at predicting and explaining initial acceptance and adoption of mobile services. Strong focus is put on modifying and applying organizationally oriented variance models of *Technology Acceptance* (TA) and *Diffusion of Innovation* (DoI) to consumption and leisure oriented mobile service settings. Sarker and Wells (2003) warns that merely instantiating existing theories in a new context can lead to ignorance of issues unique to mobile communication adoption and use. Similar to the integrative stance advocated by Pedersen & Ling (2003) they argue that traditional approaches can well be fertilized with the unique insights of related streams of consumption oriented ICT research. Similarly, Pedersen and Ling (ibid.) demonstrate how research on *Uses and Gratifications* (U&G) and the *Domestication of Technology* (DoT) can add knowledge about what people seek to obtain from mobile service use in everyday life, the expanded process of appropriation and domestication beyond acceptance, and the social consequences of mobile service use. As is revealed in this chapter, the latter streams are pivotal forming a pre-understanding about the shap*ing* of adoption and use as a process. The suggestions of interdisciplinary borrowing and fertilization between these four related research streams[44] have been of strong influence to forming a synthesized pre-understanding. Due to the particular challenges the integrative views bring to the logical structure of the pre-understanding, *only a brief presentation of each is given prior to offering more details in the synthesized pre-understanding (cf. section 3.3)*

3.1.1 Technology Acceptance

TA research, originating from Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) is the dominant strand of research for explaining and predicting information systems use in organizations (Davis, Bagozzi, & Warshaw, 1992; Davis & Venkatesh, 2004; Venkatesh et al.,

[44] It should be mentioned that not all four 'streams' have become equally theoretically established.

2003). Among the multitude of multiattribute models appearing in the literature[45], eight of the empirically validated models presenting direct, indirect and personal difference variables (e.g. age and gender) affecting intention to use and actual use of information systems have recently been reviewed, integrated and empirically tested by Venkatesh et al. (2003) to form the Unified Technology Acceptance and Use model (UTAUT).

The well established constructs and operationalizations of the various TA models[46] are ever more applied to mobile services settings (Hung et al., 2003; Khalifa & Cheng, 2002; Teo & Pok, 2003). The research rests commonly on the central assumption that contingency (necessary and sufficient) relationships can be established between antecedent, moderator and outcome variables and be inferentially modeled to predict people's intentions to use as well as actual use of a certain mobile service or a set of mobile services (e.g. WAP services). A summary of the meta-constructs of UTAUT (Venkatesh et al., 2003) and key root constructs applied in mobile service research is presented in Table 3-1. However, as the constructs have parallel and strongly related variables in DoI acceptance studies (see § 3.1.2), and the related variables of the latter are commonly implied in mobile service studies, I have chosen to also include particular root constructs of these in the table below. The constructs of the overview-table are discussed in more detail in section 3.3.

[45] E.g. Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1991, The Technology Acceptance Model (TAM) (Davis, 1989, and hybrid TBP/TAM combinations (e.g. Taylor & Todd, 1995)

[46] E.g., an in addition to TRA mentioned, commonly used models include the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB) and the decomposed TPB (see for instance Teo & Pok, 2003).

Table 3-1: Constructs Used to Explain Intention to Use/use of m-services

Meta-construct and logical structure (Venkatesh et al.,. 2003)	**Root constructs applied in mobile service research**	**Empirical m-service study**
Performance Expectancy -expected/perceived performance and use-outcomes of an artifact promote a (potential) users' intention to use/use	Usefulness Relative Advantage	Teo & Pok (2003) Hung et al. (2003) Rogers (2003) (DoI) [47] Teo & Pok (2003)
Effort Expectancy -expected/perceived efforts reduce intention to use/use and (can) moderate expected perceived performance	Ease of use Complexity Service costs Risk	Teo & Pok (2003) Hung et al. (2003) Rogers (2003) Teo & Pok (2003) Hung et al. (2003) (not sign.) Teo & Pok (2003)
Social influence -expected/perceived influences from important others and normative technology use promotes intention to use/use	Subjective norm	Hung et al. (2003) Teo & Pok (2003)
Facilitating conditions -expected/perceived beneficial conditions in the environment (e.g. technical and resources) relative to personal conditions (e.g. ability) can augment intention to use/use	Behavioral control (self-efficacy) Compatibility Trialability Observability	Hung et al. (2003) Teo & Pok (2003) [48] Hung et al. (2003) Rogers (2003) (DoI) --- « » ---, Hung et al. (2003) --- « » ---, Hung et al. (2003)
Attitude -users overall affective reaction towards a technology reflect and/or mediate motivations and influence relative degree of intention to use/use	Attitude	Teo & Pok (200) Hung et al. (2003)

3.1.2 Diffusion of Innovation Research

DoI research, heavily associated with Rogers (2003), focus on explaining and describing adoption and use of innovations from four general perspectives. First, *diffusion process* studies seek to map the spread of innovations, the diffusion networks and the rate/speed to which innovations spread in populations. Second, *innovator/adopter categorization* research focuses on identifying typical socio-demographic characteristics of population segments based upon the relative time of adoption. The third perspective, what is referred to as innovation-decision process research, centers on understanding *the decision process* of how people adopt, reject and re-invent (user change or modification in the process of adoption or implementation) innovations. Finally, *acceptability research* – which, as seen in Table 3-1, bears resemblance to technology acceptance research but is more consumer and leisure oriented – is pre-occupied with identifying the perceived attributes of innovations which facilitate or hinder adoption and

47 Rogers' (2003) study assesses adoption of mobile telephones in terms of the root constructs of relative advantage, complexity, compatibility, trialability and observability.

48 In this study measures of influences from government and mobile operators were also included. However, these were not found to be significant.

diffusion. Research on mobile telephone and service use aligning with one or more of these general categories has recently emerged in the literature. This includes mobile service innovativeness and user categorization (e.g. Constantiou, Damsgaard, & Knutsen, 2004a; Gilbert & Kendall, 2003; Ishii, 2004; Vrechopoulos, Constantiou, Mylonopoulos, Sideris, & Doukidis, 2002; Aarnio, Enkenberg, Heikkilä, & Hirvola, 2002), diffusion process (e.g. Gruber & Verbove, 2001), and user ascribed mobile technology attributes (e.g. Rogers, 2003 in his section on mobile telephone adoption). Moreover, user valuations of mobile services relative to population segments have appeared within this line of research (Anckar & D'Incau, 2002). The variance oriented constructs used to explain adoption from the technology attribute perspective have been included in Table 3-1. Thus, the table below broadly summarizes the additional key findings in DoI research on mobile services.

Table 3-2: Central Themes and Key Findings of DoI m-service Research

Theme	Key Findings	Empirical m-service study
Adopter categories	Adoption of mobile data services varies among segments in populations classifiable based on socio-demographical, behavioral and innovativeness characteristics. General trend that young people are characterized as innovators and early adopters of new mobile data services. Male dominance on data services beyond SMS. SMS use across categories incl. late early and late majority and laggards.	Constantiou et al. (2004a) Aarnio et al. (2002) Gilbert & Kendall (2003) Vrechopoulos et al. (2002)
Value of mobile services	Services most valued if they cater to spontaneous and time-critical needs. Services offering entertainment and efficiency-based value not equally well acknowledged. Services providing value on multiple-dimensions perceived as most interesting.	Anckar & D'Incau (2002)

3.1.3 Uses and Gratifications Research

U&G research is primarily associated with communications and media research (Blumler & Katz, 1974) and constitute a dominant theoretical body for explaining and predicting media attendance (LaRose, Mastro, & Eastin, 2001). Of key interest is how exposure to a medium, including a variety of ICTs, is affected by the gratifications – the pleasures, delights, and fulfillments rooted in needs and motivations (Blumler & Katz, 1974; Cutler & Danowski, 1980) – which people seek to obtain during and from its 'consumption'. The fundamental proposition is that gratifications sought from a medium predict individual exposure to the medium (LaRose et al., 2001).

Relative to TA and DoI researchers, U&G scholars attempt to *define* the *specific* gratifications and underlying needs and motives associated with exposure *to* and/or use of a medium, outline its use and/or explain how the gratifications impact (intention to) use. The resurgence of U&G research in later years has generated a substantial body of contributions defining gratifications and uses of new mass and interactive media. This includes tethered telephony (Dimmick, Sikand, & Patterson, 1994; Keller, 1977), video games (Lucas & Sherry, 2004; Sherry & Lucas, 2003), the Internet (Ko, Cho, & Roberts, 2005; LaRose et al., 2001; Mukherji, Mukherji, & Nicovich, 1998; Parker & Plank, 2000; Sheehan, 2002; Song, LaRose, Eastin, & Lin, 2004; Stafford, 2003; Stafford & Gonier, 2004; Stafford & Stafford, 2001; Stafford, Stafford, & Schkade, 2004), e-mail (Dimmick, Kline, & Stafford, 2000), instant messaging (Flanagin, 2005; Leung, 2002), SMS (Höflich & Rössler, 2001) and mobile services (Leung & Wei, 2000). While it has been noted that U&G studies tend to move from an exploratory approach towards confirmation (Pedersen & Ling, 2003), the research referenced above reveal a substantial orientation towards the latter. A summary of the key gratifications and motives associated with mobile service use derived from U&G research is presented in the table below. As is evident from root gratifications identified, this line of research combines performance aspects of media which span s purpose (e.g. task, job or goal) and pleasure (e.g. leisure and entertainment) oriented communication characteristics.

Table 3-3: Types of Gratifications Identified to Impact and/or Associated with Use of m-services

Meta-construct and logical structure	Root gratifications identified in mobile service research	Empirical m-service study
Gratifications -pleasures, delights and fulfillments associated with, obtained from and/or sought from the use of technology which motivates use	Instrumentality Sociability Mobility Reassurance Status/fashion Relaxation Immediacy Enjoyment/Fun	Leung & Wei (2000) --- « » --- Höflich & Rössler (2001) [49] Leung & Wei (2000) Höflich & Rössler (2001) Leung & Wei (2000) Leung & Wei (2000) Leung & Wei (2000) Höflich & Rössler (2001) --- « » --- --- « » ---

[49] Höflich & Rössler (2001) use the German terms rückversicherung (reassurance), kontaktpflege (sociability), verfügbarkeit (immediacy/availability), lebenshilfe (instrumentality), and nutz-spaß (entertainment/enjoyment)

3.1.4 Domestication Research

Domestication[50] research differs from TA and U&G research and finds its 'closest' alignment with the process oriented research of DoI studies. However, its strong roots to sociology and anthropology reflect a perspective which is more social-interactively focused. As explained by Aune, domestication research centers on the dual process where "*technology is adapted to everyday life* and the processes that involve *everyday life's adaptation to the technology*" (1996:93). The process oriented perspective emphasizes the present and continuous and thus aligns firmly with the core focus of this dissertation: shap*ing* of service understanding and use.

Rather than a method, domestication represent a *perspective* for researching and understanding how ICTs acquire their meaning, how people experience them, the role ICTs play when people 'consume' and incorporate them in the social practices of everyday life, and the consequences they have for the domestic sphere and society (J. E. Katz, 2002; Lie & Sørensen, 1996; Ling, 2004; Silverstone & Haddon, 1996). Domestication research departs from the strict *individual* and *deterministic* focus of TA and DoI research by putting emphasis on technology-mediated social interactions, social-structural (incl. institutional) influences and consequences of technology use. While originally oriented at the domestic sphere of household technologies (Douglas & Isherwood, 1979), the domestication perspective is increasingly used to study technologies used in multiple spheres of social life (Frissen, 2000; Haddon, 1998, 2004; Lehtonen, 2003; Pantzar, 1997). Haddon explains: "encountering technologies in contexts besides the home can [be] significant in determining what ICTs come to mean for people, what role they play in their lives and how they are experienced. This is clearly the case for the increasing range of portable technologies" (1998:11). A central point advocated by domestication scholars is the need to move beyond adoption and use, in particular 'successful adoption', and instead put stress on the larger process of ICT consumption and how this understanding and use of ICTs is shaped and shapes as ICTs have 'careers' in people's lives (Haddon, 2001). They typically see domestication as a dynamic and interactive process encompassing *imagination*, *appropriation*, *objectification*, *incorporation* and *conversion*[51]

[50] The term originated from studies documenting the taming of wild animals and how these animals became domestic. Since the 1990s the term has increasingly been used in the context of making artifacts domestic to ourselves and our life-worlds (Silverstone & Haddon, 1996; Haddon, 1991); how companionate or even antagonistic relationships are formed from interaction between technologies and people in everyday life.

[51] Imagination: the creation of imageries of an innovation and what it can do as it first enters our consciousness. Appropriation: the state where an artifact becomes mentally and physically accessible. Objectification: the state

(Ling, 2004; Silverstone & Haddon, 1996) in which use and contexts of use are shaped. Domestication can be studied at multiple levels of analysis. However, focus on the social rather than individual level tends to dominate.

Research by Haddon and Ling conducted in the UK and Norway and research by Ito and Okabe in Japan are among forefront contributions on domestication of mobile phones and services. Unique insights have here been gained on mobile service use, mobility and the coordination of everyday life, its social consequences and socio-demographic use differences (e.g. Fortunati, 2003; Green, 2002; Haddon, 2001, 2004; Ito & Okabe, 2003a, 2003b; Ling, 2000, 2004; Ling & Haddon, 2001). This line of research does not employ the variance based language of constructs and root-constructs but instead centers on thick descriptions of meanings of individual and social behavior emerging along the process of domestication. A brief selection of key themes found in this research is provided in the table below.

Table 3-4: Themes and Key Findings from Central Domestication Studies on m-services

Theme	Key Findings	Empirical m-service study
Social contact and interaction	Mobile communications changes and offer new ways for social contact and interaction in private and professional spheres of life Social contact and interaction central for adoption and further domestication	Ito & Daisuke (2003) Ito (2003) Ling (2004) Haddon (2004)
Identity and self-expression	Symbolic meaning of mobile communication important as mobile technologies are used to express identity	Ling, (2000,2004) Fortunati (2003) Haddon (2004)
Micro-coordination (social coordination)	Mobile communication both substitute and supplement time as a basis for coordination; observed increasing real-time coordination under social interactions	Ling & Haddon (2001) Ling (2000,2004) Green (2002)
Emancipation	Mobile communication create dilemma between control vs. emancipation in teen-parent relationships	Ling (2000,2004) Haddon (2004)
Safety & Security	Mobile communication offers safety and a sense of security in a variety of situations (from acute problems to life-threatening situations)	Ling (2000,2004)
Gender and age differences	Young people first to adopt mobile data services	Ling (2000,2004) Ito & Daisuke (2003a)
Ambient Virtual co-presence	Mobile communication (particularly mobile e-mail) establishes an ambient accessibility and a shared virtual space where people are electronically co-present.	Ito & Okabe (2003b)

where values and aesthetics of an object is played out. Incorporation: the state where a particular object is incorporated into practices and take its place vis-à-vis other artifacts. Conversion: the state where others incorporate their understanding of the artifact in their understanding of the person consuming the artifact (Ling, 2004; Aune, 1996). These stages are not necessarily fully linear.

3.2 Assessment of relevancy

Different foci and underlying assumptions within each strand direct how, what form and at what level the understanding of technology adoption and use can be derived. As in organizational IS research, typical variations exist not only with respect to *level of analysis* but also in what Markus and Robey (1988) refer to as *logical structure*. The latter refers to the time span of theory and to the relationships hypothesized between antecedents and outcomes; i.e. if theory is sequential[52], temporal[53] or non-temporal[54] and if variables are in determinate or indeterminate relationships (ibid., Shaw & Jarvenpaa, 1997). Level of analysis and logical structure are both central for evaluating the relevancy and applicability of the theoretical perspectives.

3.2.1 Relevancy: Level of analysis

Domestication research maintains the broadest span in level of analysis. It branches out from individual understanding and use behavior up to social consequences and effects of use behavior. Strongly influenced by social interaction theory (e.g. Goffman) and theory from sociology where the traditional dualism between agency and structure is collapsed (e.g. Giddens), domestication research tends to mix different levels of analysis. For instance, Ling (2000; 2004) combines both individual and small group interviews and quantitative national scale data in his multilevel analyses and theorizing. Technology acceptance research, acceptability research within DoI and U&G research, on the other hand, are more narrowly centered at the micro-level. Measurement, predictions and explanations occur at the individual level of analysis. Diffusion process research and innovator/adopter categorization studies of DoI differ from these by being concerned with explanation and description of aggregated adoption behavior extending towards the macro-level. Figure 3-1, adapted from Pedersen & Ling (2002), illustrates the different levels of analysis along with the predominant foci of each of the strands of research. Also different foci relative to 'stages' in the process of adoption and use can be seen in this figure (e.g. prediction of behavior, actual behavior and effects of behavior).

[52] Sequential: from one construct to another (Shaw & Jarvenpaa, 1997).
[53] Temporal (non-sequential): relationship exist between two instances of same concept (e.g. time-series)
[54] Non-temporal: Variables co-exits simultaneously (not separated in time); as in pure-variance

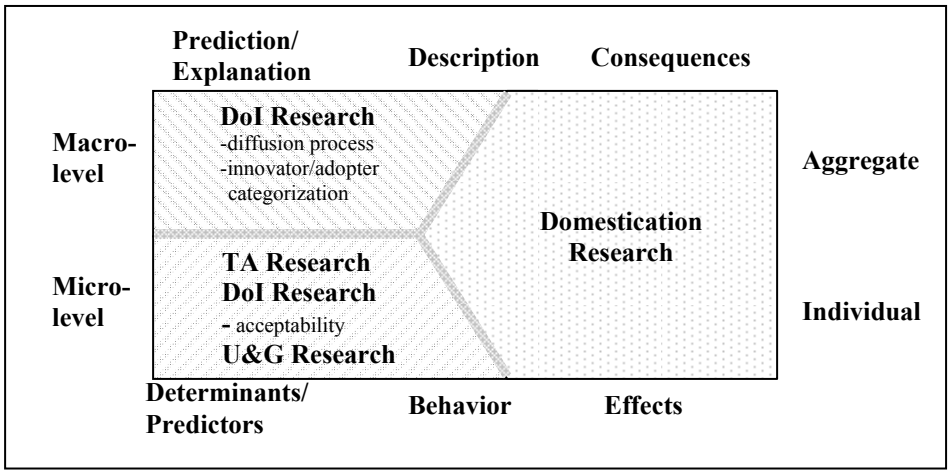

Figure 3-1: Positioning of TA, DoI, U&G and DoT research[55] Relative to Level of Generalization, Unit of Analysis, Purpose of Analysis and Analytical foci . Source: Adapted from Pedersen & Ling (2002)

The strict individual level focus of TA research, U&G research and *acceptability* research in DoI constrains the possibilities researchers have to analyze and understand effects of social interaction beyond measurements of the social influences which individuals perceive and acknowledge (e.g. encouragements from significant others). This is so because focus is placed on determinants and predictors of use behavior rather than on the influences which social interactions and communications, as actual behaviors, can exert on own and others' use and adoption behavior. Relative to the phenomenon of interest and research questions in this dissertation – centering strongly on the continued shap*ing* of user understanding based upon actual behaviors and influences of behavior – this individual-level focus is overly narrow. The individual level of analysis may result in negligence of influences on adoption and use attributable to social learning of service use that arise from interactive exchanges and other aspects related to for instance network effects and critical mass (see e.g. Rogers, 2003; Sarker & Wells, 2003). These aspects may not exist, may not be perceivable and may not be measurable unless a certain number of people already interact with particular m-services. The domestication perspective offer improved opportunities to account for such influence. In not being confined to a certain method, a certain level of analysis or a certain logical structure it enables scrutiny of behavior and the effects of interactions between people and technology at extended levels of analysis, e.g. by studying interplay between people and technology in

[55] Pedersen and Ling (2002) do not distinguish between the different sub-streams of research under DoI and do not illustrate the strong focus on prediction found in TA research.

groups. This in fact echoes the words of Markus and Robey: "By consciously mixing levels of analysis, researchers can explore the dynamic interplay among individuals, technology, and larger social structures" (Markus & Robey, 1988:596). However, adjusting focus away from perception and behavior of single individuals and towards interaction and interplay will – as interaction in nature is dynamic – imply a logical structure capable of handling social interactive dynamism.

3.2.2 Relevancy: Logical structure

Markus and Robey (1988), drawing on the work of Mohr (1982), make a sharp distinction[56] between the two logical structures of *variance* and *process*. The first denote research and theory where causes and outcomes are defined in invariant 'necessary-and-sufficient relationships' while the latter is oriented at sufficient conditions unfolding chronologically over time. Variance theory is characterized by non-temporal time perspectives and postulations of deterministic and invariable outcomes under specified conditions. Thus, specification and measurement of variables take upon a contingent logical form (Markus & Robey, 1988). TA research, acceptability research of DoI and U&G research all adhere to the variance based logical structure. This is most evident in seeing how structural equation models[57] and other inferential techniques are employed to deduce and test law-like relationships between variables hypothesized and determine behavioral outcomes (e.g. intention to use, use, adoption and/or exposure). Process theory, on the other hand, aims to explain occurrence of an outcome as a result of preceding sequences of events and their temporal unfolding as 'changes in states' (ibid., Shaw & Jarvenpaa, 1997). The states are considered necessary – as steps in a recipe – for an outcome to occur, but may not be sufficient for the outcome to occur. Thus, outcomes are asserted to happen under certain conditions but the outcome may also fail to occur (Markus & Robey, 1988).

As for IS research in general, pure process models are uncommon in mobile service research. No pure process studies have been identified in the above mobile service literature. Rather than empirical assessments of the chronological unfolding of steps, process models, e.g. the innovation-decision making process (Rogers, 2003) or the domestication process

[56] As commented by Shaw and Jarvenpaa (1997) this distinction may be considered too sharp as it does not consider hybrid models. Nevertheless, it is here deemed sufficient to illustrate the distinctive research questions.
[57] E.g. Lisrel and Partial Least Square models

(Silverstone & Haddon, 1996), they tend to be applied to position and contextualize research. For instance, Teo and Pok (2003) explicate Rogers' individual innovation-decision making process in full – "a chronological sequence of events through which an individual passes from initial knowledge of an innovation, to forming a favorable or unfavorable attitude toward it, to a decision to either adopt or reject it, to utilizing the innovation, and to finally seeking reinforcement of the adoption decision made" (Teo & Pok, 2003:484) – but then progress only to focus on the necessary and sufficient variables that predict behavioral intention to use WAP services. Similarly, Ling (2004) contextualizes his domestication research by explicating the five 'steps' of the domestication process (imagination, appropriation, objectification, incorporation and conversion) but never aims to empirically assess sequencing between stages or outcomes under different stages.

Given the explorative intent of the research questions presented in Chapter 1 strict adherence to either a pure variance or a pure process perspective will be too delimiting. Each perspective has its strengths and weaknesses relative to the phenomenon of interest. The strengths of variance research include (1) clear definitions and rather unified body of predictive and explanatory constructs, (2) rigorous testing of relationships between anteceding, moderating and outcome variables, (3) strong fundament for accumulated and comparative insights, and (4) the use of academically rigorous methods and criteria for evaluation. The constructs and findings identified in the body of variance oriented research in TA, DoI acceptability and U&G research are highly relevant for the overall phenomena of interest in this study and can not be ignored.

However, variance theory has a set of constraints and caveats which are somewhat dissonant with the phenomenon of interest and research questions outlined. The most important concerns the focus on predicted behavior rather than actual behavior and effects of behavior. Variance research tends to use *intentions to use* as a faithful 'proxy' for *actual use.* It is often assumed either "that behavioral intention will have a significant positive influence on technology usage" (Venkatesh et al., 2003:456) or that intentions will approximate behavior itself under the right conditions (Foxall, Goldsmith, & Brown, 1998). This tendency to focus on prediction of behavioral intention rather than actual behavior can be problematic because the inferences deduced may only account variations in perceptions *prior to mobile service use.* In such cases, as in some studies of mobile services where a majority of respondents have not

had direct experience with the service[58] targeted, it then becomes users' imagined perceptions of the service as opposed to beliefs grounded in use experience and effects of this which are relied upon. By not being stretched longitudinally to include actual behavior and effects of behavior, the understanding of the continued shaping of user understanding beyond anticipated acceptance is left ignored. Also, scrutiny of the impacts of social interactions and the contextual dynamics produced by social interaction so relevant for SMS, e-mail and social networking services is constrained.

Process perspectives can enable researchers to better discern such temporal aspects. Among these are the emerging impacts and patterns in data not identifiable under strict variance approaches (Markus & Robey, 1988) but nevertheless still influence the shaping of understanding and use of services. One advantage is how process theory enables specification of mechanisms and temporal relations among theoretical elements in an extended process. This can enable richer explanations of how, what and why outcomes occur and when they occur or do not occur (ibid.). In other words, the temporal unfolding of stages in the adoption and use process and the mechanisms at play during the process can be elucidated. These advantages are promising relative to the interest in the extended adoption and use process underlying the phenomenon of interest and research questions set in this dissertation.

However, the research questions also focus on characteristic service features and gratifications and how these enable and constrain engagements with services. Therefore a pure process focus on stages and sequencing between stages is not sufficient. A pure process view would risks neglecting specification of the mechanisms influencing process progression and behavioral outcomes. This may result in oversimplified accounts of general stages and negligence of patterned regularities. In Markus and Robey's view regularity and predictability is needed in order not to create "incomplete process models", i.e. simple stage models not specifying the mechanisms by which subsequent stages come about (ibid. 592). They call for maintenance of some predictability in how concepts influence stage sequencing. Relative to Shaw and Jarvenpaa's (1997) *process-variance* IS research typology, this argument is one in favor of hybrid theory; i.e. theory and models which combines features of both research types.

[58] See for instance Hung et al. (2003) where only 18.7 percent of the users in the sample were actually WAP users.

Succinctly put, the well developed constructs of variance research can bring important understanding regarding (potential) users' cognitions but warrant a longitudinal perspective in order to explain why outcomes occur, do not occur and/or change over time. Process theories can produce understandings which may more faithfully reflect actual events but tend to compromise "explained variance" and may also lack empirical fidelity if the mechanisms implied in the transitioning between stages are not properly accounted for. As emphasized by Shaw & Jarvenpaa (ibid.), this offers rationale for creating so called hybrid models which combines facets of the process-variance research typology. Such models can garner insights which neither of the pure variance and process perspectives can bring separately.

In recent years prominent IS scholars have presented hybrid models to explain the dynamics of IS adoption and use in organizations (e.g. DeSanctis & Poole, 1994; Gallivan, 2001). In the mobile service literature Sarker and Wells (2003) presented a hybrid framework which *combined* and modified explanatory concepts/factors and mechanisms relative to the use process to understand mobile device adoption and use.

3.3 Pre-understanding – A Hybrid Model

With the above considerations in mind I next model the pre-understanding. The understanding generated from extant literature align with the (hybrid) integrated framework for use and adoption of mobile devices presented by Sarker and Wells (2003). Whereas the framework offers one of the best overviews of adoption and use factors, process and outcomes in extant literature, it is by no means exhaustive. I therefore expand on their framework by incorporating the central constructs and themes from the four research streams of mobile service adoption and use research identified above. Figure 3-2 illustrates the concepts, relations and process of the hybrid pre-understanding as an input-process-output model.

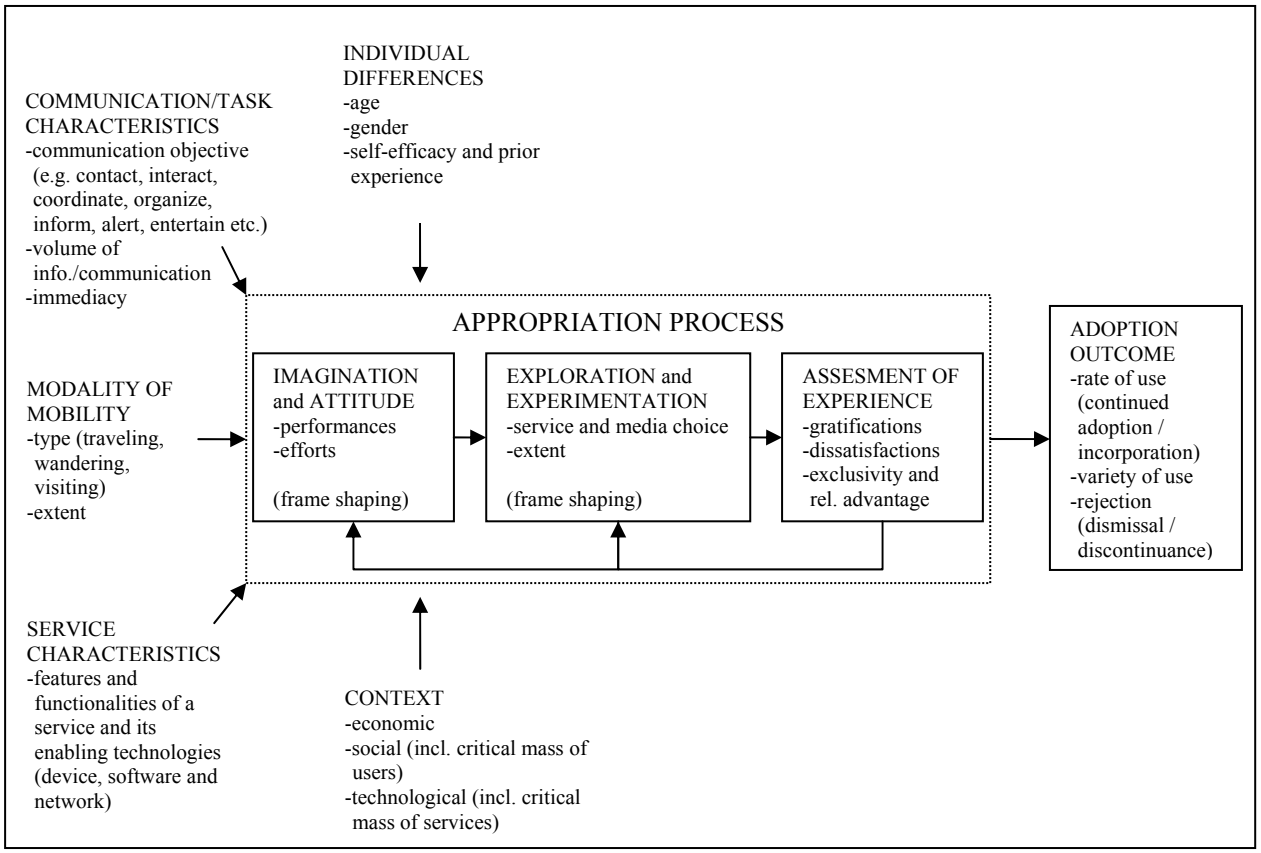

Figure 3-2: A Hybrid Pre-understanding Model for Mobile Service Appropriation and Use
Source: Modified from Sarker & Wells (2003)

3.3.1 Inputs

Inputs encompass the broad set of factors which are posited to influence user cognitions and behaviors emerging during the appropriation process of mobile data services. They encompass individual differences, communication/task characteristics, modality of mobility and context.

Individual differences. Within the body of research on mobile service use, individual difference variables are most strongly empirically documented factors accounting for variations in mobile service acceptance, adoption and use. TA research (e.g. Hung et al., 2003; Teo & Pok, 2003), DoI (e.g. Constantiou, Damsgaard, & Knutsen, 2004b; Gilbert & Kendall, 2003; Ishii, 2004; Vrechopoulos et al., 2002; Aarnio et al., 2002) and domestication research (e.g. Ito & Okabe, 2003a; Ling, 2000, 2004) consistently point to younger people (ca. 15-35 years of age) as the primary adopters and users of mobile data services. Furthermore, several of these studies point to males being the initial adopters of mobile data services beyond SMS, but that young females are the most edacious users of text messaging (Ling, 2000, 2004).

Concordant with the findings by Sarker & Wells, these studies point out that *age* (or stage in life) and *gender* differences are central for acceptance, adoption and use of new mobile data services.

Individual variations of significance may also exist regarding *self-efficacy* and *prior experience*. Self-efficacy, which refers to the judgments a person makes of own knowledge and ability to act (Bandura, 1986, 1999) (here: to use a certain mobile data services) has been found have significant impact in TA research on mobile services (e.g. Hung et al., 2003; Teo & Pok, 2003). Sarker and Wells (2003) highlight a relation between *prior experience* and self-efficacy where people with prior exposure to other mobile devices encountered adaptation difficulties when switching to a new device. Contrary, Khalifa and Cheng (2002) found that exposure to mobile commerce positively moderated the relationship between attitude and intention to use mobile commerce. This inconsistency suggests type of experience decide impacts acting positively or adversely on mobile service appropriation and use.

Communication/task characteristics. The characteristics of the communicative need and task at hand can be of central influence to media choice and use. Sarker and Wells (2003) find such characteristics to include *number of interacting participants*, *immediacy of response*, *volume of communication* and *communication objectives*. While I agree that the three latter are subsets of communication and tasks characteristics, I find the first of these to belong to context and is thus discussed under the section on context. Among *communication objectives* we find conveyance, convergence and passive reception (ibid.). Relating to this domestication research reveals how everyday communication via mobile services include objectives such as *to* contact, interact, coordinate, organize, inform, alert, and entertain (e.g. Fortunati, 2003; Haddon, 2001, 2004; Ito & Okabe, 2003a; Ling, 2000, 2004; Ling & Haddon, 2001). These communicative/task objectives may be perceived to require different degree of response immediacy (if response at all) and volume of communication and therefore centrally impact media/service trial and use. Sarker and Wells (2003) identified both how suitability of the computing medium relative to volume of communication (e.g. length of messages) and degree of response immediacy can impact service choice and use. Mennecke and Strader (2003) highlight the role of communication urgency as a central communication/task characteristic.

Similarly, immediacy of access to information and others is in U&G research found to be a central factor influencing people's use of mobile telephony (Leung & Wei, 2000).

Modality of Mobility. In section 1.2.2 on multi-sphere crossings I discussed how mobile data services enable computing to transcend constraints of stationary computing and can offer geospatial liberty to their users under various mobile activities. With this *modality of mobility,* i.e. type and extent of mobility, becomes a salient factor (Sarker & Wells, 2003). As argued by Mennecke and Strader (2003) location warrant close inspection as mobile services not only are used at multiple locations but also become location sensitive and specific. TA research has traditionally been insensitive to modalities of mobility and extent of mobility. Research and the domain of computing have been confined to a certain location. U&G research on mobile services, however, has found mobility to be one of the most central gratifications sought from mobile service use (Leung & Wei, 2000). Also domestication related research in Japan (Ito, 2004; Ito & Okabe, 2003a, 2003b) offer thick descriptions on how messaging and picture exchanges occur often during pedestrian everyday life situations. Sarker and Wells (2003) use the terms *traveling*, *wandering* and *visiting*[59] as three distinguishing modalities of mobility, which, together with the extent to which these modes are encountered, will influence people's appropriation and use of mobile services. Their findings suggest that different modalities of mobility relative to technology characteristics influenced people's perceptions, evaluations and use of mobile technologies.

Service Characteristics. While domestication research and U&G research pay modest attention to the artifact aspect of technology, both DoI acceptability research and TA research attend to general characteristics of technology. However, the latter tend to subsume these aspects under variables mapping general user perceptions of performances and efforts of artifacts (cf. Table 3-1). This is particularly evident in studies investigating WAP services or WAP phones at the general rather than service specific level (e.g. Hung et al., 2003; Teo & Pok, 2003). In most cases *the specifications and features* of services which users draw upon to form such general perceptions are not conceptualized.

[59] Traveling is defined as the *process of going from one place to another in a vehicle*, wandering is defined as *extensive local mobility arising from a person walking around*, and visiting is defined as a temporary stop at a specific location (Sarker & Wells, 2003; terms borrowed from Krisfoffersen and Ljungberg (2000)).

Findings presented by Sarker and Wells (2003) suggest that specific technology characteristics such as *interface characteristics* and *network capabilities* can influence exploration and experimentation and subsequent evaluation of users' mobile technology experience. Growing diversity in mobile data services will add other distinguishing service characteristics to these. For instance, graphical features, audio capability, interactivity, synchronicity, latency and compatibility between service, device, software, and network are other characteristics which may differentiate services and their use. Such *service characteristics*, here defined as features and functionalities of a particular service and its enabling technology, can be of strong salience as seemingly small differences can yield strong variations in shaping service cognitions and use. Orlikowski and Iacono call for IS research to more seriously engage "its core subject matter: the IT artifact" (Orlikowski & Iacono, 2001:122)[60]. This is supported as careful consideration of service characteristics can offer a stronger basis for service differentiation and comparisons; thus also comparability in research.

Context refers to characteristic conditions of the environment surrounding the (potential) user(s) of mobile data services. Economic, social and technological context characteristics identified from prior research are included in the pre-understanding presented in Figure 3-2. These characteristics can facilitate as well as impede user understanding and use of mobile services.

Economic conditions represent characteristics of economic dimension bound to the commercialization of mobile technologies. In TA research on mobile technology economic conditions researched have included service price (Hung et al., 2003), mobile operator facilitation (e.g. marketing and promotion of services) and government facilitation (Teo & Pok, 2003). In addition to pricing aspects, Sarker and Wells (2003) identified the level of proliferation of mobile service technologies and infrastructure to impact mobile technology use patterns. The economic conditions encapsulate or at least reflect issues bound to the regulatory environment and economic landscape in which services are produced, offered and used.

[60] In a decennial review of 188 published articles in ISR Orlikowski & Iacono (2001) found conceptualization of the IT artifact as subject matter to be missing in approximately 25% of the publications. They concluded that "we must theorize about the meanings, capabilities, and uses of IT artifacts, their multiple, emergent, and dynamic properties, as well as the recursive transformations occurring in the various social worlds in which they are embedded. We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become interdependent with socio-economic contexts and practices, are key unresolved issues for our field and ones that will become even more problematic in these dynamic and innovative times" (ibid.:133).

Nevertheless, modest specificity is offered in the literature as to how government facilitation or regulation impacts adoption and use. Most studies on mobile services touching on this aspect are case studies on the macro-economic factors shaping developments, industries and innovation systems in certain regions (e.g. Funk, 2001; Bohlin et al. 2003). Moreover, as regulatory aspects ultimately become reflected in the services (e.g. in terms of specifications) and how they are brought to market, one may suggest that introducing regulatory conditions as a separate variable will introduce redundancy to the framework. Thus, economic conditions and technical conditions (discussed below) are considered to absorb regulatory aspects.

Social conditions refer to environmental conditions produced from and during situated human interactions. As seen in Table 3-1, TA research on mobile service use has assessed how social influence in form individual perceptions of subjective norms – i.e. normative beliefs and acknowledgement of interpersonal influences from peers, friends, colleagues and experts etc. – impact an individual's mobile service acceptance and use. Domestication research put more emphasis on how social interactions with mobile technologies come to constitute conditions under which new forms of social contact takes place. For instance, Ling (2004) identifies how normative expectations establish around and influence use of short messaging and Ito and Okabe (2003b) introduce the notion of *ambient virtual co-presence* to signify socio-technical situations in which new forms of social interaction is enabled by a mass of people being online and constantly available for communication. For such normative expectations to exist and virtual interactions to take place a certain *critical mass* (Rogers, 2003; Schelling, 1978) *of subscribers/users* is a prerequisite. I here look upon critical mass of subscribers as a social contextual condition which arises from interaction between people where technology is instantiated and a condition which is produced as an increasing number of people perform mobile technology instantiating practices. Sarker and Wells (2003:39) found both that critical mass of subscribers as well as *critical mass of available services* increase "use of data features and, subsequently, the chances of adoption". However, not all data services, e.g. news, infotainment etc. and other services not exhibiting network effects, depend so fully on critical mass of users and *social* interaction. Moreover, and as seen from SMS, it is neither the rule that availability of a large range of service is a prerequisite for adoption. To distinguish further when and for what services critical mass of users and services are central, I find it necessary in

this pre-understanding to distinguish between the social conditions produced from and during technology interaction and other technological conditions.

Technological conditions refer here to the presence and availability of technologies in the computing environment which facilitates or encumbers the appropriation process of a mobile technology. Such conditions include the presence and availability of computing services, network infrastructure, and devices which may be complements or substitutes for the user. Together with the other 'input factors', e.g. service characteristics and communication/task characteristics, such technological conditions is posited to be centrally implied in the forming of imagination and attitudes pertaining to service performance and efforts. While Sarker and Wells (2003) found the technological condition *critical mass of service availability* to have a positive impact on use and adoption, there has been relatively modest emphasis on the technology environment in the four streams of research reviewed. An exception is Funk (2001) in his account of mobile service use in Japan. He emphasizes the interdependence between use of mobile services and the technologies present in the computing environment (e.g. services, content, phones, portals etc.) as well as the difference and convergence between the mobile and the tethered Internet as key factors. In Europe a study similarly pointed out the role of tethered Internet services acting as substitutes rather than complements to mobile services as a central technological condition regarded to encumber mobile service adoption in Europe (Bohlin et al., 2003).

3.3.2 Process: The Appropriation Process

The above constitute the key inputs to the process which Sarker and Wells (2003) call the *use process*[61]. This process, however, is not only focused on *use* as it encompasses the two sub-stages of (1) *exploration and experimentation* and (2) *assessment of experience* during which a (potential) user shapes and re-shapes technological frames[62] (Orlikowski & Gash, 1994) about how a certain technology can be used and is suited to serve communication/task characteristics of his/her everyday situations. Neither can it be described as a pure innovation-decision process (Rogers, 2003) moving from a (potential) user's initial awareness of an innovation to a decisive adoption or rejection decision as described in DoI research. More in accordance with

[61] It is also this relation between inputs and process which renders this a hybrid model.
[62] A technological frame is an interpretative scheme (a mental model) – a form of a typified template or arrangement about the nature of a technology and its (potential) use applications and benefits (see Orlikowski & Gash, 1994).

social shaping of technology (SST) theory (Bijker, Hughes, & Pinch, 1987; Mackay & Gillespie, 1992; Rohracher, 2003), the structuration of technology perspective (DeSanctis & Poole, 1994; Orlikowski, 2000) and the domestication perspective (Aune, 1996; Ling, 2004; Silverstone & Haddon, 1996) the process is viewed as one of appropriation; i.e. the process where a (potential) user mentally and/or physically incorporates new technology into daily life. It involves the shaping of understanding, attitude, meaning and behavior from the interpreting of encounters with technologies and the encodings instantiated in their surrounding communication. Mackay and Gillespie explain this: "appropriation is not just about the use of a technology: it is also about the meaning the technology has for its user" … "As well as being encoded, technologies are subjectively deployed; appropriation is the sphere in which these two forces come together" (1992:685,709).

The appropriation process, as illustrated in Figure 3-2, incorporates the two sub-stages of the use process presented by Sarker and Wells but also includes the initial sub-stage of *imagination and attitude*. Domestication research tend to present imagination as an initial stage in the domestication process where an innovation first enters a person's consciousness (Ling, 2004). Upon becoming conscious of service characteristics potential users (depending on self-efficacy and/or prior experiences) may form imaginations of what a technology can do and how it may be used relative to communication/task characteristics, the contextual conditions, and modality of mobility. It is during this sub-stage where initial *technological frame shaping* occurs and where individual imageries reflecting expectancies concerning *performance* and *efforts* can converge to form an attitude (an overall affective reaction) towards a technology. From TA research I here incorporate and position the meta-constructs (cf. Table 3-1) of performance and effort expectancies (Venkatesh et al., 2003) under imagination and attitude. This is done to emphasize that (1) performance and effort expectancies are imagined prior to experience with the subject matter, (2) that imagination of performance and efforts will be reflected in attitude, and (3) that the imagination and attitude is subject to change with experience and changes in the factors (the 'inputs') posited to impact the appropriation process. Accordingly, during the stages of exploration and experimentation and assessment of experience new insights may feed back and become implied in the frame shaping and reshaping and yield novel imageries and a new attitude towards a mobile service.

Exploration and experimentation is the sub-stage where cognitions formed may be translated into explorative and experimental behavior with a mobile service. It involves the potential choice of trying a certain service via a certain medium (e.g. WAP vs. premium SMS) available on the mobile device. It is posited that this choice will be based on the imagination and attitude formed around performance and efforts perceived. Exploration and experimentations with the service and medium may vary in extent. As Sarker and Wells (2003) explain, the frequency and volume of service and media trial in this phase can vary relative to whether or not the person primarily acts as an initiator, recipient or both and in the degree the service and media choice is utilized as a complement or substitute relative to alternative computing technologies. Trial and its extent provide grounds for the user to recursively assess the experience of the exploration and experimentation and thus for (re)shaping his/her technological frames.

Assessment of experience **encompasses the sub-stage where a user engages in experiential evaluation of a situated service use. It thus marks the point where the a user becomes able to evaluate what type of *gratifications*, i.e. pleasures, delights and fulfillments (Blumler & Katz, 1974), that can be sought and fulfilled from the use of a certain service. Sarker and Wells (2003) found users to assess experience along a functional, a psychosocial and a relational dimension. Based on the review conducted, I here find the forms of gratifications identified in U&G research (cf.** Table 3-3) not only to adequately encapsulate these aspects but also to highlight additional assessment dimensions. For instance, *instrumentality* (Leung & Wei, 2000) covers utilitarian aspects such as efficiency, effectiveness, and reliability of the mobile service to function as a tool for obtaining a certain communication/task objective. Status and fashion (ibid.) along with reassurance (Höflich & Rössler, 2001; Leung & Wei, 2000) answers to psychosocial aspects and sociability (ibid.) encapsulate the relational assessment dimension identified by Sarker and Wells (2003). In addition to this, U&G research have identified gratifications from mobile service use to include relaxation, enjoyment/fun and mobility (Höflich & Rössler, 2001; Leung & Wei, 2000). While several of these aspects are described in Sarker and Wells (2003) findings, I contend that U&G research here offers an improved categorical delineation of gratification types which more precisely enable the discerning of users' assessment of mobile service experience.

Assessment of experience is also the stage where potential *dissatisfactions* relative to the imagined mobile service performance and efforts are revealed. This includes annoyances, frustrations, and irritations. These may be grounded in the instrumental functioning of a

service. However, it may also be unanticipated issues related to previously unacknowledged paradoxical sides of technology[63] (Mick & Fournier, 1998) encountered during service use. For instance, and similar to findings by Ling (2004), Sarker and Wells (2003) find that the flipside of constant availability can be encroachment of personal/family time and that the freedom mobility can provide may also be perceived as an irritation over 'online' captivity. With the exception of domestication research, these issues have received scant attention in the four research streams. However, they may have strong salience for how advantageous a mobile service is perceived and thus its use.

Experience also enables assessment of *relative advantage and exclusivity*. This refers to how advantageous a service is in providing gratifications and the degree to which the mobile service is exclusive in offering these gratifications. As noted by Sarker and Wells (ibid.) the extent to which a certain service is utilized as compared to other ICTs can be central for the extent and mode of its use. Different services may be perceived to possess different degrees of exclusivity and relative advantage compared to alternative computing means. They may also enjoy exclusivity in certain situated use contexts, under different modalities of mobility and for particular communication/task objectives. As illustrated in Figure 3-2 these aspects are revealed to the user during encounters with a mobile service and can subsequently be implied in the (re)shaping of his/her technological frame and thus also impact adoption outcomes.

3.3.3 Outputs: Adoption outcome

Common for TA, DoI and U&G research is the association drawn between an overall positive reaction to a certain technology and a positive adoption outcome. Positive assessments of experience during exploration and experimentation will likely lead to further use. In TA research the adoption outcome is one-dimensionally defined as *use* (often measured only as *intention to use*). This narrow conception overlooks nuances which are of importance in the context of mobile services, especially continuity and discontinuity. As Sarker and Wells stress *continuity of use over time* and associated *resource commitment* (time, effort and financial resources) are central adoption outcomes. However, these outcome aspects do not inform of the more fine grained dimensions of what continuity of use over time is. Neither do they

[63] Mick and Fournier identify eight paradoxes of technology; control/chaos, freedom/enslavement, new/obsolete, competence/incompetence, efficiency/inefficiency, fulfills/creates needs, assimilation/isolation, engaging/disengaging. Several of these paradoxes align with social consequences of mobile services identified by Ling (2004) and issues raised and discussed in the book "The Tyranny of the Moment" (Hylland-Eriksen, 2001).

incorporate the possibility of discontinuity. Scholars of domestication (e.g. Haddon, 2004) and DoI research (e.g. Rogers, 2003; Shih & Venkatesh, 2004) have accentuated that use may take several dimensions and be measured in a multitude of ways; e.g., frequency of use, duration of use, continuity of use, and spread/breadth of use. For instance in their study on different uses of the Internet Shih and Venkatesh (2004) employ the two dimensions *rate of use* and *variety of use* to distinguish between limited use, intense use, specialized use and nonspecialized use. Furthermore, as emphasized by Rogers (2003), the process may as logically lead to rejection outcomes. This may be active rejection involving consideration of use and adoption but also passive rejection where use and adoption is not given consideration.

Rate of use, variety of use and rejection are incorporated to form the primary adoption outcomes presented in the hybrid pre-understanding illustrated in Figure 3-2. Rate of use refer here to how frequent the use of a mobile service occurs. It informs of the continuity and regularity of use over time and the degree to which a user has incorporated the service in routines of everyday life. It highlights relative breadth of usage and informs thus also of how universally applicable a mobile service is. Finally, rejection represents the potential of users to dismiss further adoption considerations and activity with the mobile service.

3.4 Summary of pre-understanding

Above I integrated current literature to form a hybrid framework of inputs, process and outcomes central to the shaping of understanding and use of mobile data services. Sarker and Wells' holistic framework acts as a unifying skeleton but is expanded and modified based on findings from TA, DoI, domestication research and U&G research. The most central adaptations include:

- Treating service characteristics as an input and thereby acknowledging that slight variations between services and across mobile computing environments can have significant affect on appropriation and outcomes.
- Acknowledging how context, both social and technological, changes and is created with increasing levels of service adoption and use.
- Applying appropriation to tone down the pro-innovation bias inherent in the term "use process" as appropriation signifies how a (potential) user mentally and/or physically acquaint and incorporates new technology into daily life.

- Establishing (1) imagination and attitude, (2) exploration and experimentation, and (3) assessment of experience" as key "stages" of service appropriation process.
- Adding emphasis on leisure oriented use-outcomes by identifying from U&G research types of gratifications from mobile service use.
- Extending outcomes to also encompass axial dimensions of use and rejection.

In light of the quotation from Weiser (1993) introducing this Chapter, the pre-understanding is built cross-disciplinary by integrating central aspects from research streams with different yet related angles to understand service acceptance, adoption and use. The pre-understanding forms not a model subject for test. It constitutes a hermeneutic basis for guiding the research next presented and for the theory construction in the papers and synthesis put forth in chapter 6.

4 Methodology, Research Approach and Design

The assumptions of a researcher regarding worldview, knowledge, and ethics will naturally have bearing upon the type of understanding he/she brings about. They will also affect the level of generalizability and the quality criteria upon which the work can be judged. Strong paradigmatic[64] controversies about ontological and epistemological assumptions (e.g. Chen & Hirschheim, 2004; Fitzgerald & Howcroft, 1998; Hirschheim & Klein, 1989; Jackson, 2003; Lincoln & Guba, 2003; Mingers, 2001, 2003; Weber, 2004; Weick, 1989, 1999) stand witness of how sensitive such assumptions are – and how necessary they are to explicate for proper evaluation of theory constructions (Walsham, 1995).

This chapter outlines the methodology[65] and research design underlying this study[66]. Positioning relative to assumptions and the key rationales underlying the choice of methods used to generate, analyze and interpret the quantitative and qualitative data of this study are presented. I explain also how a choice of different methods and the data derived from these methods are brought together to form an interpretive understanding which a single method could not contribute independently. Contemporary thinking on multi-method rationale and methodological limitations are discussed relative to the research design presented. Finally, I review criteria proper for evaluating the understandings derived during my research.

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[64] The term paradigm, originally coined and popularized by Kuhn (1970) and extended by Burrell and Morgan (1979) is today commonly applied to signify the general and fundamental set of philosophical assumptions – the ultimates or first principles – that has reached congruent practices and agreements among a scholarly community and which are drawn upon to outline the principles for conducting research (Lincoln & Guba, 2000, 2003; Mingers, 2001). It is distinct from methodology as it can be thought of as a worldview – a *weltanschauung* or general perspective for breaking down complexity of the real world – formed upon the assumptions and beliefs according to ontology, epistemology and axiology (Denzin & Lincoln, 2000; Guba & Lincoln, 1994; Lewis & Grimes, 1999; Lincoln & Guba, 2000, 2003; Mingers, 2001; Mingers & Gill, 1997). Paradigms tend to become rigid and ingrained in the socialization of adherents and practitioners. Because they will inform of what is considered important, what is legitimate, and what is reasonable they can thus provide relief from lengthy existential considerations (Mingers, 2001).

[65] Mingers (2001) identifies three semantically separate uses of the term methodology in science. First, it can signify the study of generating a body of knowledge about methods and their principles – the 'method-*ology*' – a science of methods. Second, it is also used to denote a certain (set of) research method(s) of a particular study. Obviously, especially if method(s) is understood as a technique for inquiry, deploying the term in this way renders no substantial difference between *methodology* and *method(s)*. Third, and as used here, the term can signify the principles for undertaking and conducting a research project. It is then involved with the question: How can the inquirer go about finding out whatever he/she believes can be known (Denzin & Lincoln, 1994)? Succinctly put; methodology focuses on the best means for generating comprehension about research phenomena (Denzin & Lincoln, 2000).

4.1 Paradigmatic schools of thought

The former chapter revealed the dominance of variance theory in mobile service research. It also echoed the growing number of calls for process and hybrid theory as supplements to overcome some of the limitations variance theory has for theory generation. Variance research adheres commonly to the paradigmatic assumptions of positivism and/or postpositivism[67], while theories sensitive to processes tend to align with the assumptions of constructivism (here synonymously with interpretivism[68]) or the specific ontological assumptions underlying Giddens' structuration theory[69] (e.g. Orlikowski, 2000; Orlikowski & Baroudi, 1991).

The philosophical assumptions of paradigms are seldom directly explicated. However, pertinent variations can be found in the interdependent concepts of axiology[70], ontology, epistemology, and methodology (Denzin & Lincoln, 2000; Mingers, 2001). Axiology deals with the question of how ethics and values should be treated in research; that is, should ethics and values be (sought) excluded or are they inherent, formative and included in research? Ontology focuses on the nature of reality and the nature of the human being in the world. The central question is: What is the form and nature of reality and what can be known about it (Guba & Lincoln, 1994)? Epistemology, literally the study of knowledge, is in science commonly used to signify the nature of the relationship (a form of 'posture') between the inquirer and the knower and/or known and what can be known (Denzin & Lincoln, 1994; Lincoln & Guba, 2000; 2003). The epistemological question is: How is the researcher positioned (e.g. a subjective or objective relation between the researcher and the researched) relative to the phenomena of interest and what can be known about it? Methodology focuses on the means for generating comprehension about a certain research phenomena (Denzin & Lincoln, 2000). The methodological question thus concerns: How can the inquirer go about finding out whatever he/she believes can be known (Denzin & Lincoln, 1994)?

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[67] To avoid lengthy passages on the distinctions between positivism and postpositivism I will here use positivism as a common term. For the distinctions, e.g. between assumptions of naïve realism vs. critical realism, belief in degree of truth discernable and use of methods please see Lincoln and Guba (2000: Chapter 6).

[68] Please note that I here follow Guba & Lincoln (1994), Lincoln and Guba (2000, 2003) and apply the term constructivism as a synonym for interpretivism; the terms are sometimes used interchangeably.

[69] Giddens work on structuration is sometimes treated as an own ontology.

[70] Lincoln and Guba (2000; 2003) groups axiology among the basic beliefs which feed and set direction to the research inquiry process and suggest to "make values or, more correctly, axiology (the branch of philosophy dealing with ethics, aesthetics, and religion) a part of the basic foundational philosophical dimensions of paradigm proposal … to help us see the embeddedness of ethics within, not external to, paradigms" (Lincoln & Guba, 2000: 167).

Assumptions related to the philosophical questions are most often revealed in the logical structure of research, the methods employed, and in the presentation, voice and form research findings are presented. As such, paradigms take manifest when nested sets of congruent assumptions are reflected in researchers' works. Following from Kuhn's (1970) structuring of scientific works, several scientific paradigms have been identified. Often referenced are Burrell & Morgan's (1979) four[71] paradigms and the five[72] paradigms identified by Guba & Lincoln (2000). I choose only to focus on the two most central to the present study discussed here; namely, postpositivism[73] and constructivism. Besides being the most relevant for my study, further justification for this selection can be found in Chen and Hirschheim's (2004) paradigmatic bracketing of IS research from 1991-2001. Well aligned with Orlikowski and Baroudi's (1991) study ten years earlier, they found that the overwhelming majority of IS publications had a positivist paradigmatic anchoring while interpretive research was slightly represented (single digit percentage). Critical empirical research[74] and participatory research were basically non-existent in the literature. The different philosophical assumptions of postpositivism and constructivism are presented together in Table 4-1.

In the postpositivistic school of thought the social world is sought explained under assumptions and with procedures and evaluation criteria similar to those of the natural sciences. Relative to positivism, it can be seen as a milder form of what Lee (1991) describes as the "natural-science model" of social science. An axiological position is taken where values and ethics are either (sought) excluded, avoided or denied as these are regarded sources of bias which can disturb the epistemological goal of objective knowledge outcomes. The ontological position is one of critical realism reflecting a belief in a 'real' reality – a reality being 'out there' – which can be, though imperfectly, apprehended probabilistically and be subject for

[71] Burrell and Morgan define the following four: functionalist, interpretivist, radical structuralist, and radical humanist. These four have been debunked by Deetz (1996) because the epistemological objective-subjective dimension has proved too rigid and to provide too much of an entrenched delineation.
[72] The five paradigms identified by Lincoln & Guba (2000) are: positivism, postpositivism, critical theory, constructivism and participatory.
[73] Although IS researchers analyzing paradigms and their positions in research not often make the distinction between positivism and postpositivism, I put emphasis on postpositivism as few contemporary scholars of IS would stringently subscribe to naïve realism, deny any subjective influence or fully claim that their hypothesis are established as facts or natural laws (e.g. Weber, 2004).
[74] While the critical theory paradigm largely share the epistemological stance of constructivism (except being more explicit on value mediated findings), the key differences are 1) an ontology of historical realism where reality is shaped by social, political, cultural, economic, ethnic and gender values crystallized over time, and 2) that reality and knowledge is constructed and evaluated dialectically through dialogue.

replication. An epistemology is maintained where an objective and detached stance is taken both in relation to the phenomenon investigated and to the knowledge which can be derived about it. Postpositivism seeks to reach what Lee (1991) describes as a third-level understanding[75], one which is generalizable and can stand the test of falsification. This entails "rational analysis of data in a mental problem space and construction of deductive arguments of cause-and-effect" (Boland & Tenkasi, 1995:353). Methodological principles for obtaining knowledge about phenomena tend thus to be oriented at verification or falsification of hypothesis by means of inferential statistics, structural and contingency modeling, mathematical analysis and experimental and quasi-experimental test designs (Guba & Lincoln, 1994; Lee, 1991).

As opposed to the postpositivistic paradigm, researchers of the constructivist paradigm are characterized by maintaining an inclusive and formative axiological standpoint. As Denzin & Lincoln (2003:9) writes: "There is no value free science". Ethics and values are in the constructivist paradigm considered formative, included and naturally implied in both the procedures under which knowledge is created and in the knowledge itself. The bar (cf. Table 4-1) maintained by postpositivists between ontology and epistemology is therefore collapsed among constructivists as knowledge is always seen to contain a subjective flair. The degree of subjective flair may vary from ethno and phenomenological 'purity' to interpretive conformation and justification. The ontology, one of relativism, sees reality as actively, locally and socially constructed and specific to actors or groups of actors (Guba & Lincoln, 1994; Schwandt, 1994). It is therefore mutually assumed that the knowledge generated will take upon a subjective to intersubjective character and arise from transactions between the inquirer and the knower/agent. Theory constructions, ontological elements of realities, will from this perspective never be unconditionally true or correct, but only more or less informed and sophisticated (Schwandt, 1994). The constructions are formed as an interpretive understanding, or what Lee (1991) calls a 'second-level' understanding'. These emerge from iterative cycles of interpretation (e.g. rounds in the hermeneutic circle) (Prasad, 2002) where the researcher's local understandings are trialed against the understandings gained from experiencing and analyzing human behavior, language and meaning. Methodologies such as hermeneutics,

[75] Lee's three level of understanding are: 1) the first-level; the subjective understanding, 2) the second-level; the interpretive understanding; and 3) the third-level; the positivist understanding

phenomenology, interpretive case and field studies[76], and ethnography are well associated with constructivism and commonly applied to obtain constructivist accounts.

Table 4-1: Predominant Paradigmatic Assumptions of Postpositivism and Constructivism. Modified with inspiration from Lincoln and Guba (2000)[77].

	Postpositivism	Constructivism
Axiology (values and ethics)	*Excluded – influence denied.* Values and ethics are excluded and their influence is avoided or denied. Knowing is intrinsically valuable and an end in itself.	*Included – formative.* Values and ethics are included and formative for the inquiry, its process and its results. Knowing is instrumentally valuable as a means to perform agency for social progress or emancipation by researchers and/or participants.
Ontology	*Critical realism.* A 'real' reality exists but is only understood in imperfect and probabilistic ways.	*Relativism.* Reality is constructed locally and specifically and can be more or less congruent.
Epistemology	*Modified dualist/objectivist.* Knowledge aims to either be verified or not falsified objectively so it can be established as probable facts or laws. It is accumulated through accretion of generalizations which are tried against criteria such as significance, falsifiability, logical consistency, relative explanatory power, survival, internal and external validity, reliability, and objectivity.	*Transactional/subjectivist.* Individually subjective constructions and reconstructions of knowledge through 'participation' in the experience of another (vicariousness) and where knowledge coalescence form intersubjective understanding that is considered trustworthy and authentic (e.g. crystalline validity and authenticity criteria).
Methodology	*Experimental/manipulative (modified) principles.* Primarily aimed at verification of hypothesis but is open to critical multiplicity and falsification. Predominantly quantitatively oriented but can also include qualitative methods. Inquiry designed from a researcher control perspective.	*Hermeneutic and dialectic principles*[78]. Inquiries are of qualitative character, e.g. open-ended interviews, group interviews, and field studies and aimed at reaching interpretive understanding often through discussion of thesis and antithesis. Designed from a shared control perspective.

The different meta-theoretical assumptions presented above also result in paradigmatic idiosyncrasies concerning how research is undertaken. Relative to these assumptions certain preferences and typicalities exist regarding methods employed, researcher posture, form of knowledge presentation, and the form of knowledge generated. For the postpositivistic paradigm these inclinations are reflected in the strong employment of quantitative methods, the external (etic) posture of the researcher relative to research subjects, objectivity in voice and

[76] Please note that case studies in IS are commonly conducted under meta-theoretical assumptions of (post)positivism. See for instance Weber (2004), Lee (1989) and Walsham (1995). Also field studies in form of quasi-experimentation (e.g. Cook & Campbell, 1979) often tend to adhere to positivistic assumptions and principles.

[77] The dashed line between ontology and epistemology under constructivism represent the intertwinement of ontological and epistemological assumptions which arise with relativism and transactional/subjectivist assumptions; i.e. reality is subjective and knowledge of it is necessarily also so.

[78] Prasad (2002) notes that hermeneutics has both a strict and a less strict application and is used in a variety of perspectives and approaches; e.g. existentialism, phenomenology, and postmodernism.

presentation of results, and the generation of knowledge in a law-like (nomothetic) form. Constructivism hold rather diametrical inclinations as methods used are mostly qualitative, and a more immersed (emic) position tends to exist between researcher and the knower. Consequently, as knowledge generated focus on the local and particular (idiographic) and the style of presentation seeks to demonstrate subjectivity and intersubjectivity by mixing voices of the interpreter and the knower. An overview describing the differences is provided below.

Table 4-2: Characteristic Methods, Researcher Posture and Form of Presentation of Postpositivism and Constructivism. Modified with inspiration from Lincoln and Guba (2000).

	Postpositivism	Constructivism
Methods	*Technical and quantitative. Extensive* (Mingers, 2003). Quantitative dominant, but technical qualitative methods are (becoming[79]) accepted. Typical: surveys aiming for measurement and statistical analysis (often inferential statistics, contingency and structural modeling), quasi-experiments (e.g. Cook & Campbell, 1979), and *positivistic* oriented case studies (e.g. Dubé & Paré, 2003) and grounded research (e.g. Glaser & Strauss, 1967). Primarily deductive. Considered extensive as 'thin' data are usually collected from a large number of cases (Mingers, 2003).	*Qualitative (some quantitative; mix). Intensive* (Mingers, 2003). Qualitative data are dominant but quantitative data are also used for interpretation together with other insights; less technical. Typical: interviews, group interviews, *interpretive* case studies (e.g. Walsham, 1995), field studies (e.g. Klein & Myers, 1999) and grounded research (e.g. Strauss, 1987). Primarily inductive. Considered intensive as the overarching goal is to obtain in-depth data from a smaller number of cases.
Researcher/ inquirer posture	*Etic - outside-in – external to subjects*. A "disinterested scientist" (Lincoln & Guba, 2000:171) with respect to voice of object.	*Emic – inside/immersed – internal.* A "passionate participant" and a facilitator of subjective and intersubjective voice reconstruction (Lincoln & Guba, 2000:171).
Presentation	*Objective voice of the researcher.* Subjective voice seen to be potentially distorting to objective ideals. Tend to be presented in concordance with established rule and style-based vocabulary; formulaic; unproblematic.	*Voices of inquirer and knower are mixed.* Various degrees of dominance in voice depending on subjective focus. Reflexivity over researcher and participant in the processes of research and its presentation is problematic. Textual representation is an extended issue as it involves reflecting over the representation of *I*, *me*, *we* and *they*[80] (e.g. Mead, 1934).
Form of knowledge -illustrations relevant to research questions	*Nomothetic and representative.* -factors affecting attitude, intention to use, and use -gratifications sought and influencing use -socio-demographic group/category differences in use -acceptance and diffusion rates (speed of adoption)	*Ideographic and particular.* -emergence and development of socio-technical practices and dimensions of use/practices -construction and re-construction of the meaning of technology in everyday life -consumption, appropriation and domestication processes of technology

[79] This is for instance reflected in works by Markus (1994) and Trauth & Jessop (2000).
[80] Am I presenting my (researcher) account, our (researcher and participant's) account, or their (inter)subjective account? In short: in the eyes of me, their eyes, or their eyes in the eyes of me (see for instance Mead, 1934).

While the differences in the two tables seem diametrically opposed, the differences in practice may be more subtle. Weber argues that "the differences lie more in the choice of research methods rather than any substantive differences at a metatheoretical level" (Weber, 2004:x). From similar observations we also find a growing school of researchers augmenting the case for pluralism (weak, strong or disciplined) in research. Many of these suggest that increased paradigmatic confluence can enrich and complement current dominant perspectives (Gioia & Pitre, 1990; Lewis & Grimes, 1999; Lincoln & Guba, 2003; Mingers, 2001). However, crossing the paradigmatic boundaries should be done cautiously and requires careful considerations of where paradigmatic transition zones exist in the assumptions and where the meta-theoretical assumptions are incommensurable (Lewis & Grimes, 1999). While paradigmatic crossing was warned against in the first edition of the Handbook of Qualitative research, Lincoln and Guba open for cautious transitioning in the latest edition (Lincoln & Guba, 2000). For methods, however, mixing and triangulation has been promoted more strongly (Creswell, 1994, 1998, 2003; Jackson, 2003; Mingers, 2001, 2003; Mingers & Brocklesby, 1997; Mingers & Gill, 1997). Today, mixed method procedures is becoming more common and are often highlighted as beneficial when the purpose is to explore phenomena from different angles, obtain complementary insights and validate across and between methods (e.g. Creswell, 2003; Jick, 1983; Lee, 1991; Markus, 1994).

4.2 Methodology and research design

4.2.1 Meta-theoretical considerations

Five particular issues have been formative for why the constructivist paradigm has come to guide the methodology and research design of my work.

First, the *level and extent of (pre)understanding* about the specificities of mobile service use and adoption is still shallow. Before embarking on a third-level understanding or deductive testing of preexisting adoption and use frameworks, I initiated my work from the position that knowledge of ideographic and particular character was needed about the phenomenon in an everyday life situated use context.

Second, as current research has not paid sufficient attention to *temporality and dynamism* (see section 1.2.3) and thereby not sufficiently theorized about the changes to people's constructed realities as the reality may change with unfolding technology interactions,

deeper interpretive insights emerging over time rather than static confirmatory tests would be needed.

Third, to understand construction and reconstruction of cognitions beyond the absolutist reflection in form of pure numbers, a degree of *interaction* with mobile service users was not only unavoidable – but desirable. However, to become fully immersed in the everyday life of research subjects and follow their use of mobile services (e.g. a strong emic posture as would be the case if taking a critical or participatory approach) in all chambers of their social life would be impossible. Not only are there time-space constraints, but some chambers, as experienced by Ling (2004) with respect to sexual content of SMS messages, can be sealed off (also ethically) due to their private and intimate nature. This forces the researcher to balance her/his degree of freedom to choose between an etic or emic research posture.

Fourth, certain mobile data services are dependent upon social interaction in order to be usable and valuable (e.g. SMS, MMS, chat, messenger etc.). Therefore, the *scale* of research needs to strike a balance between the number of 'knowers' to be informed by while at the same time securing adequate knowledge depth. Of concern here is both the need to obtain an adequate number of respondents so that effects of networked interactions can be captured while simultaneously guard against information overload for subsequent analyses and interpretations.

Finally, to be sensitive to *contextual conditions* and impacts of changes to these, there is a need *not* to isolate the phenomena of interest from its natural context; i.e. the contextually situated everyday mobile service use. As opposed to acceptance and adoption studies in organizations, the use of mobile services can traverse across blurry boarders in the spheres of social life (cf. section 1.2.2). Thus, knowledge should be captured as contexts are experienced rather than in laboratories stripped from these influences.

The five issues discussed above reveal aspects of my axiological, ontological, epistemological and methodological inclinations. It should be mentioned that the angle to which the research phenomenon and questions were viewed and sought researched has been more formative for the research design than inherent metatheoretical assumptions. Yet, the above needs to be viewed in relation to the axiological, ontological, epistemological and methodological considerations guiding my research design.

Axiological considerations. Axiologially, I am of the position that ethics and values will to a certain degree color understandings constructed and be formative for what is legitimate to do and report. Formative for the research are particularly the ethical considerations pertaining to monitoring of research participants and their use of mobile services. Here, because of the private and intimate nature of much mobile communications, agreement and mutual understanding must be in place between the inquirer and the 'knowers'. The axiological point of view is thus that the values and ethical position of the researcher will be implicated through the frame of researcher interpretation and through the 'slippage' which can occur in interactions between a researcher and the actors under study (directly or through questions in inquiries).

Ontological considerations. Ontologically, mobile service use is *neither* viewed as an isolated event of adoption, nor as an outcome which is invariable. It is not an event viewed to invariably occur when necessary and sufficient conditions are present as postulated in variance research. Rather, I view it as a socio-technical process; that is, a process with variable outcomes arising when the social and technical interface. The process can lead to variable outcomes. Mobile services can be engaged and disengaged with over time based on the local understandings of the service and corresponding situated use contexts. Thus, outcomes can change along with socio-technical interactions. This does not mean that the process is fully erratic and unpredictable, but that certain conditions can vary in their salience and impact as the process unfolds.

Furthermore, I view mobile data services as a composition of virtual resources embedded in physical and material resource infrastructure. Around the virtual resources, as with any resource, individual and social rules can develop as people interact with the services in everyday life. These rules, e.g. heuristics of what a mobile service is, when it can and should be used, what it can do and what it can bring, will become embedded in the realities people hold and are knowledgeable of (e.g. Giddens, 1984). Prior to events of service use (*ex ante*) these will exist merely as imageries and expectancies. However, during activation of mobile services, and in a sense *ex post* (here: after the event of use), these rules can be converted into user knowledgeability. In this way I see such heuristics to both be produced and to influence interaction with mobile services. This is also so for contextual conditions. Activation of mobile

services may both be influenced by contextual conditions around which users but at the same time activation of services are also involved in producing contextual conditions. This is so because activation of a mobile service carries with it meanings and interpretation of context; that is, knowledgeability of the setting of interaction is incorporated in activity and can thereby be reproduced.

From this ontological position, the reality of mobile services, their existence, is one determined locally as people engage with services in situated use contexts. By situated use contexts I reflect here Suchman's (1987:179) logics that service use will be highly dependent upon the "moment-by-moment interactions between actors, and between actors and the environments of their action". Specific meanings and uses can come to constitute these local realities particular for an individual or a group of individuals. However, socially expanded realities can also form when understandings and practices coalesce and become 'bound' over larger time-space spans. This means that a multiplicity of particular understandings and uses may exist around a certain service, but that congruence can establish if meanings and contextual representations are recursively instantiated in social practices over time and space (see Giddens, 1984). I find Boland's (in Orlikowski & Gash, 1994) adaptation of Wittgenstein's notion of 'family resemblance' to illustrate this well: understanding can obtain a socially shared character if certain elements in assumptions, knowledge, and expectations instantiate similarity. This further implies that the reflection of reality associated with a certain service can both come to direct and be directed by the practices associated with it. To adopt Maturana's (1988:39) words: "reality arises as an explanatory proposition of our experience of operational coherences in our daily and technical life as we live our daily and technical life".

The above ontological position strikes a balance between technical determinism and social determinism[81]. It is acknowledged that technology can and will influence the course of social practices, interactions and society, but also that the course of social practices can and will influence the life and evolutionary course of technologies. Thus, a dual perspective (Aune, 1996) is adopted which acknowledges that social life is adapted to mobile services and, relative to degrees of interpretive flexibility (Bijker et al., 1987), mobile services are also adapted to everyday life. This echoes Giddens' (1984) structuration theory underlining that action and

[81] Technological determinism reflects beliefs, assumptions and contentions signifying that technology shapes society. Social determinism, also referred to as the social construction of technology, reflects beliefs of the opposite; that social forces shape the course of technology (see e.g. Rogers, 2003; Ling, 2004).

structure is not a dualism but a duality. Central to acknowledge here is the view of technology as a modality which can *enable* interaction and data exchanges across time and space, but also *constrain* the form of interaction possible over these spans.

Epistemological considerations. Considering the inclusive form of axiology and relativistic oriented ontology above, the epistemological stance maintained can be only one under which it is acknowledged that neither reality nor the knowledge produced of it can be fully objective. While objectivity is characteristic for the postpositivism paradigm, and critical subjectivity (a focus on cocreated understanding) is characteristic of the participatory paradigm, I maintain a middle position between the foundationalist and the critical epistemologies. Consistent with the axiology and ontology, I seek to tap into the local realities constructed by people interacting with and through mobile services. The position between the inquirer and the known is thus of transactional and subjective character (Lincoln & Guba, 2000) where findings are constructed and reconstructed interpretatively based upon theory and the data the inquiries into the communications and actions of mobile service users bring about. From this vantage point it is acknowledged that more or less idiosyncratic ideas and meanings can exist and be instantiated in the practices where a specific mobile service is implicated. However, my position is different to that of a phenomenological point of view which would aim to present a pure and unencumbered first person/first-level subjective understanding (*Verstehen*[82]*)* (Boland & Day, 1989; Lee, 1991). It is also different to that of the participatory project seeking to co-create understanding for the objective of change or emancipation (Kemmis & McTaggart, 2000; Lincoln & Guba, 2000). I maintain more of an outsider position, one of an observer, inquirer, and interpreter where congruencies and patterns in meanings and behaviors among several subjects are sought. As such, and in affinity with the interpretive notion of language games[83] (Wittgenstein, 1972) which both interpretive philosophies and 'strong' constructivism shares (Schwandt, 2000), I seek understanding about the systems of meaning and action-constituting

[82] There is a distinction between explanation (*Erklären*) and understanding (*Verstehen*). The first is aligned with the goals of natural science to apply hypothetico-deductive logic to offer law-like explanations, while the latter (in different forms) is generally refer to the process of understanding the underlying meanings of individual and social behavior which distinguish the social world from the natural world (see e.g. Schwandt, 2000; Lee, 1991; and Prasad, 2002).

[83] Very succinctly put Wittgenstein (1972) sees rules of language both to be produced as language is used in the flow of everyday practice and governing of how language is used in these practices; some of the rules are ingrained and others are made up or altered as 'we go along'.

heuristics which are revealed through the actions (both utterances and as traces in behavior) of individuals studied.

The epistemological position I explicate above aims at a second-level understanding (Lee, 1991) where subjective accounts, when considered interpretively plausible, are brought into a greater consistency and harmony. This implies that understanding is considered an intellectual process where a researcher constructs and re-constructs knowledge about the meaning of human action and the contexts under which it takes place (Schwandt, 2000). Knowledge thus emerges in form of a bricolage. It is constructed from iterative cycles between the expressive behaviors of subjects and the theoretical lenses of the researcher.

Methodological considerations. Methodologically, the paradigm of constructivism is associated with hermeneutics (Lincoln & Guba, 2000, 2003); that is, hermeneutics in a broad sense bordering to synonymy with, or even a foundation for, interpretivism[84] (see e.g. Klein & Myers, 1999; Lee, 1994; Sarker & Lee, 2006; Schwandt, 2000; Walsham, 1993). As Prasad (2002) notes, there is both a 'weak' application where hermeneutics tends to be equated with the omnibus term 'qualitative research' and a 'strong' philosophically grounded hermeneutics associated with detailed studies and analyses of *text* (esp. sacred texts). Few phenomenologist are today practicing the pure or classical forms of hermeneutics (Miles & Huberman, 1994). And interpretive field studies, even those highlighted as exemplary (Klein & Myers, 1999), seldom explicitly refer to or discuss procedures relative to the hermeneutic circle[85] or fully comply with all seven principles for interpretive research suggested by Klein and Myers (ibid.)[86]. Among management scholars variations of hermeneutics (weak and strong) are now applied for analyzing and interpreting human practices, utterances, artifacts and their use (incl. information systems and technology), institutions and organizing as metaphorical forms of

[84] For instance, Walsham (1993:9) consider both Winograd & Flores (1986) cognition and action oriented approach as well as Boland & Day's (1989) phenomenological hermeneutic works as being "centrally based on the interpretive approach". Also in Klein & Myers' (1999) presentation of principles for evaluating interpretive field studies they draw solely upon the philosophical basis of hermeneutics – even though hermeneutics is not clearly recognized in the three exemplars of interpretative research they provide.

[85] The principle of the hermeneutic circle suggests that "human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form". It is a meta-principle "fundamental to all the other [six] principles" (Klein & Myers, 1999:72). It can be considered a "device of mind" which enable the reader of a 'text' to interchangeably hop between interpretations of parts in terms of the whole and vice versa.

[86] Among the principles it is especially the *principle of interaction between the researchers(s) and subjects*, and the *principle of dialogical reasoning* which exemplary field studies are week at satisfying (Klein & Myers, 1999) .

'text' (Boland, 1985; Boland & Day, 1989; Lee, 1994; Sarker & Lee, 2006; Walsham, 1993). The central argument underlying these expanded applications of hermeneutics is that "social/cultural practices and institutions are 'texts' not in any physical sense, but because they may be 'read', understood and interpreted in a manner that is similar to our reading/understanding/interpretation of written texts" (Prasad, 2002:24). Along these lines Boland (1985) argues that since *use* of technology and *design* of technology are products of how the 'text' of technology is interpreted and created, research on *either or their interaction* is a hermeneutic task.

While I will not describe my methodology as hermeneutic in the strict philosophical sense, I find the contemporary hermeneutic principles (e.g. Klein & Myers, 1999) fundamental for systematic design of the field study of mobile service use and behavior and for the evaluation of resulting theorizing. Concordant with the approach employed by Trauth and Jessop (2000) I use the hermeneutic principles to facilitate an interpretive interplay between findings of analyses and theory. However, I do not embark in the study the 'clean slate' fashion of early grounded theory (see e.g. Charmaz, 2000). Rather, I draw upon the state and situation of current mobile service use (from Chapter 2) together with the pre-understanding derived from literature on adoption and use of mobile services to form interpretations of new data in light of the pre-understanding and the evolving novel understanding. In this way, and more true to the principle of the hermeneutic circle, I move back and forth between findings pertaining to the 'part' I am studying and the larger 'whole' which is identified from literature and the context. I thus let the 'texts' of different data forms (numbers documenting use and language written and spoken by the participants) 'speak to me' in light of the pre-understanding and context and not in an unencumbered 'blank slate' way. This interpretive approach thus blends the strengths of the hermeneutic principles with procedures associated with grounded theory.

Of strong significance to the considerations underlying my research methodology is how interpretive research resting on hermeneutics as a foundation does not fetishize methods but allow iterative cycles of interpretation between different data types. As Prasad states: "the hermeneutic approach offers management researchers considerable flexibility for combining qualitative and quantitative methods" (2002:26). Relative to the emphasis on temporal change highlighted above and in section 1.2.3, combinations of methods can be beneficial for understanding both the diachronic and the synchronic aspects of behavior, meanings and

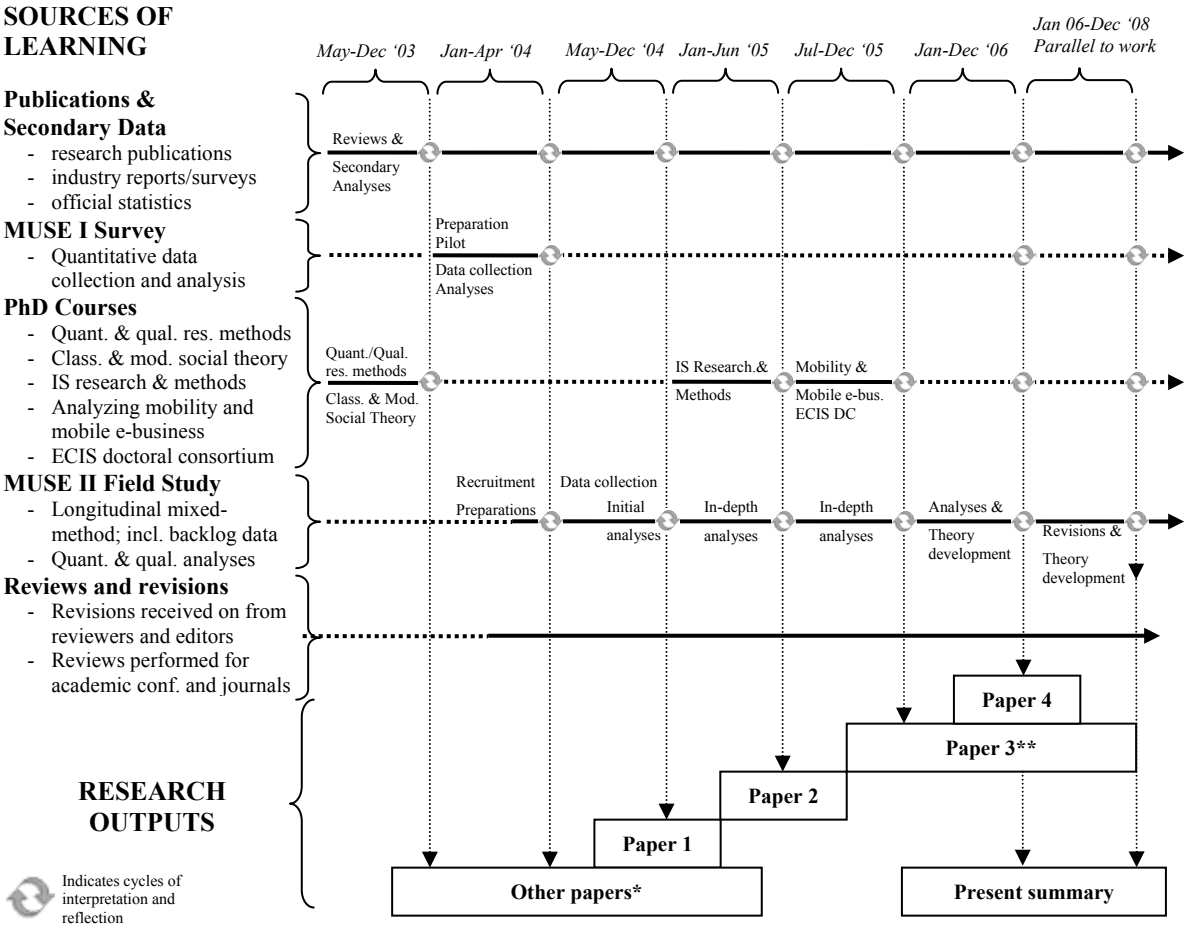
contexts of situated mobile service use. The view Prasad presents corresponds also with the methodological view Strauss and Corbin (1990) advocate concerning a circular *interplay* between analyses of qualitative and quantitative data. Similar to rounds in the hermeneutic circle they argue: "The qualitative should direct the quantitative and the quantitative feedback into the qualitative in a circular, but at the same time evolving, process with each method contributing to the theory in ways that only each can" (ibid.:34).

These and other combinatory views (e.g. Creswell, 2003; Mingers, 2001, 2003; Mingers & Brocklesby, 1997) are particularly important for understanding the interplay between cognition and behavior in relation to mobile service use. Because a person usually can discursively explain and describe most of the actions undertaken in everyday life, thus also practices with mobile data services, and since actions performed indeed carry instantiations of the heuristics (e.g. mental rules) he/she draws upon to perform those actions (Giddens, 1984)[87], the methods chosen need to both supply data documenting her/his actions while at the same time offer data capable of bringing cues about what the actions mean and under what context(s) the enactments occur. In order to document mobile service use while in parallel being equipped to capture the meaning attributed to such behavior I therefore find rationale for combining methods in a mixed methods field study (e.g. Creswell, 1994; Mingers, 2001). Such a design facilitates interplay between data and theory during theorizing. Feedback and feedforward cycles between absolute numbers documenting use as well as the deeper meanings explained by respondents can ensure that both the situation under which mobile service use occurs, the meanings emerging and the particular action conducted can be interpreted in an interdependent and mutually informative fashion. Interpretations are allowed to emerge and be refined during iterative cycles of inquiry, interpretations and theorizing. This also facilitates understanding to gradually escalate to higher levels of abstraction and higher level contexts which, as highlighted by Markus and Robey, is central when theory is difficult to delimit to one level of understanding and when understanding is directed at the "dynamic interplay among individuals, technology, and larger social structures" (Markus & Robey, 1988:595-596).

[87] While the author acknowledges Giddens concept of 'double hermeneutics' – that first and second order concepts of respectively the social scientist and the social agent can be mutually adapted and applied – this hermeneutical 'looping' is not studied from the epistemological position of this research.

4.2.2 Research design and sources of learning

The overall research design and implied sources of learning are illustrated Figure 4-1. Upon presenting the secondary sources of my study, I proceed to illustrate and carefully describe the mixed method field study conducted as this constitutes the primary qualitative and quantitative data source for the study.



* For an overview of other papers – see appendix 1

** Paper 3 has appeared in two versions. The initial version was accepted as a conference paper to the IFIP 8.6 Conference on Mobile Information system in Leeds ultimo 2005. It has also appeared as a Sprouts Working Paper (vol. 5, issue 3, 2005). It was completely rewritten based on reviews from Information and Organization received during 2006. After a second rewrite during early 2007 it was accepted for publication at Information and Organization and issued in its final version in January 2008.

Figure 4-1: Sources of Learning during the Project Period and Resulting research Outputs[88]

[88] This figure was adapted and produced with inspiration from an original illustration offered by Dr. Rens Scheepers (1999:22) (available online: http://www.dis.unimelb.edu.au/staff/rens/thesis.pdf)

4.2.3 Secondary sources and data

Secondary sources and data are contained under the two headings "Publications & Secondary Data" and "PhD Courses" in Figure 4-1. Knowledge derived from these secondary sources has to varying degrees been implied in forming the research methodology, understandings presented in the research papers and the present summary. Scholarly publications, industry reports and official statistics on mobile service use have been strongly influential for my framing of the phenomenon of interest and for establishing the research questions. These, as shown in the figure above, have not only been strong sources of learning influential at the onset of the study but have been continuously implied and revisited in (1) the research papers, (2) the design and interpretation of the primary data derived during the field study, and (3) in the reflection over findings, contributions and limitations in the present document.

Scholarly research. Upon the initiation of the research, the number of scholarly, especially empirical, publications on mobile service use was limited. The literature identified and reviewed in Chapter 3 reflect this embryonic and unsystematic state but identifies at the same time four different streams (TA, DoI, U&G and DoT) of literature that all, in specific ways, are relevant and useful relative to the phenomenon of interest. The pre-understanding generated from the review of the four streams greatly influenced the "MUSE II" field study inquires and the ways prioritized issues were operationalized. As primary data was generated, the streams of research were frequently revisited during the further theorizing in the research papers.

During the course of research we have witnessed a sharply growing body of research[89] on mobile service use and adoption. Naturally, this research has come to strongly influence the understanding formed. I want here to emphasize in particular the growing set of novel constructs for adaptations of technology acceptance research to a mobile service setting (e.g. Nysveen, Pedersen, & Thorbjørnsen, 2005), studies on the domestication of mobile services (e.g. Haddon, 2004; Ito, Okabe, & Matsuda, 2005; Ling, 2004) and uses and gratification perspectives on internet and mobile services (e.g. Pedersen & Ling, 2003; Stafford et al., 2004). Furthermore, several studies on the evolution of mobile service innovation and use in Europe (e.g. Bohlin et al., 2003; Elliott & Tang, 2004) and in Asia (e.g.Sharma & Nakamura,

[89] As a curiosity the number of publications on registered in the m-lit.org data base has from December 2004 until January 2006 grown from 550 to 850 references.

2004; Yoo et al., 2004) have emerged and been informative for the understanding developing during the research process (as is reflected particularly in paper 3).

Research reports and statistics. During the course of study several research reports and a corpus of ever more detailed statistics from official authorities have also emerged. The official statistics from the telecommunication authorities in Denmark (The National IT and Telecom Agency) have been tracked continuously. Along with similar statistics from Norway (The Norwegian Post and Telecommunications Authority), Sweden (The National Post and Telecom Agency) and Japan (The Telecommunication Carriers Association) and reports on mobile service use in Europe and other world regions (e.g. Menon, Page, Watt, & Bell, 2005; Nokia, 2003; Smoreda & Thomas, 2001) these statistics have greatly influenced the understanding generated in paper 3.

PhD Courses. As a rookie to the field of information systems, several PhD courses have been of great influence and had a direct bearing on the research papers. The introduction course to IS research (w/ Suprateek Sarker) and a workshop on theory building in IS (w/M. Lynne Markus) provided invaluable insights to IS research methods, approaches and the history of IS. Furthermore, the course on mobility and mobile e-business (w/Kalle Lyytinen) enabled a more fine grained understanding of the specificities and role of technical components and infrastructure enabling mobile data communications. Along with the emphasis on the role of the IS artifact from the former courses and theories from the course on modern and classical social theory (esp. Giddens) this enabled the establishment of the tripartite institutional framework presented in paper 3 and drawn upon in paper 4 and 5. The courses on qualitative and quantitative data analysis have also been of direct benefit to the various forms of analyses conducted during the research period.

Reviews and revisions. In writing a paper based dissertation, reviewers' comments, critique and criticism is an invaluable source of learning. Not only have the papers benefited greatly from the feedback of several anonymous reviewers, but so has the way I have developed my line of thinking, conceptualization and worldview of mobile service adoption and view. Of

particular value were reviews received from Mike Gallivan and the anonymous reviewers and editors of SIM and Information & Organization.

4.2.4 Primary data, methods and analysis

The corpus of primary data consists of data obtained during the "MUSE 1 Survey" and the "MUSE II" Field Study. The data of the former is used only to contextualize the research in Chapter 2 and is not directly invoked in the four selected papers. For methodological considerations of the MUSE I survey I refer to our resulting papers (Constantiou et al., 2004a, 2004c) and appendix 3. The primary data analyzed, interpreted and theorized upon *in the four papers* of this dissertation derive from the "MUSE II" mixed method field study. The field study was designed to obtain data on (1) how users' understandings and heuristics shape and are shaped by the adoption and use of mobile data services and (2) dimensions of use of mobile data services. The "MUSE II" study design can be characterized as a *concurrent mixed method* field study as both qualitative and quantitative data are gathered and analyzed in parallel (Creswell, 2003) over a 14 week period of mobile data service trial. Below I present this concurrent research design, methods and analysis of the field study carried out between March and July 2004.

Sample and Recruitment Criteria. The sampling strategy underlying the field study can be categorized as *criterion based* (Miles & Huberman, 1994) as three key criterions were used during recruitment. First, each participant had to be affiliated with a socio-demographic group suggested to be among the early adopters of new m-services; students and young professionals (e.g. Constantiou et al., 2004b; Ishii, 2004; Ling, 2004; Aarnio et al., 2002)[90]. Second, the person was to be a member of a social/work group in vicinity to the research area in Copenhagen and in which group he/she had frequent social interaction. This criterion was important in order to register shaping of understanding and use emerging from social interactions between participants and register potential peculiarities and consequences due to network effects. Finally, participants had to have some interest in but only marginal to no mobile data service experience prior to joining the project. These selection criteria ensured that the research (1) would investigate relevant mobile service users, (2) could be sensitive to

[90] Please note that these groups were also, during the introduction of 3G services and WAP portal services at the time, the main segments heavily targeted in marketing campaigns.

ongoing social interactions and communications among participants, and (3) obtain access to "virgin" users with diminutive direct or indirect (through others) advanced service experience.

During recruitment it was found that the criteria were principally fulfilled in three groups of people. Two of these participant groups consisted of students at the IT University in Copenhagen and the final participant groups consisted of members of a work team at the Consumer Information Agency in Copenhagen. The resulting field study sample encompassed overall 38 participants. Among these 16 were females[91] and the average age was 30.

Well aligned with the average findings from the MUSE I survey, most of the recruited participants called less than 15 minutes via their mobile phone each day and had only marginal to no experience of mobile data services beyond SMS prior to joining the study. A handful had tried WAP when it first came to market but none was a frequent user. All participants used short messaging (SMS) and a majority sent more than 20 SMS per week. The use of multimedia messages (MMS) was close to nil and only two participants occasionally used mobile e-mail. Despite interacting in three different groups, the participants demonstrated relatively homogenous mobile service use prior to the project.

To take part in the study all participants contractually agreed to (1) use the SIM card[92] offered by the mobile network operator as the ***only*** SIM card to be used during the 14 week trial period; (2) provide researchers unconditional access to all traffic data registered – excluding interpersonal messages (use and contents of SMS and MMS was not monitored to preserve privacy and to establish trust and rapport with participants); and (3) participate actively by answering questionnaires and being available for group interviews.

[91] It should here be mentioned that the variety of mobile data services available to the participants was sufficiently broad to cater to multiple user segments – from young to the more mature and males as well as females. Therefore, social group affiliation and interaction was weighted stronger than a person's age and gender for the recruitment and selection of participants.

[92] SIM is an abbreviation for subscriber identity module (SIM) – an application running on a smartcard which ensures identification of a subscriber and his/her transmissions on a cellular network.

Mobile services accessible and investigated. Upon signing and answering two initial questionnaires each participant was provided a new (Nokia) mobile phone. The phone was equipped with a pre-charged SIM card from the collaborating mobile phone operator. The monthly disposable amount pre-charged to each participant's SIM card was set to 250DKK[93]. This amount was calculated based upon a pre-survey revealing that three out of four participants currently had an average mobile service expenditure (voice and data) of less than 225 DKK per month[94]. Configuration settings were preset for GPRS and WAP. However, and in order to naturally observe potential complexity regarding similar configuration of MMS, each participant needed to configure their phones for MMS use[95].

The mobile phones provided to the participants granted access to use of SMS, MMS, mobile e-mail[96] and a range of mobile data services available on the Danish mobile operators' mobile service portal. An overview of the services reported upon in the research papers is provided in the table below:

Table 4-3: Included mobile data services

Service category	Description
Short messaging service (SMS)	Sending of short text messages and ordering of value added content.
Multimedia messaging service (MMS)	Sending and receiving text, pictures and video.
Mobile e-mail	E-mail service utilizing a GPRS connection for sending and receiving normal e-mail.
News	Text and multimedia contents on world and local affairs.
Infotainment	Text and multimedia contents on entertainment and show-business.
Content Downloads	Ringtones, backgrounds, logos, screensavers and games (mostly Java-based games) which can be ordered and downloaded on the phone.
Search & Find	Search for maps, locations and directions, phone numbers, and addresses.
Chat & Dating	Personal profile and match to other personal profiles along with chat in mobile chat rooms.

[93] € 33.60 / US $ 41.20 with exchange rates of March 20th, 2004

[94] At the end of the field study only three participants answered that they had reached this budget constraint during the project.

[95] The procedure for MMS configuration was similar to configuration of GPRS and WAP. Each user needed to visit an the home page (from a computer) from the mobile operator and then (1) navigate to the MMS configuration setting page, (2) select mobile device brand and type, (3) enter her/his mobile phone number, (4) install configuration settings received via SMS.

[96] In order to use mobile e-mail, the e-mail client on the phone needed configuration. This procedure required the participant to enter his/her e-mail address, incoming mail server, login and password.

Data collection. Prior, during and subsequent to the mobile service trial period, participants were presented a series of quantitative and qualitative inquires. The inquiries drew upon the major theories identified in Chapter 3. This included technology acceptance and diffusion of innovation predictors, domestication characteristics and uses and gratification features. Data collection occurred in form of group interviews, online inquiries and backlog usage data. Upon group interviews and two initial online questionnaires with open and closed ended questions five inquiries were conducted during the trial period. Two additional inquiries were conducted after the trial period. Parallel to these inquiries the collaborating mobile operator, TDC, collected the log files that registered mobile portal service use. Table 4-4 offers and overview of the data collection, intents, and key theoretical aspects targeted.

Hyperlinks to the each online inquiry were distributed directly to each of the participants via e-mail. The online survey tool SurveyMonkey[97] was found to work excellently for the purposes. It allowed easy crafting and distribution of inquiries and enabled instant views of patterns in quantitative responses and reading of qualitative responses. In this way it was possible to reflectively use the insights generated during the field study to craft subsequent questions. The tool also allowed monitoring of response activities which ensured that responses were given by our participants within the time 4-5 day deadline and that reminders could be sent as these deadlines were approaching.

While the closed ended questions typically used rating scales and alternatives, the open ended questions allowed the participants to describe in own words what they associated with the mobile data services and their experiences. This included comments on performances, outcomes, contributions, efforts, social conditions, commercial conditions and technical conditions, how they learned, what they learned, from whom they learned and what their experiences were like. The open ended nature detailed aspects other than the efficiency and work oriented variables usually targeted in TA and DoI research could freely emanate in participants responses.

As seen in Table 4-4 two rounds of group interviews were conducted. An interview guide was crafted for each round. The initial targeted an exploration of expectancies of new mobile data services relative to current services use. The second targeted a deeper scrutiny and

[97] www.surveymonkey.com

discussion of pertinent themes emerging during the field study. All group interviews were video recorded and then transcribed.

Table 4-4: Data Collection during the Longitudinal Field Study

	Focus	**Key Theoretical reference(s)**	**Data collection method**	**Closed or Open-ended**	**Key Intent**
#	**Pre launch**				
1	Expectancies towards new mobile services and currently valued services	Pedersen & Ling (2003) Sarker & Wells (2003)	Group Interviews (4) 20 participants.	Open	Explore current use and emerging imaginations of m-services. Record initial imagery when experiencing new m-services.
2	Current use of mobile phone and services, role of phone in everyday life. Desired features and functions.	Rogers (2003) Vrehoupoulus et al. (2002)	Online data collection (n=38)	Closed and open	Obtain quantitative data on user participants (aligned with the MUSE I survey of 1,100 respondents conducted in Denmark) to guide qualitative inquiries.
3	UTAUT measures; expectancies	Venkatesh et al. (2003)	Online data collection (n=38)	Closed	Obtain measures on intentions to use and central latent constructs (e.g. performance, efforts, and social conditions) influencing attitudes and intentions to use new mobile data services.
	During				
4	Interpretations pertaining to technology acceptance factors (open ended UTAUT) (W:3-4)	Venkatesh et al. (2003).	Online data collection (n=36)	Open ended	TA factors used to obtain *essay* answers reflecting experience and interpretations of m-services.
5	Service and portal specific experiences; performances, efforts, and gratifications (W:6-7)	Rogers (2003) Teo & Pok (2003) Pedersen & Ling (2003)	Online data collection (n=36)	Open and closed	Identify participants experience with services and obtain qualitative inputs on their interpretations concerning qualities (esp. functioning) and gratifications / contributions.
6	Mobile service learning, use /domestication process and experience (W:9-10)	Same as 5 + Haddon (2001)	Online data collection (n=36)	Open and closed	Essay answers to questions aimed at obtaining detailed descriptions of the m-service experience since joining the project.
7	Actual use (database file for each participant) (W:1-14)	-	Electronic registration by MNO (n=38)	NA (Factual numbers)	To guide the crafting of relevant questions and adapt to evolving setting based on actual vs. pronounced use.
8	Reflections over experiences and process (W:10-13)	Integration of the above.	Group interviews (6); 21 participants.	Open	Exploration of key themes during discussions of m-service performances, contributions, properties and gratifications experienced.
	End				
9	Current use and experiences gained (W:14 +)	Same as 2 + Pedersen & Ling (2003)	Online data collection (n=36)	Open and closed	Manifest developments in use, properties and gratifications sought as expressed by participants.
10	UTAUT measures; experiences (W:14)	Venkatesh et al. (2003)	Online data collection (n=36)	Closed	Obtain measures on intentions to use and central latent constructs set to influence intention to use/use.

Whereas the 38 person sample is not particularly large, the concurrent qualitative and quantitative research approach generated a substantial corpus of data. The qualitative data consist of 988 essay type responses to open ended questions and 15 hours of group interviews. Moreover, the participants provided 9,616 quantitative entries to the 263 closed ended questions, items, and statements[98] presented to them during the 14 weeks. The responses were

[98] This encompasses the 46 items of the UTAUT measurements conducted twice (2 and 10 in Table 4-4), 28 questions/items/statements of the first online inquiry, 78 of the fifth, 39 of the sixth and 26 of the ninth.

augmented with the 4,327 records of mobile portal service accesses (PSA) distributed over 711 mobile portal sessions (MPS) registered on the participants' SIM-cards. The latter documented that the different services enlisted in the table above were actually used or not used, provided central data on the dimensions of their use, and exact time of use. As mentioned, due to privacy concerns these backlog data files did not include operator data on short messaging, multimedia messaging and mobile e-mail. Regarding data on the use of these services reliance was thus put on participants' quantitative self-reports. Examples of questions, themes and data extracted from the overall data collection can be found in research paper 1, 2 and 4.

Data analysis. Data analysis was undertaken in two main phases. Initial identification of important trends and preliminary themes relative to theoretical constructs was carried out concurrent with the data collection. Parallel to this, descriptive statistics of use data and drivers of use provided indications on congruence and incongruence regarding the understanding and heuristics shaping among participants and on the causes of use; e.g. statements from some participants and pertinent issues highlighted for the specific services were assessed for relative agreement/disagreement (see e.g. example in Paper 4). These initial analyses offered a basis to frame critical questions and carefully define and refine further study targets.

Following the concurrent preliminary analysis more intensive analyses were undertaken. Upon completion of data collection each open-ended response and each transcribed 'passage' (filtered for dross; trivial and useless data) from the group interviews were organized chronologically and analyzed. In a corresponding data set the quantitative responses were organized in similar manner and then analyzed in detail.

In-depth analysis of qualitative responses were performed according to qualitative coding, classifying and clustering principles (Miles & Huberman, 1994). As opposed to the inductive, purist and unencumbered open coding approach suggested by Strauss and Corbin (1990), the coding was undertaken along the more structured lines suggested by Miles and Huberman (1994). Initial coding of responses was conducted based upon a provisional start list derived from the key theoretical constructs identified in the literature review presented in Chapter 3 (see also Appendix 4). This procedure ensured interplay between findings and theory while at the same time allowing emerging themes to appear and be detected from the data. Furthermore the analysis procedure made it possible to seek that recurring categorical and service specific

congruencies and idiosyncrasies could be revealed with respect to *in vivo*[99] codes (ibid.) emerging from the data. Memos in form of interpretations of statements and utterances were then written next to central 'passages' and as a summary at the end of the chronological passages for each respondent (Microsoft Excel was used for this procedure). The labels and memos formed a basis for selective ordering and theorizing based on constant comparisons (Charmaz, 2000; Strauss & Corbin, 1990). This included comparisons (1) between the data sets of each participant, (2) within the data sets of each participant at different points in time during the field study, and (3) specific and overall comparisons between the qualitative and quantitative data sets for the participants.

The limited number of participants imposes constraints on the applicability of advanced statistical analysis for the quantitative data set. The most advanced statistical procedures involved Partial Least Squares (see Paper 1) as well significance tests for comparative changes to perception measures at the beginning and at the end of the field study (see documentation in Knutsen, Constantiou, & Damsgaard, 2005). Due to sample limitations, descriptive statistics and tabularized comparison tables were used to analyze closed ended responses and the backlog data. The 4,327 registered backlog portal activities were organized so that pivot tables at the consolidated, group and individual level could be tabularized in detail with respect to time, date, week, types of content/service, and session. This also made it possible to determine whether or not each user engaged recurrently with a particular service during the period and thus facilitated constant comparison between categorized statements and the actual and reported use of the mobile services (see Paper 4 and Chapter 6).

4.3 Evaluation criteria

The application of different methods under the overall mixed method field study requires special considerations regarding criteria for evaluation (Creswell, 2003). Different positions are held among scholars if the similar criteria can be used for evaluating quantitative as qualitative analysis; some even question if criteriology is at all proper. For instance, Weber argue "there are no differences between positivist notions of validity and interpretivist notions of validity" (2004:viii) while Guba & Lincoln (1989; 2000) suggest that constructivist research

[99] *In vivo codes* represent essential terms as used by the participants (Strauss & Corbin, 1990).

warrants a replacement of the positivist criteria of internal and external validity and introduce the 'parallel' (quasi-foundational) criteria of *trustworthiness* and *authenticity*. And, while Schwandt (1996) is almost[100] on the course of sending a "farewell to criteriology" we find Klein and Myers (1999) polar position introducing a list of seven principles for designing and evaluating interpretive field studies.

Operating at crossroads between methods I maintain adherence to the usual canons of validity and reliability for the quantitative aspects of the field study. For the quantitative methods and analysis in research paper 1 I employ criteria required for evaluating the validity and reliability of partial least squares (PLS) analysis. This includes adjustment of constructs and variables relative to sample size so that adequate explanatory power is ensured along with prescribed bootstrap procedures to evaluate internal and external validity.

However, due to the constructivist assumptions and the dominant qualitative orientation underlying the three other papers, I seek primary compliance to the principles Klein and Myers (Klein & Myers, 1999) outline for interpretive field studies. These principles align well with Strauss and Corbin's evaluation criteria (1990) as they also set focus on evaluation based on the adequacy of the research process of a study and the empirical grounding of the findings. Relative to Strauss and Corbin, I find that Klein and Myers' principles better exemplify and inform of how researchers in their design and evaluation can work to meet the criteria. As illustrated in Table 4-5 there are key 'parallels' between these criteria, the view maintained by Weber (2004) and the quasi-foundational criteria presented by Guba and Lincoln (1989).

[100] I say almost because even though Schwandt's (1996) work is entitled "Farewell Criteriology" he issues three criteria; complementarity/supplementarity, critical practicality, and impact (extent of contribution to calibration of human judgment).

Table 4-5: Key 'Parallels' between Criteria for Evaluation

Weber (2004)	**Guba & Lincoln (1989)**	**Klein & Myers (1999)**
Validity - empirical data must ensure that knowledge claims put forth are plausible and defensible - statistical conclusion validity only applies when aim is to generalize from large amounts of data from a sample or population - validity for qualitative research is evaluated upon degree of shared understanding between researcher, colleagues and participants	Credibility ('parallel' to internal validity); - isomorphism need to exist between the constructed realities of respondents and the reconstructions attributed to them Transferability ('parallel' to external validity) - degree of similarity and salient overlaps existing between the context being researched and an alternative context so that judgments can be made regarding how the study can be applied and can potentially produce similar results in an alternative situation	Meta-Principle of the hermeneutic circle - understanding of a (constructed) complex 'whole' is generated from preconceptions about the meaning of its parts and their interrelationships Principle of contextualization - critical reflection required of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged. Principle of abstraction and generalization - requires relating the idiographic details revealed by the data interpretation through the application of the principles above to theoretical, general concepts that describe the nature of human understanding and social action.
Reliability - ultimate criteria is replicability - for positivist the criteria are straightforward as research methods are routinized and well formalized. - interpretivists seek to facilitate similar grounds for replicability by carefully describing and presenting research methods and the way interpretations are formed (interpretive awareness); but replicability is more difficult due to subjective nature of interpretation and less well-defined methods	Dependability ('parallel' to reliability) - the degree of stability of the data over time relative to the changes performed to inquiries as more sophisticated constructions are made - judgments need to be made relative to data as the inquiry process changes and temporally unfolds which thus warrant researchers to document the changes occurring	Meta-principle of the hermeneutic circle Principle of dialogical reasoning - requires the researcher to confront his or her preconceptions (prejudices) which guided the original research design (i.e., the original lenses) with the data that emerge through the research process

Table 4-5 continued

Truth / Objectivity - it is not possibile to start with a *tabula rasa* but measures can be taken to match experience and interpretations with current commonly accepted understandings	Confirmability ('parallel' to objectivity) - the degree to which data, interpretations and outcomes of inquiries are rooted in the contexts and come from the persons apart from the inquirer - warrant source traceability	Meta-principle of the hermeneutic circle Principle of interaction between the researcher(s) and the subjects - requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researcher and participants Principle of multiple interpretations - requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision
	Authenticity[101] (pure constructivist criteria) - degree to which a negotiated construction is created and reflect co-created understanding and the degree to which this understanding has become more sophisticated and can stimulate and empower individual action	Meta-principle of the hermeneutic circle Principle of interaction between the researcher(s) and the subjects Principle of dialogical reasoning Principle of suspicion - requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants

The principle of the hermeneutic circle is implied in the overall research of this dissertation and is given explicit recognition in the synthesis presented in Chapter 6. The theorizing in the research papers shows a gradual escalation in levels of abstraction and level of context. Each paper represent, as shown with the circular arrows in the figure above, an interpretive cycle where current theory is invoked and theorizing is performed based on primary and secondary sources. From an understanding of 'parts' and their interrelationships the interpretive understanding is sought to progress towards an escalating 'whole' and back to the parts. I seek to progresses from the study of individual perceptions and meanings (e.g. paper 1, and 2) towards an interpretation of congruencies in meanings and mobile service engagements (e.g. paper 3 and chapter 6) and up to an institutionally informed interpretation of how specifications, properties, gratifications of mobile services enable and constrain their use

[101] Authenticity is composed of ontological authenticity (enlarging of personal constructions), educative authenticity (improvement of understanding of others' constructions), catalytic authenticity (stimulating of action), and tactical authenticity (empowerment of action) (Guba & Lincoln, 1989)

(paper 4). The movement in the hermeneutic circle back to an improved understanding of each part is well reflected in the final paper where the pre-understanding is revisited and further developed based on the findings of the study.

The *principle of contextualization* of the social and historical background of the research setting (Klein & Myers, 1999) is reflected in Chapter 2 of this dissertation where technologies of mobile data services and their use in Denmark is described. It is also specifically attended to in the institutional and diachronic perspective developed and used in one of the research papers (paper 4). Furthermore, the description of the settings and data collection conducted in the mixed method field study (see next section) further contextualizes the research situation.

The *principle of interaction between the researcher and subjects* (ibid.) has already been indirectly touched upon under the axiological and epistemological considerations discussed above (e.g. degree of possible immersion). Relative to the hermeneutic ideal of a socially constructed understanding emerging during the interaction between the researcher(s) and participants (ibid.), my posture being one more of an outsider vis-à-vis the 'knowers' somehow encumbers realization of this ideal. I seek interaction with participants via data-collection procedures, e.g. virtual interaction via online inquiries and direct interaction via group interviews, but I am not, due to the limitations in following people's real-life *in situ* use of mobile services, socially immersed in the everyday life of the participants. Consequently, and much like the exemplars Klein and Myers (ibid.) refer to, the potential effects my inquiries and activities have on the participants, their understanding, and use of services can only be limitedly accounted for.

Regarding the *principle of abstraction and generalization*, and as seen in Figure 4-1, I seek abstraction and conformity relative to theoretical constructions found in published research on technology adoption and use. Theoretical constructions found in research on technology acceptance, diffusion of innovation, uses and gratifications and domestication are drawn upon in the theorizing and discussions in the papers. Furthermore, theoretical constructions of Giddens stratification model (in paper 3), institutional theory (in paper 4), and social cognitive theory (Chapter 6) constitute lenses for abstraction and generalization in the papers. However, due to the rather limited sample size, generalizations are not sought at the more rigorous third-level (positivistic) of understanding (Lee, 1991). General concepts and

refinements of concepts are proposed in the papers and the idiographic details between the pre-conceptions, findings and emerging refinements are discussed.

The principle of dialogical reasoning is not particularly well adhered to in the research papers. While I consciously revisit and look at contradictions between preconceptions in theoretical understanding of theory vis-à-vis findings in the final paper, I do not actively engage in a discussion of how my preconceptions have been altered in other papers. An overall reflection over how my understanding has developed during the course of research and as the story of the data has become interpreted is therefore presented in more detail in Chapter 6 along with suggestions for further research.

The principle of multiple interpretations is not explicated in the research papers but is implied in the empirical reporting and theorizing. For instance, in paper 4 different interpretations of the instrumental aspects and gratifications pertaining to the same service is used to illustrate how different participants express different understanding of service functioning and value. Similar differences can also be found in the reported results of paper 1 and. Also the identification of different forms of service engagements in the synthesis in Chapter 6 illustrates how multiple interpretations and variations in the dimensions of use can exist around the same as well as different services.

Concerning Klein & Myers' (1999) final principle, the principle of suspicion the mixed method research design facilitates cross-checking of whether or not the services the participants comment upon and rate are in compliance with and directed at the services they actually have experienced. Not only does this guard against erroneous usage reports but it may also reduce potential tendencies among participants to express themselves as more technologically advanced or more self-efficacious than they actually are (a few instances of this was encountered during the cross-checking between usage data and statements concerning the services). On the other hand, similar biases can not be 'rooted out' for the services, e.g. SMS, MMS and mobile e-mail, where I have had to rely upon the self-reported use data.

5 Findings and Contributions

This chapter presents the central findings, contributions and limitations of the four selected research papers. I offer first an overview of the title of the papers, their level of publication and the specific research question(s) targeted in the paper. Second, I discuss findings relative to the research questions presented in section 1.3 and the key research challenges outlined in Chapter 1. Research contributions and a set of limitations are discussed for each paper. The chapter is quite compressed. To better establish an overview, I next offer a brief overview of the main findings discussed in each paper.

In the first paperI research and offer an account of how preconceptions of service performance, efforts and overall attitude are not persistent and static among the field study participants. They are dynamic and alter as participants gain service experiences. Measurements obtained prior to showed positive expectancies and attitudes. To the contrary, statements obtained during trial revealed disappointment to the performance of services, especially compared to internet services. As a result, negative attitudes shaped and emerged among the participants. It is thus concluded that researchers should be cautious inferring that positive attitudes and intentions automatically render *sustained* service acceptance/adoption.

In research paper 2 we conceptualize the process and account for forces implied in the dynamic shaping of service understandings found in the former paper. We find that people reflexively monitor their own and others' service use (incl. wider communication) and that what is experienced and monitored not only influence people's behavioral rationalization and motivation to engage further with the services, but also their awareness of novel services and functionalities. Notably, we observe how use of interpersonal communication services can trigger service awareness, learning and actual trial and use by a receiving party across physical and virtual co-presence. It is during this process we learn of service properties and gratifications.

In research paper 3 we look at the wider shaping of service engagements. We study how specifications, properties and gratifications of services eventually can institutionalize in society. Once institutionalized, they will enable but also constrain the further course of service use and innovation. By studying secondary literature we find that institutionalization of seemingly minor differences in service specifications of SMS and mobile e-mail rendered very distinct use and innovation paths. In Norway the massive uptake of SMS lead the further

developments to be focused on premium SMS services. In Japan mobile e-mail had richer expressive properties providing a path to more advanced mobile internet services.

Finally, in research paper 4 we identify and typify a range of service properties and gratifications which the field study participants attribute to different mobile data services. The findings reveal central differences within and between the interpersonal communication services (i.e. SMS, MMS and mobile e-mail) and the content oriented services (i.e. News, Infotainment, Downloads and Search & Find). Expressive properties are exclusive for messaging services and are associated with highly valued pleasure and utilitarian oriented social gratifications. In contrast, content oriented services have a narrower gratification scope which also is highly sensitive to instrumental properties related to speed, rendering, and user interface. Most used and valued among participants are services with strong expressive properties that offer utilitarian and hedonic social and content gratifications.

5.1 Selected papers

The papers have been selected due to their relevancy and contribution relative to the challenges and research questions presented in Chapter 1. Each and together they also contribute to the intent of theory building from a mixed method perspective and thus match overall methodological position presented in Chapter 4. Finally, the selected papers also best reflect how my understanding of the phenomenon of interest grew from the application of different analytical methods and during several interpretative cycles.

Each paper has been given a number (1-4) in order to concisely reference them in the discussion of findings, contributions and limitations. References to a specific research paper will commonly be made by referring to the particular number assigned below. The number represents the order to which the paper was written. However, completion of paper 3 stretched across a process of one and a half year. Paper 4 was written parallel to this process and was published well in advance of paper 3. Each paper can be seen to demarcate iterative loops in the hermeneutic circle – as described in chapter 4. They chronologically present how understanding of the phenomenon of interest was refined and enhanced during research and authoring. From paper to paper this can be noticed in how process elements and concepts from one paper are carried to the next and gradually refined.

Table 5-1: Overview of the Research Papers, Publication Level and Research Question(s) Addressed

Paper	Author(s)[102]	Title	Publication Level	Research question addressed[103]
1	Knutsen, Lars A.	M-Service Expectancies and Attitudes: Linkages and Effects of First Impressions.	In Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS '05). 2005. The Big Island, Hawaii. IEEE Computer Society.	RQ 1 In particular: The continued shaping of user understandings of new mobile data services.
2	Blechar, Jennifer Knutsen, Lars A. Damsgaard, Jan	Reflexivity, the Social Actor and M-service Domestication: Linking the human, technological and contextual	In: Proceedings of the IFIP 8.6 Conference on Designing Ubiquitous Information Environments: Socio-technical Issues and Challenges. Cleveland, OH, USA. August 3-5, 2005. (Sørensen, C., Yoo, Y., Lyytinen, K., & DeGross, J. eds.). Kluwer Academic Publishers.	RQ 1 In particular: Conceptually understanding the shaping of user understanding from reflexivity during use of new mobile services.
3	Knutsen, Lars A. Lyytinen, Kalle	Messaging Specifications, Properties and Gratifications as Social institutions: How Messaging Institutions Shaped Wireless Service Evolutions in Scandinavia and Japan	Published in Information & Organization (I&O). 2008. Vol. 18, Issue 2	RQ 2 & 3 In particular: How specific properties and gratifications of messaging enable and constrain mobile service use and innovation
4	Knutsen, Lars A. Lyytinen, Kalle	Properties and Gratifications of Mobile Data services: An Explorative Investigation	Published in Systèmes d'Information et Management (SIM). Special issue on mobile information systems and m-business. 2006. Vol. 11, Issue 2	RQ: 2 and 3 In particular: Specific properties and gratifications of different mobile services; a typology of properties and gratifications associated with different services is presented.

The proceeding sections 5.2 to 5.5 contain discussions of findings, contributions and limitations of the papers. For each paper I first offer for a brief presentation, a recap of its research question(s) and discussion of method(s) before I present findings, contributions and limitations.

[102] Note on authorship: Please see note provided in paper 2 and co-author statements in Appendices 1c and 1d.
[103] For the ease of reading I will repeat the phenomenon of interest and the corresponding research questions here. The phenomenon of interest is: "*Shaping of user engagements with new mobile data services*". Research question 1: "*How is user understanding of new mobile services shaped during early mobile service experiences and engagements?"* Research question 2: *What characteristic properties, gratifications and adoption/rejection behaviors shape around new mobile data services?* Research question 3 is: *How do service specifications, properties and gratifications enable and/or constrain user engagements with new mobile data services?*

5.2 M-Service Expectancies and Attitudes: Linkages and Effects of First Impressions.

Paper 1 is written based on the initial data collection and analyses conducted in the field study described in section 4.2. During this initial phase it became apparent that perceptions of performance of the mobile services, the efforts needed to use the services, and attitudes towards the services were not stable. Rather, they altered during exploration, further service engagements, and interaction and communication among users. To further investigate and report on the effects of first impressions this paper sought to examine the relations between performance expectancies, effort expectancies and attitude (cf. TA constructs in chapter 3) and at the same time document qualitative aspects emerging around these constructs as experience with services were gained and interaction unfolded.

5.2.1 Research question addressed

Paper 1 addresses the first research question defined under the phenomenon of interest presented in section 1.3; i.e. the shaping of user understanding of new mobile data services. It also, but more peripherally, attend to research question 2 as typical acceptance constructs are used to analyze and order user understandings. The aim is to answer how user understanding of performance, efforts and attitudes of new mobile services is shaped and how this understanding evolves in the immediate period after respondents have been provided access to new mobile services. Towards this end I first explore and test relations between expectancies related to performance of new mobile services and the efforts needed in order to utilize new mobile services to see how these constructs affect attitudes toward new mobile services. Upon this I qualitatively assess understandings related to these constructs and how they change as first impressions of the mobile data services are generated.

5.2.2 Methods

A mixed method procedure was used for data collection and analysis from the 38 field study participants. Quantitative and qualitative data were collected during the first three weeks of the field study described in section 4.2. Quantitative data were obtained from questions using standard 7-point rating scales (see Venkatesh et al., 2003). Qualitative data were generated two

weeks later from open questions targeting the same variables as those of the previous measurements. Quantitative and qualitative data analysis procedures were used on the two respective data sets. For the quantitative procedure I applied a structural equation analysis to estimate the proposed structural relations between the personal difference variable of age, and the latent constructs of performance expectancy, effort expectancy and attitude. The first step of this analysis consisted of a factor analysis to test that each construct's assigned and measured items loaded on the appropriate latent construct[104]. Upon confirmation, Partial Least Squares (PLS), utilizing the PLS-Graph[105] software (Chin, 1995), was used to estimate the structural relations between the personal difference variable and the latent constructs. The qualitative data were analyzed by partitioning the data relative to constructs analyzed and then bracketing similarities and differences under key themes in clustered summary tables (Miles & Huberman, 1994).

5.2.3 Research findings

The structural relations between the latent constructs, i.e. *performance expectancy*, *effort expectancy* and *attitude* are found to be significant. These findings concur with previous research using adaptations of technology acceptance models (Hung et al., 2003; Teo & Pok, 2003). It is thus confirmed that individual perceptions of performance and efforts are strong predictors of attitude towards new mobile services. In light of this, the findings from the following qualitative analysis become interesting.

Overall, the findings from the open ended questions pertaining to performance and effort expectancies show that during experience and first impressions an increasingly negative attitude grew towards the mobile services among the respondents. Respondents tended to evaluate the functioning of services with 'regular' Internet services as reference. While measurements obtained prior to use revealed positive expectancies and attitudes, the qualitative statements revealed a strong disappointment regarding performance and efforts, as well as a growingly negative attitude among participants of the field study. About half of the participants explicitly responded that they would be even more welcoming towards new mobile services if

[104] Principal component analysis with oblique rotation was used to assess factorial validity for the items and scales for each of the latent constructs.
[105] Descriptive statistics, scale reliability analyses and factor analysis was performed in SPSS (v. 11.0) whereas PLS-graph (v. 3.00 b. 1126) was used to estimate the structural equation model and to test the hypotheses.

the services would be more useful in everyday situations and provide true wireless and mobile value. The in-depth findings also suggest that in order to promote and enable the creation of positive attitudes around mobile services, the services need to cater to value-contexts specific for mobile use. They also need to provide users freedom from complicated configuration procedures and support current day-to-day individual and social practices. Unless these issues are augmented, the reflections of first impressions on attitude are likely to result in negative rather than positive feedback effects and limited user engagement.

5.2.4 Contributions

The explorative investigation in paper 1 offers three contributions on mobile service adoption and use. First, it adapts central constructs from technology acceptance research (i.e. constructs from the Venkatesh et al.'s 2003 unified model) to a mobile service setting. Both quantitatively and qualitatively it contributes an adapted operationalization of constructs and items which can be used to collect data and measure attitudes towards new mobile services at a general level. This forms an initial basis from which large sample extensions can be made with respect to specific mobile services, and from which advanced models incorporating a larger range of constructs used to measure, model and predict people's intentions to use new mobile services can be established.

The second contribution is how the combination of quantitative and qualitative data benefits our understanding with a more field realistic view (cf. section 1.2.4, p. 12). The exploration of qualitative data contributes specific insights on the potential impact of experiences with tethered Internet services and the particular performance and effort criteria they draw upon and compare with as experience with new mobile services are gained.

The final contribution is the set of new insights to temporal alterations and dynamism of mobile service adoption and use (cf. challenge of temporal change discussed in section 1.2) the combined research approach garners. The clear changes observed sends a signal of caution to researchers not to treat initial positive perceptions and attitudes as definite and unmalleable. Rather the findings of the study suggest that more consideration should be given to how user understanding becomes constructed and reconstructed from the learning of own and others experiences and interactions during different 'phases' of the innovation-decision process (see e.g. Rogers, 2003) or the domestication process (see e.g. Ling, 2004).

5.2.5 Limitations

The sample size of this study is small and poses limitations. The sample size is adequate to fulfill the strong heuristic set for PLS[106] analysis to provide strong explanatory power. But even if the general validity and reliability criteria are fulfilled, replications of the study with different respondents and larger sample sizes could add rigor to the study. However, the key intent was to reveal if associations between latent constructs are significant and if the qualitative aspects of these latent constructs reveal changes as experiences with new mobile data services are gained. For these purposes the sample size was considered adequate. Another limitation of this paper is that no quantitative measurements documented the change which actually took place in perception measures as experience was generated. In a follow-up paper we later documented that significant changes to these and other perception measures occurred (see Knutsen et al., 2005). The third limitation is the broad focus on 'm-services' (plural) as a 'proxy' artifact rather than on specific mobile services. In not focusing on particular services, the paper becomes subject to the very same critique I later raise together with Prof. Lyytinen in paper 3 and 4; i.e. problems with specificity of the artifact in question.

5.3 Reflexivity, the Social Actor and M-service Domestication: Linking the Human, Technological and Contextual

Paper 2 focuses on the dynamism of adoption and use discovered during the analyses performed for paper 1. In search of a process oriented view, literature from sociology (Giddens, 1984) and domestication research (Haddon, 2001, 2004; Ling, 2004) along with views of the user as a social actor (Lamb & Kling, 2003) were brought together to offer a new model. The model incorporates Giddens (1984) idea of reflexive monitoring. The model is used to illustrate how users reflexively monitor own and other people's mobile service and technology activities its role in the shaping of mobile service understanding and se. We assess

[106] The strong regression heuristic requires the sample size to be 10 times either 1) the block (the set of indicators underlying a latent variable) with the largest number of formative indicators (largest measurement equation) or 2) the dependent latent variable with the largest number of independent latent variables impacting it (i.e. the largest structural equation measured.

how previous and emerging experiences with technology, hereunder m-services, is reflexively considered and also re-projected in interpretations and understandings of new mobile services.

5.3.1 Research question addressed

Paper 2 is concerned with the first research question from a more conceptual perspective. We integrate insights from Giddens (1984) stratification model with the five 'stage' process model of domestication (Ling, 2004; Silverstone & Haddon, 1996) to propose that the shaping of users' mobile service understanding is a reflexive process where both own behavior as well as other people's use of mobile services and related technologies are centrally implied.

Rationalization over own and other experiences and behavior together with individual motivation are suggested to actively determine progression or regression in the five stages of domestication (imagination, appropriation, objectification, incorporation and conversion). Furthermore, the process model emphasizes how unintended consequences and the unacknowledged aspects of mobile service are conduits to new mobile service behavior as they can trigger rationalization and motivation to engage in new mobile service domestication activity. Empirical findings show how prior individual experience, observation of others' behavior, and reflexivity applied to interpret contextual signals of mobile technology behavior and communications all are implied in the shaping of mobile service understandings. The paper thereby presents a novel social interactive perspective to address the initial research question.

5.3.2 Method

For establishing the conceptual process model we first reviewed and integrated central theoretical thoughts and concepts domestication process and works in IS research treating users as social actors (Kuutti, 2001; Lamb & Kling, 2003) with ideas from Giddens' (1984) structuration theory, particularly his stratification model. After establishing the conceptual understanding we assessed data from the field study to seek a deeper understanding of the shaping of mobile service understandings. The body of primary data for this paper consists of responses the 38 participants made to open ended questionnaires and group interviews provided during the field study (see section 4.2). Data analysis followed Miles & Huberman's (1994) coding procedures. We first partitioned the data based on descriptive codes guided by a start-list derived from the literature on acceptance, diffusion, uses and gratification and domestication. Second, to explore patterns in the data we attributed pattern codes and placed

the data into a clustered summary table. Following the clustering, our key findings were extracted and illustrative quotes were selected.

5.3.3 Research findings

Two primary findings are highlighted in paper 2. First, we identify how experience with Internet services appears to be re-projected onto evaluations of new mobile services. These cognitive re-projections are centrally implied in the rationalization people use to evaluate and form an understanding of the value and qualities of mobile data services. Particularly the performance and functioning of services of similar character found on the 'regular' Internet shape participants' understanding of new mobile services. The re-projections work as heuristics in the reflexive monitoring of own and others' mobile service use. They also influence the creation of performance imaginations prior to use and in the experience based evaluation of service performance. As such they influence people's behavioral rationalization and motivation to engage further with the services.

The second key finding emerging in this study is how cues provided from others' mobile service use and communications bring important inputs to the shaping of an individual's mobile service understanding. Contrary to what is acknowledged in most TA research we find that people seldom directly acknowledge social influence in form of others encouragement to use a certain mobile service. Rather it is frequently mentioned how new mobile service possibilities are learned as consequences of observing others' use and from receiving content during message exchanges. We observe how such and similar unintended consequences can illuminate aspects of mobile service use which were not previously acknowledged. A central observation here is how the reflexive monitoring of own and other's behavior both involves the monitoring of activities in physical co-presence (e.g. looking over the shoulders of other users) as well as those behaviors which are mediated virtually (e.g. observing a new feature by receiving content from a person).

5.3.4 Contributions

The central contribution of this paper, also highlighted by its two anonymous reviewers, lies more in its theoretical development and presentation of the socially dynamic perspective on acceptance and adoption than in its empirical findings.

The model presented draws upon three different streams of literature which together enable us to identify how reflexive monitoring of own and others use of mobile services and related technologies can be centrally implied in the shaping of an individual's mobile service understanding. In this way it contributes a new social interactive perspective which views adoption as a process where understanding of artifacts shape from individual rationalization and motivation as own and others' behavior is reflexively monitored.

In contrast to predominant constructs of technology acceptance theory the new perspective maintains that evaluations of technology are continued in several domestication 'stages' and that social influences are not only the direct encouragements or 'pressure' exerted by friends, family and peers. By also incorporating Giddens (1984) notions on unintended consequences and unacknowledged conditions we disclose how these aspects can incite novel understandings and challenge an individual's established thinking and behavior. These observations further illuminate and underline how prior and concurrent experiences arising during the social monitoring of everyday mobile service and technology behaviors are key to the shaping of mobile service understandings and use.

5.3.5 Limitations

The strongest limitations and weaknesses of paper 2 lie in its empirical foundation and explication. A strict publication page limit meant that only two of the central findings were explicated. Ideally, more and better data from the field study should have been applied to delineate each of the constituent parts and sub-processes of the theoretical model. By so doing we would have created a tighter connection between the two parts of the paper and been able to precisely differentiate the contributions of our perspective from for instance the individual level innovation-decision model (e.g. Rogers, 2003) and technology acceptance models (e.g. Venkatesh et al., 2003). Emphasized by one discussant of the paper, Prof. Mike Gallivan, efforts along these lines would have improved the overall clarity and quality of the paper and enabled us to pinpoint where the paper exactly brings novel contributions relative to extant work; i.e. how the model enable theorizing upon unintended consequences, unacknowledged conditions and the role of reflexive monitoring of technology behavior and impacts on the particular 'stages' of mobile service domestication.

5.4 Messaging Specifications, Properties and Gratifications as Institutions: How Messaging Institutions Shaped Wireless Service Diffusion in Norway and Japan

Paper 3 emerged from the studying of secondary literature searching to describe and explain adoption and use of new mobile services in different regions of the world (Knutsen & Lyytinen, 2005a, 2005b). During this we observed that current theory in limited ways explain variations in service ecologies and their development. Modest attention is paid to the seemingly minor differences in institutionalized technical specifications relative to differences in institutionalized service properties, their gratifications and how the relations between these can engender distinct use and innovation pathways. In particular, the extended institutionalized impacts of the most widely dispersed 'killer applications' of Scandinavia and Japan, respectively SMS and mobile e-mail, had not received sufficient scrutiny. In observing this we set out to understand how specifications, properties and gratifications of a service can enable and constrain further service developments (RQ 3).

We embarked on establishing an institutional framework to explain the variations in the emergence, growth and ecological pathways of mobile data services. Technical specifications, user ascribed properties and user obtained gratifications were introduced as interdependent analytic frames – as a tripartite framework. We applied the logic of new institutionalism which enabled us to view the three interrelated characteristics of technologies to be capable of institutionalizing in social systems as a result of social structuration. The resulting institutional framework was applied to assess how seemingly small variations in service specifications of messaging, when institutionalized, rendered idiosyncratic mobile service use and innovation trajectories[107] in Norway and Japan. I want to *underline* that while we originally analyzed Denmark, Sweden and Norway, we selected Norway as the Scandinavian country of focus in the final papers because of the similarity in the state of research undertakings, scholarly traditions, data, and findings in the two countries[108].

[107] By trajectory I refer to the patterns created by the relations between services and other artifacts in service ecology. Service ecology refers to the higher level system generated by the interplay between the artifacts and the elements of their environment.
[108] There are very strong similarities in the type of research conducted by Ito in Japan and Ling in Norway.

5.4.1 Research question addressed

This paper addresses primarily research question 3 presented in section 1.3 but provides also answers to research question 2. Our theorizing, which is based upon an integration and discussion of current literature, enable identification and definition of three key types of mobile service properties along with three prominent gratification types. Together with technical specifications, the analytic categories of properties and gratifications are brought together to form a tripartite framework. We apply the framework to analyze SMS, MMS and mobile e-mail services. An institutional shaping lens is suggested to analyze and explain differences in the mobile service evolutions in Norway and Japan. The analysis performed demonstrates how different specifications of mobile services enable and constrain the spectrum of qualities users assign to mobile services and the valuable contributions they seek and obtain from their use the mobile services. We attend to research question 2 through the analysis and discussion of specific properties and gratifications associated with the different forms of messaging services. Research question 3 is addressed by explaining the feedforward and feedback logics of how institutionalized differences in service specifications, properties and gratifications enable and constrain different pathways of mobile service use and innovation.

5.4.2 Method

We review, analyze, discuss, integrate and extend current conceptualizations of technology and its use to perform new theorizing based on secondary literature. Three different views of mobile service adoption (i.e. models of individual acceptance, models of service adoption, and models of industry and socio-economic environments) are identified to contribute in distinct yet limited ways to our understanding of why different evolutionary pathways of mobile service use have emerged in various regions. We then explore how an institutional perspective can contribute novel insights and help overcome the chasms in current theory. To substantiate our conjectures we develop a tripartite institutional framework for structured analysis. The framework rests on new institutional theory, in particular social institutions and structuration (e.g. Giddens, 1984), institutional perspectives of technology and innovation (e.g. Barley, 1990; Barley & Tolbert, 1997; Hargadon & Douglas, 2001; Orlikowski, 1992, 2000), gratification research (e.g. Blumler & Katz, 1974; Leung & Wei, 2000; Stafford et al., 2004), and sociological domestication studies of mobile service use (e.g. Ito & Okabe, 2003a; Ling, 2004). From our integrative literature review and theory building we proceed to perform a case

study on the role of messaging in Norway and Japan. An institutional explanation is then presented as to why mobile service use and innovation in Norway and Japan has followed and formed different trajectories.

5.4.3 Research findings

In the paper we identify how two different forms of messaging technologies, SMS in Norway and mobile e-mail in Japan, are two 'killer applications' centrally implied in the shaping of distinct developments in the mobile service ecologies. During their rapid and parallel growth, their different technical specifications along with user ascribed properties and associated gratifications institutionalized. We observe how specifications of services established as reverse salients (Hughes, 1989) that further constrained and set direction on service use and innovation in the service ecologies.

Both SMS and mobile e-mail have strong expressive properties (especially reach) which enable exchange of a variety of user originated content across the mobile phone populations. Striking similarities are found in the social gratifications they offer users; e.g., everyday social contact and nursing of social relations. Nevertheless, pertinent differences exist in the specifications of these messaging services. Mobile e-mail in Japan has a much richer property and gratification spectrum than SMS. It particularly provides a tighter interconnection between messaging and other portal based mobile services. While MMS shares certain specifications with mobile e-mail, our analysis reveals how a technical divide between SMS, MMS and mobile portal services exist in Norway which constrains users from obtaining an extended set of content oriented service gratifications. The institutionalization of e-mail has been promulgating for advanced mobile service use in Japan. In contrast, the strong institutionalization of SMS in Norway has confined advances in use and innovation to premium SMS services. It is worth to mention here that in a prior version of the paper we also analyzed similar developments in Denmark and Sweden (Knutsen & Lyytinen, 2005a). We suggested here that innovation and use beyond premium SMS was very limited in all three GSM infrastructure based countries and thus in systems with the same or extremely similar set of technical specifications.

Our research findings suggest that systemic and regional differences in use and innovation of new mobile services can be explained by (1) open-endedness of institutional

alignments formed around the specifications, properties and gratifications of messaging and (2) the following dual bridging between institutions.

The first points to how institutionalized specifications, properties and gratifications both enable and constrain further innovation and use. The relative openness of specifications, i.e. how they can be expanded upon once institutionalized, come to play a differentiating factor for both service innovation and use. If a limited path is offered, new properties and gratifications are hard pressed to build upon the existing. Mobile e-mail allowed a smooth extension to multimedia and Internet services. SMS on the other hand forced MMS to be developed and introduced as separate technology. Thus, once an open ended set of service specifications institutionalize, a path for further innovation and use which aligns with what is already in place can be more clearly leveraged.

The second, the dual bridiging between institutions, encapsulates how the path of mobile service innovation is directed by the nature of bridging between institutions on the supply and demand sides. Bridging use from one service to another hinges on the feed-forward and feedback interplay between the specifications in place, and how the properties and gratifications that can build on top of what is already established (see figure 1 in Research Paper 3). This is in turn decisive for the ability of supply-side organizers to leverage upon and innovate around existing institutions for so to extend the gratification potential of mobile services. We conclude that subtle technical differences, when institutionalized, both enable and constrain trajectories of service innovation and use. As such the findings supports Lynne Markus' (2005:19) contention that "small differences in features of apparently similar tools could be associated with big differences in usage patterns and social outcomes".

5.4.4 Contributions

The paper offers three key contributions. First, from the extension of theory offered by applying the lens of new institutionalism we are able to distinguish three interrelated views of technology and bring them together to form a new framework suited to analyze and explain differences in mobile service use and innovation across institutional environments.

Second, the framework allows us to analyze mobile services from the three angles of technical specifications, service properties and service gratifications and thereby account for institutional dependencies. Compared to current theory this enables us not only to account what services are used, but why they are used, how they specifically contribute to use experience,

and how their interrelations affect each other. Relative to the challenges highlighted in section 1.2.1-1.2.3 these contributions make us able to untangle some of the compound complexity which is caused by common and interdependent properties of infrastructure, devices, applications and services. Such treatment of artifact specific differences enables nuanced comparison across institutional environments beyond what measurements of models of technology acceptance can facilitate. The paper thus responds and addresses the increasing number of calls among IS researchers (Benbasat & Zmud, 2003; Markus, 2005; Orlikowski & Baroudi, 1991) for more theorizing on the IS artifact; "their embeddeness in space, time and context; their multiplicity of components; their dynamism and so forth" (Markus, 2005:2). A central contribution of our framework is how it can be applied to render understanding of regularities and irregularities across institutional technology environments which are attributable to differences in technological specifications, user attributed properties, and gratifications.

Third, our framework and analysis also contributes insights for practitioners. In particular we unveil how pivotal it is to integrate and direct innovation around institutions both at the supply and demand side in order to advance the mobile service ecology. We also present some of the difficulties arising when limitations to continued innovation around current institutions require a fundamental specification reissue (e.g. as for SMS vs. MMS). Editor-in-Chief at Information and Organization, Daniel Robey, seems to concur with the importance of the above contribution where he in an e-mail writes: "The manuscript makes an impressive contribution to the literature on mobile services and institutionalization"[109].

5.4.5 Limitations

The strongest limitation of paper 3 concerns the reliance on secondary data for the comparative studies between properties and gratifications of services in Norway and Japan. While similar theory and methods underlies the sources we draw upon in our discussion of properties and gratifications, a comparative assessment based on identical methods and primary data collection in both Norway and Japan would have been ideal. We remark in the paper that understanding properties and gratifications should ideally come from users' authentic voices obtained in field studies and phenomenological inquiry. For the theorizing and following

[109] E-mail from Daniel Robey, October 23, 2007.

analysis in the paper we were limited to recent studies of mobile service use conducted by consumer behavior scholars, sociologists and anthropologists in Norway and Japan. There exists thus considerable potential for refinements and further explication of differences by conducting parallel and identical studies in the two different regions. This could not only delineate more nuanced differences in properties and gratifications and ensure that the authentic voice of the users are well maintained, but also improve the potential for cross-case validations of central similarities and differences.

5.5 Properties and Gratifications of Mobile Data services: An Explorative Investigation

In paper 3 discussed above we write: "We need to also construct typologies which link service specifications, properties and gratifications. By integrating empirical insights with typologies we will be better equipped to connect institutions at the provisioning and user sides – their synchronic effects and diachronic shaping" (Knutsen & Lyytinen, 2008:127). Paper 4 (written in parallel to paper 3) attends directly to this by creating a typology of properties and gratifications of different types of mobile data services.

5.5.1 Research question addressed

Paper 4 addresses primarily research question 2. It also provides insights relevant to research question 3. We draw upon the definitions of property and gratification types identified in paper 3 to analyze, categorize and order the properties and gratifications the users of the field study associate with different services such as SMS, MMS, mobile e-mail, 'News', 'Infotainment', 'Downloads' and 'Search & Find'. The specific question of the paper is: "What particular properties and gratifications emerge around different mobile data services during their use?" (Knutsen & Lyytinen, 2006:54).

5.5.2 Method

The corpus of data analyzed in this paper comprises the various qualitative data obtained from the field study data with 38 participants described in section 4.2. Each open-ended response to questionnaires and statements from group interviews was first organized chronologically for each participant. The texts were then analyzed by principles prescribed for coding of

qualitative data by Miles and Huberman (1994) and selective coding procedures described by Strauss & Corbin (1990) in their principles for grounded theory. For the coding procedures we used a provisional start list (Miles & Huberman, 1994) established based upon the types of properties and gratifications identified and defined in paper 3 and its previous versions.

Upon analyzing the participant responses for *in vivo codes* the statements were categorized under the different property and gratification types (i.e. instrumental, aesthetic and expressive properties, and pleasure and purpose oriented content, process and social gratifications). Within each category, the responses were sub-bracketed for each service type investigated. From this the typified property and gratification associations emerging among participants as they engaged and disengaged with the different mobile data services were derived.

5.5.3 Research findings

From the empirical data of the field study we identify and classify characteristics of different mobile data services based upon the typologies of properties and gratifications. We are able to distinguish which properties of instrumental, aesthetic and expressive character that users find most salient for the different services. In similar manner, we identify how different types of utilitarian and hedonic content, process and social gratifications are associated with the different services. The resulting service classifications reveal central differences within and between the interpersonal communication services (i.e. SMS, MMS and mobile e-mail) and the content oriented services (i.e. News, Infotainment, Downloads and Search & Find).

Expressive properties seem to be exclusive for the messaging services and are centrally associated with highly valued pleasure and utilitarian oriented social gratifications. In contrast, the content oriented services have a narrower gratification scope. In order to be gratifying these services also rely more heavily upon instrumental properties as the real-time functioning (e.g. speed, rendering, etc.) is more directly experienced. This aspect was discovered as participants experienced disruptions and annoyances during service use. Common for SMS, MMS and mobile e-mail is how content gratifications is most saliently linked to texts and images originating from other users. We find that the social and content gratifications associated with SMS and mobile e-mail are both pleasure and utilitarian oriented, while they for MMS seem purely pleasure oriented.

Infotainment, News, Downloads and Search & Find services offer content gratifications based on information and multimedia content crafted by commercial providers. Whereas News, Infotainment and Downloads were strongly associated with pleasure oriented gratifications, Search & Find was more oriented towards uses where the purpose was of utilitarian character, e.g. obtain information for use and re-use and coordination and orientation in purposeful everyday tasks. An important general observation is how poor instrumental service functioning could dampen, constrain or hinder users from obtaining content and social gratifications. Lack of process gratifications could even constrain engagements or have people disengage with the services.

5.5.4 Contributions

Paper 4 discerns some of the central characteristics that distinguish various mobile data services. By employing the two interrelated perspectives of properties and gratifications identified in paper 3 we take the first empirical steps to further validate and refine the typologies of the tripartite framework. The research undertaking in paper 4 offers three contributions to theory and practice.

First, the systematic understanding of properties and gratifications can not only serve to unveil similarities and differences regarding endorsed and unendorsed properties and gratifications. It also helps in discovering interdependencies between them. This paper thus further contributes to untangle the complex nature of compound product-service offerings (cf. section 1.2.1) by allowing identification of particular service characteristics. We contend this aspect is central for both practitioners and researchers aiming to understand what qualities and contributions people seek from mobile data services.

Second, more careful articulations of properties and gratifications can sharpen characterizations of services and improve accuracy in predictions and explanations. By outlining the 'genes' of the artifact this can remedy the 'proxy'-artifact problem (see section 5.2.5) and ensure that conclusions and accumulative insights are made for particular services. Not only does this promote explicit theorizing about the specificities of certain artifacts but can also improve the potential for effective triangulation and comparisons across studies and regions.

The third contribution is how our longitudinal study of cognition and adoption behavior provides an approach to generate realistic views of technology and its valuations. As the

artifacts IS researchers target to understand are no longer contained within organizational space but cuts across multiple computing spheres of everyday life (see section 1.2.2), research needs to contribute understanding of the sense-making of technology and its use in its original computing environment and even across multiple environments. We argue that further research along the lines conducted in the field study can contribute improved scholarly and practitioner understanding of (1) situated contexts of use, (2) impacts of reflexive monitoring of service behavior and learning, and (3) the dynamics and different dimensions of mobile service use.

5.5.5 Limitations

Paper 4 shares most of the same basic weaknesses of that identified for paper 1 and 2. The sample size is small and comprises an unrepresentative selection of participants. Although we find the sample size tolerable for the explorative purposes of our research, generalizations beyond the sample are unfeasible. A larger sample size would have been desirable and recommendable in order to further substantiate the findings[110]. Aware of this problem we sought to evaluate findings by discussing and comparing for conformity and disparity next to extant theory (e.g. as reccomended by Strauss & Corbin, 1990). However, the explorative approach revealed novel aspects, e.g. aesthetic properties and process gratifications, for which such form of 'validation' could not be properly conducted. The approach enabled the discovery of aspects attributable to process gratifications and distortions to these, the empirical foundations for these discoveries were too general to be delineated with precision for each service. Consequently, we call for deeper investigations of these issues in future research so that the diachronic aspects of use process changes and aesthetic qualities of services can more firmly be discerned.

A final limitation worth emphasizing is the lack of focus on causal relations. Strauss and Corbin (1990) emphasize the importance for theory to explicate systematic relations between concepts (e.g. through axial coding). However, as the purpose in this paper was to explore what properties and gratifications emerge around particular types of services, we did not engage in suggesting causal connections beyond an 'enable-constrain' level (e.g. that certain properties

[110] A note of research advice: Based on the experience with the field study I would recommend researchers contemplating similar pursuits to ensure there is sufficient researcher capacity to adequately analyze the substantial body of data such an approach renders. For instance, a replication of this study with double the number of respondents would quickly require coding of 2,000 open ended answers and 30 hours of group interviews. Analysis of such a corpus of data would benefit from strong analytic cooperation between two to three researchers.

can enable and constrain the obtainment of certain gratifications). There are thus opportunities for future research to proceed towards researching causal descriptions and inferences between properties, gratifications and for instance user value.

6 Theory Developments, Conclusions and Implications

In this chapter I revisit, expand and synthesize findings of the research with the pre-understanding of Chapter 3 and conclude on the research. Developments to theory are offered by nesting key themes of the research papers with the *inputs, process* and *adoption outcomes* presented in the hybrid framework of the pre-understanding. I present a set of propositions for key themes and observations. *Only key themes altering or complementing the inputs, process and outcomes central to the pre-understanding are presented and discussed.* Of this reason the reader may benefit from revisiting chapter 3. The present chapter and dissertation ends by offering overall conclusions and implications for theory and practice.

6.1 Theorizing and contributions to theory: a synthesis

The research of this dissertation shows how mobile service engagements shape and how people engage and disengage with various services. As chapter 3 revealed, the predominant views on adoption and use are limited in considering effects of temporal dynamism. Black (1983) suggested some 25 years ago that dichotomous operationalizations of the individual adoption process (e.g. use/nonuse, purchase/nonpurchase, adoption/rejection) are problematic. He argued that because people are "continually entering and leaving the process" the "[c]orrect measurement … extends past the initial decision and necessitates adding the temporal dimension of usage" (Black, 1983:356-357). Since then, scholarly lingo such as post-adoption (Ahuja & Thatcher, 2005; Black, 1983; Jasperson, Carter, & Zmud, 2005; Karahanna, Straub, & Chervany, 1999), assimilation (Gallivan, 2001), use-diffusion (Shih & Venkatesh, 2004), appropriation (DeSanctis & Poole, 1994), technology-in-practice (Orlikowski, 1992) and domestication (Haddon, 2001; Silverstone & Haddon, 1996; Silverstone & Hirsch, 1992) commonly signify concern among scholars for *engagements* with technology, cognitive or behavioral, *beyond* intentions to use and determinative points of acceptance and/or adoption.

But even if the espoused interest in the careers of technologies subsequent to acceptance spans researchers from IS, marketing, and sociology of technology, the efforts to empirically establish theory in this domain have remained surprisingly unendorsed (see e.g. Mick & Fournier, 1998; Rogers, 2003). Along with scant theorizing on the specificities and

distinguishing elements of the artifact in our research (Markus, 2005; Orlikowski & Iacono, 2001) this has left limited understanding of how *artifact specific* cognitions and behaviors shape and influence each other during adoption and use processes, especially as use of services spread and reach higher social levels.

By no means exhaustive, the research comprising this dissertation offers contributions to the analyzing and theorizing on mobile data understandings and use. In the next presented theory building exercise, marking the (for now) closing loop in the hermeneutic circle of the dissertation, I suggest certain modifications and extensions to the *inputs*, *process* and *adoption* outcomes presented in Chapter 3. Based on the research observations during which subjects were entering and leaving the process of engaging with mobile services, I formulate in this chapter what I call "The Service Engagement Framework". The modified hybrid (combining input variables, process, and outcomes) framework is presented in Figure 6-4. Figures 6-1 to 6-3 are partial components in the step-wise construction of the framework.

6.2 Inputs shaping user understandings and use

Two central inputs drawn from the research in paper 3 can be introduced to refine and complement the *inputs* of the pre-understanding: 1) *service specifications* and 2) *institutional feedback.* The first sharpens the concept of *service characteristics* identified in current theory. The latter is more novel, as it recognizes how institutionalized service properties and gratifications become new inputs which both enables and constrains service adoption and use.

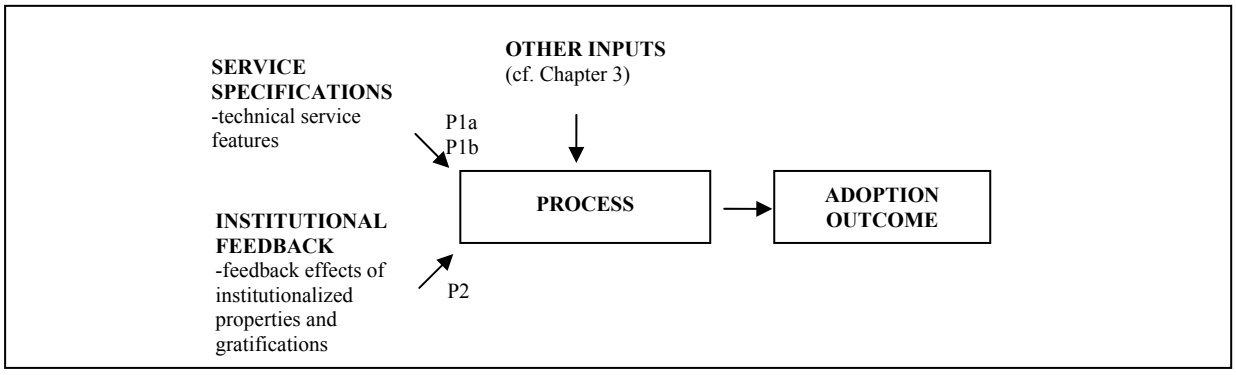


Figure 6-1: The Service Engagement Framework - Inputs Adding to Pre-understanding

6.2.1 Service Specifications

A central theme in paper 3 and 4 is how the myriad of services needs to be carefully distinguished based on their central characteristics. This applies particularly to features and functionalities of the service under scruitny and its enabling technologies (e.g. network infrastructure and handsets). The importance of service characteristics as inputs shaping user understanding and actual use is outlined in the pre-understanding. Paper 3 and 4 adds a more detailed view of mobile service characteristics. *Specifications* given to a service by its creators are distinguished from the *properties* users construct around the services when they encounter and enact service specifications, and from the *gratifications* that are offered from initial or recurring engagements with the service. In paper 4 the field study analysis provided empirical data to identify how users attribute different properties to the services analyzed and how the properties offer various hedonic and utilitarian gratifications. The findings of paper 3 underscored particularly how even modest specification differences of messaging technologies made significant impact to properties and gratifications associated with mobile messaging services in Norway and Japan. As our analysis show: the incremental differences in fundamental artifact specifications can be the key differentiator in rendering distinct variations in overall innovation and use trajectories.

Specifications *define the service as inscribed by its advocates.* When projected to users they become inputs feeding forward into the process where users create initial imageries and understanding of the service. They become inputs providing cues to the process where users make sense of what a service can do and about what gratifications it may or may not offer. In paper 3 we posited that specifications enable but also constrain what properties users construct and the gratifications a service can offer. Among the three technology characteristics it is only specifications that are considered an input. Properties can be constructed only when specifications become perceivable and somehow made sense of by users. This is so also for imagined gratifications. Realized gratifications will obviously only come alive when the service has been encountered or when the user has become aware of properties and gratifications by other people's use or service oriented communications.

The above modification to the pre-understanding has implications for research aiming to investigate, modify, or develop models of how users assess a service relative to other data services. Researchers need to specify how certain specifications of a service and variations in

specifications among services impact the set of properties users construct and the types of gratifications they enable. Spelling out the role of specifications is essential for reducing the inclination in current IS research to apply a proxy view of technology (Markus, 2005; Orlikowski & Iacono, 2001). Attending to the nuanced service characteristics, as opposed to broad and general user perceptions, enable deep understanding of the 'genes' of the service and analysis to discern and accunt effects on user engagement. Paper 3 and 4 suggested both theoretically and empirically that even small variations in service specifications can render significant variations as to what properties and gratifications users attribute to the service. The clear example was how the specifications of SMS enabled a similar yet more limited property and gratification spectrum compared to mobile e-mail.

P1a: Different service specifications generate variations in service properties and gratifications and user service engagements

In Paper 3 we also found and explained that variations in technical specifications are decisive for how different use trajectories of mobile data service use and innovation forms diachronically, especially when certain services reach a dominant position in the service ecology. When specifications take structural manifest and institutionalize they can enable but also constrain the further ecological pathways. New services may need to comply with established technical specifications. With this they can be constrained in the freedom to deviate from what has taken manifest. It was observed how SMS was a vehicle for bringing more advanced premium SMS services to the users in Norway. At the time of study, it was not a vehicle for bringing people on the mobile internet as was the case with e-mail in Japan. Thus, specifications can enable innovation, but also become reverse salients (Hughes, 1989), i.e. specifications in a system constraining service innovation and use. These salient effects are augmented when the specifications become deeply embedded in the overall patterns of use. It is observed and proposed that:

P1b: Specifications enable and constrain service properties and gratifications and direct service engagements and innovation in the service ecology.

6.2.2 Institutional feedback

In paper 3 we observed how the feedback loops of institutionalization operate as a mechanism setting direction for the adoption of mobile services and the larger course of innovation and use developments in society. I call the *effects of the presence* of this mechanism institutional feedback. *Institutional feedback refers to the effects that already institutionalized properties and gratifications of an artifact have on users' technology engagements* – here specifically service engagements.

The investigation of SMS in Norway and mobile e-mail in Japan explained how feedback effects develop and have impact when particular mobile data service properties and gratifications have institutionalized among users. When heavily implied in everyday use they can affect how novel or alternative services are perceived and engaged. Institutional feedback enables and constrains new constructions of user understandings and provides direction and a form of path dependence to the established standards and normative practices. Institutionally established properties (e.g. expressive richness and reach) and gratifications (e.g. social contact) of SMS in Norway and mobile e-mail in Japan have both enabled new service use and innovation, e.g. premium SMS and picture e-mail. At the same time they have reinforced current ways of enacting with an established service. Institutional feedback can in this way both hinder and promote people's engagement with novel services. It hinders when the normative properties and gratifications blocks for novelty, but promotes when novelty is propelled by the existing standards and social practices.

Institutional feedback complements the typical conceptualizations discussed under *social context* in the pre-understanding such as *social influence* and *subjective norms*, i.e. expected/perceived influences from important others and normative use of technology. Rather than a direct social influence, e.g. in form of an encouragement to use a service as highlighted in organizational IS acceptance research (see Venkatesh et al. 2003), institutional feedback represent *effects of the service properties and gratifications* institutionalized in *society* through normative technology use that exerts influences on service engagements. The focus is thus not on normative technology use practices, but on the properties and gratifications which have become institutionalized as normative technology use has established and instantiated in practices over time.

In paper 3 we identify how the deep structured use of SMS and mobile e-mail lead to institutionalization of specifications on the supply side (providers) and properties and gratifications on the demand side (users). Institutional feedback transpired as use of services reached critical mass (Rogers, 2003; Schelling, 1978) and their associated properties and gratifications nested with the use practices became normative and dominant. Rules and typifications bound to service properties and gratifications took manifest in society and created a fundament for understanding, evaluating and valuing emerging service properties and gratifications. Once established, through massive adoption and use, they progressively impacted the service use and innovation trajectories. While this can promote people's engagement with a certain service, it can also have the adverse effect. Even if a service exhibit superior specifications its use may be suppressed and hindered by the properties and gratifications already deeply established among users in society. It was observed in paper 4 how participants of the field study acknowledged that MMS and e-mail had richer properties compared to SMS. Nevertheless, SMS continued to be the service preferred and most widely and recurrently employed for mobile messaging due to its dominance for ensuring pervasive expressive reach. Consequently, models of use and adoption need to acknowledge how the domination of established properties and gratifications can both facilitate but also hamper people's cognitive and behavioral service engagements and thereby also the adoption outcomes. This can be captured by studying effects of institutional feedback.

P2: Institutional feedback from socially manifested service properties and gratifications enable and constrain current and new mobile service engagements

6.3 Process

Mobile data services tend to lie dormant on the software menus of mobile devices or on mobile internet sites and portals and await activation once the device is at users' hands. Given also that the costs of trying mobile data services tend to be miniscule it is plausible that many services will live and die under the proverb "easy come, easy go". The empirical data of this dissertation lends support to Black's (1983) mentioned observation: people continuously enter and leave the adoption process. In fact, the process seems more stochastic and far less

predictive, linear, absolute, and unidirectional compared to what is commonly assumed in dominant causal models of TA and diffusion acceptability research (cf. chapter 2).

Paper 1, 2 and 4 provide empirical data suggesting us neither to bluntly accept absolutist conceptions of a *point* of acceptance or adoption (e.g. behavioral intention, first use or first purchase), nor equate these with full use of an innovation. The first paper provided insights on how attitudes towards use or service trial not necessarily cause *adoption* under the definition: "a decision to make full use of an innovation" (Rogers, 2003:21). As elaborated below it may simply mark a state from which *forms* of user *engagement* or *disengagement* may follow.

Systematic attention needs to be tuned at the *shaping* of cognitions and behaviors prior to as well as *when* a new mobile service is encountered and, if so, put into practice. As pointed out by Orlikowski and Iacono (2001), we need to theorize specifically about the engagements with artifacts in time and over time across a variety of use contexts. Similar reasoning forms a basis for the conceptualization of the adoption and use process as one of *continuous reflexive monitoring of own and others artifact articulations and use* presented in paper 2. Here the analysis suggested that what people *do with* and *say about* mobile services can engender new usage – intentionally as well as unintentionally. Services do not exist in a vacuum but as components in a world of artifacts where numerous of services co-exist and are interlinked. The underlying process-based view, along with elements of the tripartite framework of research paper 3, laid the foundation for paper 4 where we embarked on an analysis and categorization of the specific mobile service properties and gratifications that users constructed and reconstructed during user engagements and disengagements with different mobile services.

The longitudinal observation synchronous to the process of user engagements and disengagements garnered observations that would not have been caught in traditional linear and static acceptance surveys. For instance, poor and inadequate process gratifications (e.g. navigating, operating, and experiencing service latency) were found to overshadow potential positive content and social gratifications and make people alter conceptions or disengage with certain services shortly after trial. I next conceptualize and define the process of *service engagement* to adequately encapsulate the above observations.

6.3.1 Service Engagements

From the research papers, in particular paper 1, 3 and 4, it can well be suggested that the common dichotomous separations, e.g. adoption ("decision to make full use of an innovation") versus rejection ("decision not to adopt") (Rogers, 2003:177), and use versus no-use (Black, 1983; Shih & Venkatesh, 2004) are too narrow to adequately account for the adoption and use behavior for the mobile data services investigated.

First, the orthodox outcome variables do not capture the fine grained axial dimensions of adoption/use. This pertains particularly to the *rate of use* and *continuity of use*. To illustrate, if use/no use is applied as determining criterion the backlog data of the field study would provide rationale for labeling 32 out of the 38 participants as a *user or adopter* of mobile portal services. A different picture emerges with the facts that five persons visited the portal services *once* during the field study and that only 9 of the participants used the portal services during the field study's last two weeks. As shown in Table 6-2 a breakdown to the level of specific portal service gives even a more nuanced picture of this observation.

Second, the dichotomous separations background the cognitive dimensions of "use". In the field study it is found that mobile services are "used", "enacted", "activated", "applied", "adopted" in mind as well as in practice. Furthermore, it is observed how images of a mobile service experience stays in mind and influence later imageries and interpretations even if the service is used no more – especially negative experiences. Thus, terms which "fetishize" behavior and downplay the cognitive dimension are found constrictive. They focus on the acts but not on associated state and development of cognitive involvement and engagement.

From current literature Sarker & Wells' (2003) *use process* was in Chapter 3 modified to a process of appropriation to more adequately acknowledge this separation. The literature suggested further that appropriation could be separated into three main stages: (1) *imaginations and attitude*, (2) *exploration and experimentation*, and (3) *assessment of experience.* It was maintained that what is learned during one state may feed bi-directionally into the other. In hindsight it is clear that the cognitive view is well maintained in this view, but that behavioral forms of activity are not. A conceptualization providing analytical separation between expressed cognitions and behavior is thus needed.

Service engagement, which can be seen as a subset of broader technology engagement[111] (Crook & Barrowcliff, 2001), is coined and introduced to open for specific delineation and circumscription of the cognitive as well as behavioral dimensions of users' data service activity. Linguistically engagement signifies both the act and state of engaging or being engaged with something. *Service engagement is defined as an individual's cognitive and behavioral engagement with mobile data services.*

The cognitive component refers to the mental involvement bound to the shaping of a user's service understanding. It encompasses shaping of a technological frame (Orlikowski & Gash, 1994) a mental imagery of what a technology is and can do (its nature and properties), what can be obtained from its use in a certain context or way (gratifications). The behavioral component on the other hand encapsulates situated interaction with a technology. Service engagement thus maintains the analytical distinction made between cognitions and behaviors in social-cognitive theory: cognitions and behavior are analytically separate but reciprocal (not necessarily mutual) relations exist between them (Bandura, 1986, 1999).

With reference to paper 1, 2, and 4 it is found that service engagements appear in form of discursive acts, i.e. in utterances instantiating individual understanding of a certain mobile service, and in behavioral acts, i.e. service use. Behavioral service engagements reflect, to adopt Lave's (1988) terminology, manifestations of users' *cognitions-in-practice.* Discursive expressions of mobile services on the other hand, instantiate users' *cognitions-in-head* which may or may not be communicated.

Far from all service engagements appear *naturally* in utterances, expressions, articulations or service interactions. Imaginations and expectations bound to new services are seldom directly observable. Neither is experience-based meanings attached to "abandoned" services, i.e. services not presently engaged with. As observed with the wide and frequent use of SMS (cf. paper 4), the more service engagement recurs (i.e. the more routinized, taken for granted and incorporated in everyday life it becomes) the less discursive expressing occurs. Nevertheless, and as observed with the strong institutional feedback loops of SMS (cf. paper 3), such prior cognitions should be carefully assessed in order to delineate particular properties

[111] The term technology engagement is employed by Crook and Barrowcliff (2001) but is neither defined nor explicated; it is only generally used to signify behavioral use of computing features and patterns in actual use.

and gratifications shaped during service use. If not, we cannot account how new cognitive and behavioral engagements build on what is already established in mind and practice.

In order to sufficiently incorporate the facets above, three subset forms of service engagements are suggested. The analysis of qualitative and quantitative data from the research papers offer basis for distinguishing between (1) *explorative engagement*, (2) *recurring engagement* and (3) *disengagement*.

6.3.2 Explorative engagement

Explorative engagement represents a primary form of service engagement. It signifies *a novel service engagement where the user cognitively or behaviorally engages with a hitherto unfamiliar service or quality of a service*. Cognitive explorative engagement occurs when users' shape mental *imageries and typifications* of particular service properties and the gratifications obtainable in situated use contexts. The imageries and typifications structure and become mental service images/technological frames (Orlikowski & Gash, 1994). They are shaped by imagination, memory, and rationalization. Behavioral explorative engagement is quite straightforward: it occurs when a user behaviorally interfaces with the service and they act upon or communicate with each other.

It is under explorative engagement which the distinction and relations between cognitive and behavioral engagement are elucidated. Prior to behavioral engagement the user's mental image of a particular service is unencumbered by experience. At best the imagery contains traces of knowledge formed from attention given to interactions and communications in the surroundings or experience from interactions with related services or service qualities. If no behavioral engagement has occurred the imagery is thus formed merely by the *inputs* presented in Figure 6-4. Albeit experience and self-efficacy with related technologies and services may well exist, it is not until the behavioral engagement with the particular service in question that imageries of anticipated properties, gratifications and situated use contexts are experientially confirmed or contrasted. This was clearly observed in paper 1, 2, and 4. Mental imageries of service properties and gratifications were observed to form and shape the knowledge basis and general spirit towards behavioral engagement with the services.

P3: Cognitive explorative engagement shapes mental imagery of the properties and gratifications of a certain service upon which behavioral engagement can take place.

However, no neat linear necessary-and-sufficient contingency relation can here be posited. Cognitive engagement often precedes behavioral engagement. But also the opposite is true. This occurs when behavioral engagements of more unconscious, unplanned and unintended nature take place. It is observed to typically take place when users play and explore the features and services available via the interfaces of a mobile device. Under these circumstances it is not a clear set of expectancies or cognitions towards certain service properties or gratifications under a situated use contexts which inform or direct behavior. Rather behavior is largely serendipitous an intuitive.

As illustrated in Figure 6-2 experience from behavioral engagements, hereunder experiences due fortuitous service encounters, may feed back into cognitive engagement which may impact and shape subsequent behavioral exploration. In paper 2 it was observed with picture messaging how service use unintentionally triggered service awareness and explorative engagement when a person simply received or were alerted by someone else utilizing a new way of communicating an image to their device. Moreover, it was seen how trial and accidental service engagements, e.g. when pressing buttons and playing around with the device, also could trigger such awareness and trial.

These observations resonate perfectly with social cognitive theory which maintains that cognition and behavior are tied together reciprocally – although not necessarily symmetrically (Bandura, 1986, 1999). Cognitive engagements may lead to behavioral engagements. Similarly, behavioral engagements may yield cues for cognitive processing. The concept of reflexive monitoring, introduced in paper 2 by drawing on Giddens (1984), encapsulates this reciprocal relation. Users may adjust or adapt current service images, but may also generate new as a result of reflexively monitoring own and/or others' service use and related communications. Reflexive monitoring of service use refers to the monitoring of own and others' mobile service engagements. By monitoring the cues that our own and others' service use and communications generate, people can shape and reshape mental imageries of service properties and gratifications. In the field study we observed both how people came to try a new service as a result of monitoring others' service use (e.g. as with MMS), and how they

reshaped cognitive imageries as a result of trying a service. As is explained later, the former was observed to be particularly central for services with strong expressive properties such as SMS. In sum the observations from serendipitous service encounters and reflexive monitoring provide rationale for suggesting that:

P4: Behavioral engagements can, via the reflexive monitoring of own and others mobile service engagements, precede and trigger cognitive engagement.

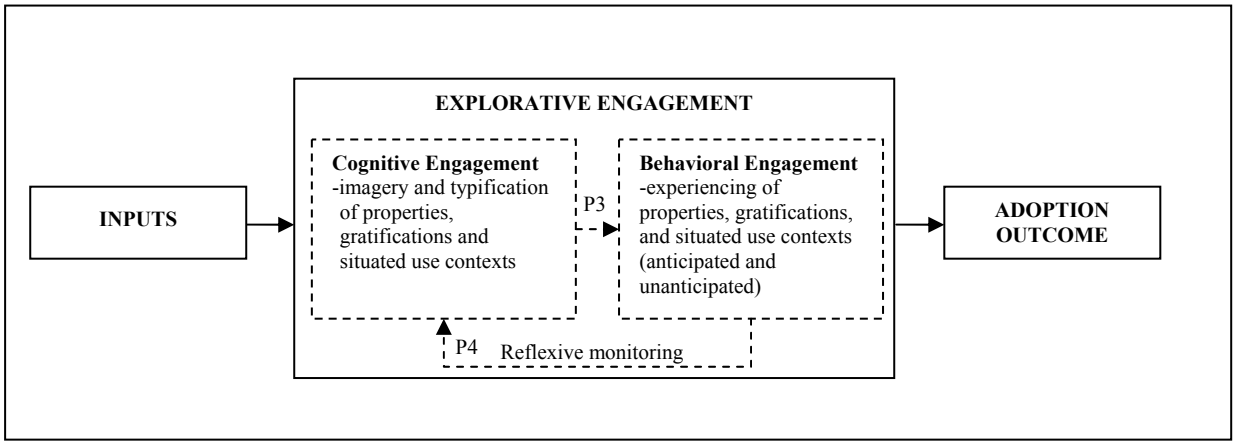


Figure 6-2: The Service Engagement Framework - The Process of Explorative Engagement

Explorative engagement cannot be equated with adoption under the definition "full use of the innovation" (Rogers, 2003). This is evident when service engagement is purely cognitive. Without behavioral engagement it is merely a general user intention based on imagery which may exist. Acceptance research tends often to rely on measures of perceptions of usefulness, ease of use and relative advantage *prior* to behavioral engagement. Reliance on such early perceptions is risky as understandings among users at this very point often are too shallow to define and comprehend what "full use" of the technology or service at hand entails. Properties and gratifications of the service and impacts from situated use contexts have not been processed and learned. While an early assessment of relative advantage can have formed at this point it is important to remember that this is the imagined relative advantage based upon the properties and gratifications the user shapes imaginatively. These imageries can guide initial use, but are also subject for further shaping as experience(s) of such initial engagements are interpreted and reinterpreted.

Paper 4 shows how construction and reconstruction of instrumental, aesthetic and expressive properties along with content, process, and social gratifications occur during explorative engagements with the various data services. It also shows how new experiences may feed back cognitive cues for reconstructing previous conceptions and understanding. In particular the negative experiences and inferior properties relative to other computing services tended to dramatically alter property and gratification imageries (cf. paper 1 and 4) and cause disengagement with certain of the portal services investigated. On the contrary, when positive imageries either were confirmed or superseded, as for instance with users of mobile e-mail, it was observed that users sought to replicate the experience by repeating prior behavioral engagement. Thus, first when people either disengage or recurrently engage with a certain service one can argue that *adoption outcomes* have been rendered.

6.4 Outputs - Adoption Outcomes

For mobile services the explorative engagements are perceived too indeterminate to be labeled *adoption* under the definition given above (full use of innovation). Findings of paper 1 and 4 along with a simple analysis of continuity of use from the datasets in Table 6-1 and Table 6-2 suggest we should more carefully separate between the more capricious explorative engagements and outcomes that are more enduring, finite and solid.

Theory reviewed and synthesized in Chapter 3 acknowledges the above separation by setting focus on two dimensions; rate of use (continuity) and variations in use. Paradoxically, these dimensions pull in opposite directions. *Rate of use* points to repetition and the production of a stable outcome. *Variations in use* points to potential idiosyncratic use and multiple applications of a service; and thus varying outcomes. The latter dimension tends often to be neglected. Nevertheless, for mobile services variations are of strong importance. Gratifications rendered by service use may vary sharply even if the same service is used. Variations can arise due to alternative use contexts, shifting modes of mobility and when communication/task objectives differ. Moreover, variations in use can well associate with and engender discovery of properties that make the service engagement process explorative rather than stable and determinative. In paper 3 we observed how SMS use was aimed at various forms of social coordination, utilitarian as well as hedonistic interpersonal communication, and as an instrument for ordering ringtones, games and other general value added. Similarly, picture

messaging is used across larger physical space but also in proximate physical co-presence. With the scenarios of a single service being able to serve a multitude of communication/task objectives the variations in use naturally multiply – and so will the span of gratifications. Delineating more finite adoption outcomes therefore warrants a clearer conceptualization. Here the research observations provide a basis for suggesting that *recurring engagement* and *disengagement* are two key forms of service adoption outcomes.

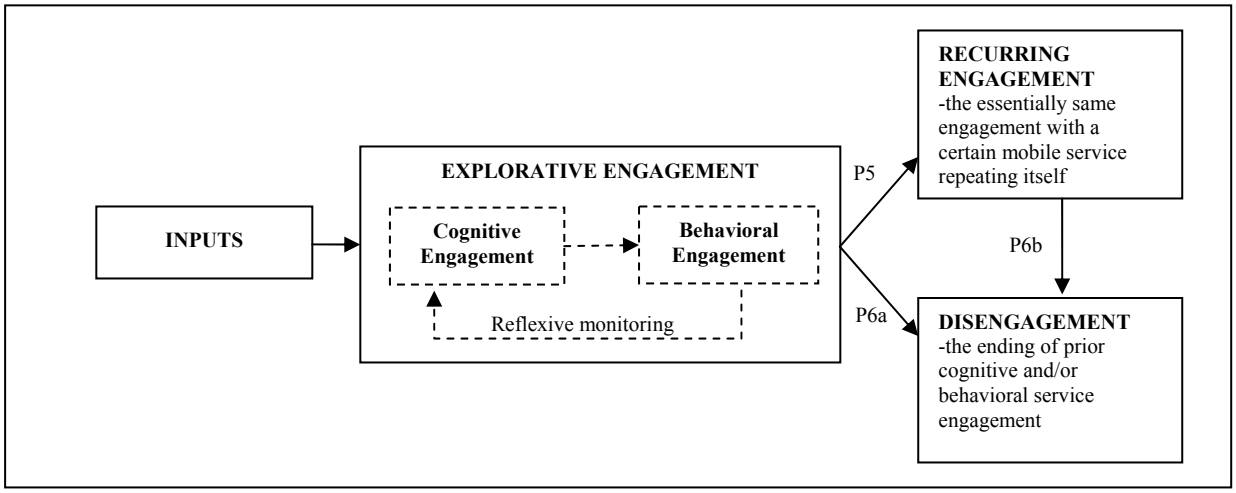


Figure 6-3: The Service Engagement Framework – Outcomes

6.4.1 Recurring engagement

Recurring engagement represents a derivative form of explorative engagement. It derives from and is essentially imitative of previous engagement. *Recurring engagement is defined as essentially the same engagement with a certain service repeating itself.* Recurring engagement is in essence repetition of the same (at least near to same) service behavior where the user aims to replicate obtainment of known gratifications. At this point the user has acquainted the service properties via explorative engagement and now knows the features of the service in need of activation for achieving certain hedonic or utilitarian content, process and/or social gratifications. Recurring engagement is therefore purposeful and deliberate. There is here a clear difference from explorative engagement: *no new service aspects are subject for exploration during recurring engagements*. If new aspects emerge, e.g. from inputs or reflexive monitoring, it will by definition revert into explorative engagement. Recurring engagement resonates thus the frequency and stability associated with *rate of use* in current theory.

Given its repetitive nature, recurring engagement constitutes a gateway to routinization and what domestication researchers call incorporation – the temporal assimilation of a service into time structures and routines (Haddon, 2001; Ling, 2004; Silverstone & Haddon, 1996). Through recurring engagement the properties of the service, its appropriate contexts of use and the gratifications obtainable from its use become taken-for-granted and ingrained in practices of everyday life. It is therefore also the gateway to further institutionalization and the emergence of institutional feedback.

P5: Recurring engagement derives from behavioral explorative engagement and occurs when a user re-engages with a service with the purpose to replicate a former service experience and re-experience associated gratifications.

It is worth to mention that because a single mobile service can be used in a variety of contexts (unlike stationary computing) it should ideally be a requirement that the recurring use occurs under a known and previously experienced use context. Unless the use occurs under the same or strongly similar technological, social and/or economic context (cf. the pre-understanding) the perception of service properties and offered gratifications may not be the same for the user. Contextual variations can make intended recurring engagement become explorative. It must here be admitted, with a simultaneous call for further investigations, that this aspect is not sufficiently treated in the research comprising this dissertation.

Recurring engagement occurred as participants of the field study re-engaged with a mobile service to evoke a gratification (or a set of gratifications) that had experienced previously. As shown in the table below, next to SMS recurring engagement occurred most frequent for interpersonal communication services such as mobile e-mail, and MMS. SMS was used 6-20 times per week among 13 of the field study participants and 14 used it more than 20 times per week. Increased engagement with MMS and mobile e-mail is noted both in cognitive and behavioral form. For MMS and mobile e-mail there is a larger share of participants at the end of the field study having explored MMS and mobile email. This can be seen in Table 6-1. More importantly, and as seen in Table 6-2 the number of participants also engaging with these services on a more recurring basis also increased. This is particularly so for mobile e-mail.

Table 6-1: Relation to MMS and Mobile E-mail

Response alternative	MMS Pre	MMS W13	m-email Pre	m-email W13
I have not heard of this	-	-	1	-
I have heard of this but not tried	18	4	18	12
I have tried this a few times	9	12	10	9
I use it now and then	6	15	3	6
I use up to 5 times per week	1	3	1	5
I use it more than 6 times per week	-	-	1	2

The patterns of recurring use are not so strong for the portal services. News and infotainment and portal messaging services obtained a modest degree of recurring engagement. This was spotted for news services where quick updates were sought during transport and for Search & Find services providing directions and directory services.

Table 6-2: Recurring Engagement

Service	1 time	2 times	3 times	4 times	>5 times
Backgrounds, Logos and Screensavers (BLS)	14	6	3	0	0
Dating[112]	15	8	3	2	1
Games[113]	10	4	3	2	0
Infotainment[114]	20	12	8	5	2
MNO Personal Information[115]	15	9	3	1	0
News[116]	26	14	8	7	6
Portal Messaging (MM)[117]	19	12	7	5	2
Ringtones[118]	11	11	0	0	0
Search & Find[119]	22	11	5	3	2

Beyond News and Search & Find and Infotainment, the above data show few of the portal services reaching a level of recurring engagement sufficient to become incorporated into the routines of the participants' everyday life. Thus, utmost care should be used in labeling the above for services adopted or accepted. Most users engaged in an explorative way for then to

[112] Mobile web pages for profiling and matching to other personal profiles along with chat in mobile contact features
[113] Games for download – e.g. Java games
[114] Mobile web pages with content of informative and entertaining character in text and multimedia formats
[115] Account information, receipts and subscription status on mobile network operator (MNO) services
[116] Media pages with news content in text and multimedia formats; entertainment and show-business.
[117] Mobile web page which enables users to send pictures and video-clips from a portal based online photo-gallery as well as use pre-fabricated multimedia content in multimedia messages (MMS).
[118] Ringtones/ringtunes for download
[119] Search for maps, locations and directions, phone numbers, and addresses; not location specific

abruptly or gradually abandon the portal services or simply forget them. In other words, the most finite outcome for these services tended to be disengagement.

6.4.2 Disengagement

The term disengagement is introduced to encapsulate how halt and ending came to the many service engagements observed during the field study. *Disengagement is defined as the ending of prior explorative or recurring service engagement.* As opposed to explorative engagement and recurring engagement, disengagement is identified to amputate the incorporation of a service into people's everyday practices. Consequently, disengagement also bars the further shaping of service properties and gratifications and the overall development of technological frames (Orlikowski & Gash, 1994) associated with the service.

Disengagement is also a derivative form of engagement. It derives from explorative engagement (cognitive as well as behavioral) and from recurring engagement. Disengagement subsequent to cognitive engagement occurred when imageries of service use were not sufficiently intriguing to trigger behavioral engagement. However, as presented in detail in paper 4 under process gratifications, disengagement most often followed explorative behavioral engagement. It tended to be abrupt and rooted in negative experiences or simple annoyances discovered during initial service use. In paper 2 and 4 the experiencing of poor latency and complex navigation (instrumental properties) were key reasons for people to abruptly disengage. But also finding services functioning inferior to 'traditional' internet services (cf. paper 2) caused abrupt disengagement.

P6a: Disengagement follows from *explorative engagement* when a user gradually reduces or stops cognitive and/or behavioral exploration of a service.

Disengagement following recurring engagement was observed to be more gradual in nature. Statements from the participants reflected particularly how gradual disengagement took place as the initial *geist*, curiosity and novelty faded. Along with annoyances attributed to poor or inferior service functioning made people stop using the service or slowly forget its existence. They silently desisted from attempts to 'replicate' the service experience they had recurrently displayed.

P6b: Disengagement follows from ***recurring*** engagement when a user ceases to replicate prior service use.

The form of withdrawal, reduction, abandonment and halt to further engagement observed in the research could not be adequately captured by term *rejection* applied in the pre-understanding. Rejection is "a decision not to adopt an innovation" (Rogers, 2003:177). Despite declining engagement participants neither directly nor in absolute terms rejected the idea of using the mobile data services. Neither was it so that the users uttered a clear decision not to adopt the data services. In fact participants made frequent idealistic imageries of future use of the services if improvement to service variety, quality and functioning reached a level where gratifications could be offered close to those known from regular Internet services (cf. paper 2 and 4). Even the six participants who only cognitively but never behaviorally engaged with portal services had clear ideas about how different services could be gratifying. Besides, for people having behaviorally engaged it was not necessarily the service itself, but the underlying specifications in the underlying infrastructure (e.g. network and devices) which tended to hinder gratifications and catalyze disengagement. Under these circumstances it was more a matter of "disengagement for now" than a final rejection.

Diffusion theory separates between active and passive rejection (ibid.). Active rejection occurs when a potential user has consciously *decided* not to adopt after consideration and trial. Passive rejection occurs if use never really has been given consideration. Disengagement as defined above covers both of these dimensions. The term aims to neutralize some of the biases embedded in these rejection concepts. This concerns particularly the overly rationalistic decision-making perspective, what Rogers (ibid.) call the pro-innovation bias, as well as the signification of high involvement and permanence in adoption decisions – a high-involvement bias. The logic of high-involvement decision making (Foxall et al., 1998), planned behavior (Ajzen, 1991) or reasoned action (Fishbein & Ajzen, 1975) is found *not* to be the rule. Users neither always perform careful considerations, nor obtain firm knowledge, nor become persuaded prior to service use. Mobile data services are often just tried following brief awareness of its properties and by intuitive hints about potential gratifications. Sometimes services are activated and encountered incidentally. Such encounters do not necessarily lead to finite adoption or rejection. They may merely render cues for the user to shape or re-shape

imageries of service properties and gratifications upon which they may immediately or later, under the same or different context, engage upon and form discrete choice.

Passive rejection implies that a person is *conscious* about the existence of a service. Some form of cognitive explorative engagement must have taken place. Even without really considering adoption or use, such vague consciousness or imageries can in fact be sufficient for the user to remain passive for a period for then to engage with the service when he/she finds it intriguing to further explore its properties and gratifications under a certain use context. Thus, if the user *for now* passively rejects a service this does not imply that he/she has permanently rejected. The user may disengage for now but leave room to enter explorative engagement again at a later point where context or other inputs may be different.

The above observations are not sufficiently treated in current decision-making models. One reason is the inclination to treat all acceptance and adoption processes as high-involvement. Another is the pro-innovation bias: the inclination to automatically assume that innovations are positive, should be received positive, should naturally diffuse rapidly, and should neither be re-invented nor rejected (Rogers, 2003). This tendency is also found in consumption oriented stream of uses and gratification research (Blumler & Katz, 1974; Dimmick et al., 1994; E. Katz, Blumler, & Gurevitch, 1974; Leung & Wei, 2000; Noble, 1989). The tendency is to exaggerate the gratificational aspects of new technologies. In fact, implicit biased assumptions that a technology under question *will* be gratifying has caused low overall accounting of variance in explaining (intentions to) use (LaRose et al., 2001).

When assumed and implied in our research these biases covertly directs attention away from "negative" diffusion outcomes and effectively camouflages the fact that services can vary greatly in terms of the frequency we should *expect* to see them used in everyday life. It is often so that a single observation of use or a negative measure for intention to use is equated with rejection. Expected service engagement may vary greatly. This must be taken into consideration. Should we expect a single use? Or will engagement occur more occasionally, regularly, frequently or even constantly? If we include these dimensions we can move one step closer to what Black (1983) called for 25 years ago regarding the axiological dimensions of use and how people enter and leave the process. We will also be in a position to better examine and conclude whether or not they disengage permanently or intermittently. After all, it is over the time we study the service engagements we will learn the typical engagement and

disengagement patterns which should be expected for a specific service (e.g. the frequency of using e-mail vs. purchasing of a ringtone).

6.5 Summary: The Service Engagement Framework

The resulting service engagement framework follows a hybrid structure (see Shaw & Jarvenpaa, 1997). It blends variables, process and outputs. It is not presented as a fully testable model. Rather it is a *framework*: According to Crossan et al. (1999:523): "A framework defines the territory and takes us a step closer to a theory … Theory is about connections between phenomena a story about why acts, events, structure and thoughts occur". They further offer certain requirements for a theoretical framework:

a) identify the phenomenon of interest
b) state key premises or assumptions underlying the framework
c) relationship among the elements needs to be described

The Service Engagement Framework is constructed for research to target the phenomenon: *Shaping of user engagements with new mobile data services*. The key premises and assumptions of the framework are:

1) Service engagements render from inputs, shape during process and yield outcomes.
2) There is a reciprocal feed-forward and feedback relation between cognitive engagements and behavioral engagements where the latter also may precede the former; i.e., cognition shapes behavior and vice versa via people's reflexive monitoring of own and others service engagements and communications.
3) Service engagements shape at the individual, group and social systemic/institutional levels and may alter as engagements oscillate between levels
4) Service engagements and recurrence are service specific
5) Permanence and stability of service engagements is determined by recurrence[120] of enactments in time and space where the seemingly same specifications, properties and gratifications are implied, instantiated and socially manifested

[120] Given expectancy of service engagement frequency beyond once or a few times.

Concerning the relations, all the novel elements of the framework and proposed relations have been explicated throughout the present chapter and presented as propositions. Other relationships, including the inputs established in current research – i.e., individual differences, modality of mobility, communication task characteristics and context that affect the process – were presented in the integrated review of current literature in chapter 3. A revisit to Chapter 3 is advised for a fuller presentation of these framework components. Accompanying Figure 6-4 is therefore only a summary of the overall propositions and relations suggested for the research framework. This summary is provided in Table 6-3.

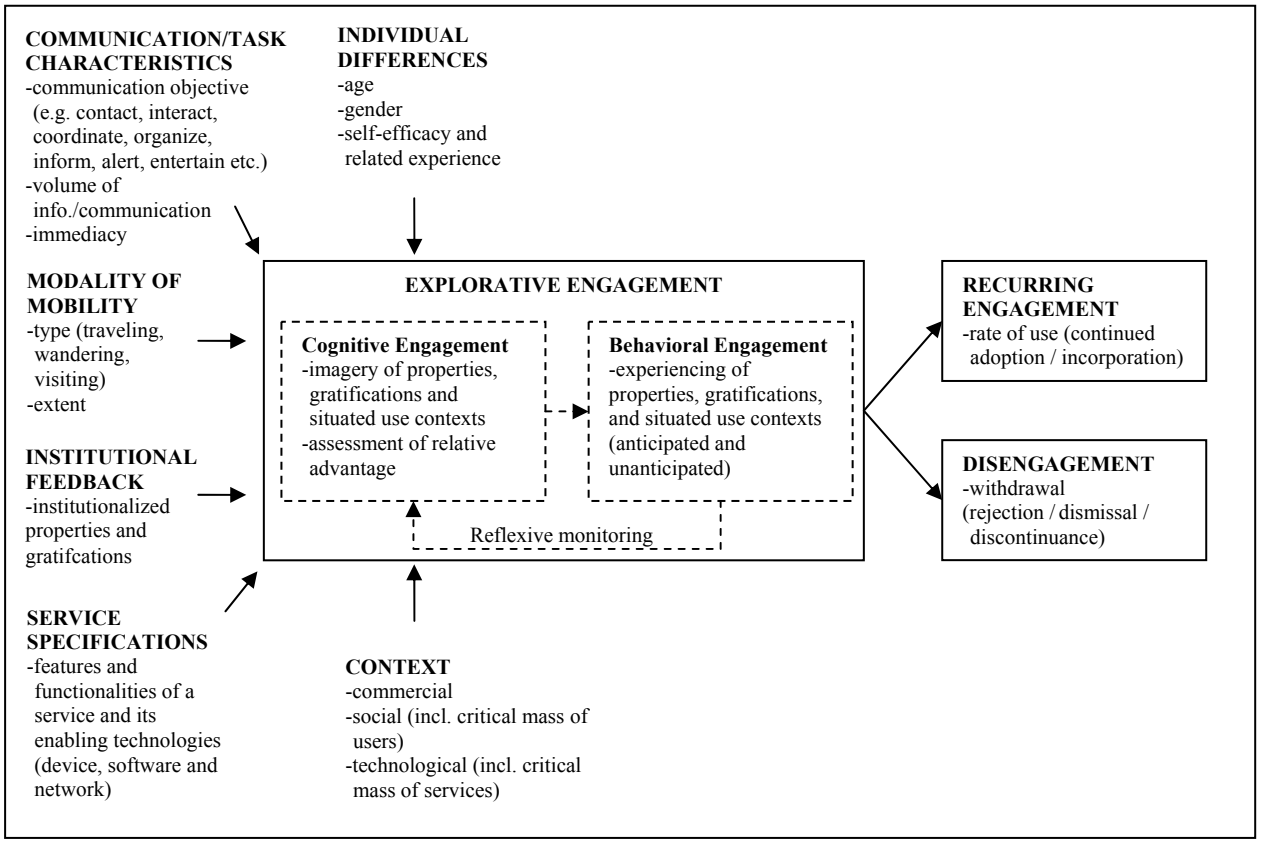


Figure 6-4: The Service Engagement Framework

Table 6-3: Constituents of the Service Engagement Framework: Inputs, Process and Outcomes

	Concept	Definition	Logical structure/new proposition	Supporting data
INPUTS	Service specifications*	Features and functionalities of a particular service and its enabling technologies as inscribed by its advocates	-generate variations in service properties and gratifications, in users' service engagements and the overall patterns of use	RP 3 Pre-understanding
	Institutional feedback*	Effects of already institutionalized service properties and gratifications on users' mobile service engagements	-enable and constrain current and new mobile service engagements	RP 3
	Communication/ Task Characteristic	Characteristics of the communicative need and task at hand	-variations in need/task at hand influence the shaping of properties and gratifications under explorative engagement	RP 3,4, Pre-understanding
	Modality of Mobility	Type and extent of mobility	-type and extent influence the shaping of properties and gratifications under explorative engagement	Pre-understanding
	Context	Characteristic conditions of the environment surrounding the (potential) user(s) of mobile data services	-contextual variations (economic, social, technical) influence the shaping of properties and gratifications under explorative engagement	RP 2, 3, 4 Pre-understanding
	Individual differences	Individual characteristics of the user	-determine variations in explorative engagements (and later outcomes)	RP 1 Pre-understanding
PROCESS	Explorative Cognitive Engagement*	Users' shaping of mental imageries of particular service properties and gratifications	-shapes imageries of properties and gratifications and form basis for behavioral service engagement	Field study data; RP 1, 2, 4
	Explorative Behavioral Engagement*	Users' novel physical interactions with a service.	-can precede as well as render cues for cognitive engagement as the service engagements by the user or other users are reflexively monitored	Field study data; RP 1, 2, 4
OUTPUTS	Recurring Engagement*	Essentially the same engagement with a certain service repeating itself	-derives from explorative behavioral engagement when service engagement is sought repeated	Field study data; RP 4
	Disengagement*	Ending of prior explorative or recurring service engagement	-derives from explorative engagement when users withdraw from or stop their cognitive and/or behavioral exploration of a service -derives from recurring engagement when the users refrain from replicating previous service use.	Field study data; RP 1, 2, 4.

*New concept introduced. Other concepts are maintained from the pre-understanding in Chapter 3.

6.6 Suggestions for Future Research

We are gradually starting to comprehend the shaping of mobile data service understanding and use. Nevertheless, an untapped reservoir of further research opportunities exists.

An overview of ideas for future research is offered in the Tables 6-4 to 6-6. These are ordered into thre key research categories – service/artifact, process, and outcomes. Also suggestions on relations and temporal aspects are offered. In paper 4 we conclude that mobile service use cannot easily be confined to a singular level of analysis. Thus, suggestions for future research are offered at three different levels of analysis; the individual, group and systemic[121]. In Chapter 4 it was underlined that our analysis should not be confined to a single method but be guided by methodology most fruitful to the purpose of the study, the research question and type of desired knowledge outcome. We should therefore welcome qualitative, quantitative and mixed method studies on the below subjects.

6.6.1 Service/artifact

Despite the modest contributions made in paper 3 and 4, much more theorizing is needed about the IS artifact. Markus called particularly for understanding "their embeddeness in space, time and context; their multiplicity of components; their dynamism and so forth" (Markus, 2005:2). This is a call for untangling the challenge of compoundness (cf. 1.2.1) and to avoid simplistic views of the artifact. Research on mobile services should specifically be focused on specifications, properties, and gratifications. Particularly needed are:

1. typologies of service specifications, properties and gratifications
2. variations created by socio-technical dynamism as use transcend to social levels
3. service/artifact specific impacts on innovation and use trajectories
4. services and artifacts interdependence (issue of compoundness/world of artifacts)
5. artifact role in the gestation of communities, social networks and service ecologies

As a novel insight from research paper 3, it is also suggested further research on institutional feedback to better understand how it enables and constrains service use and innovation at multiple analytical levels. Given how expressive properties were found to have a particularly central role in the gestation mobile service use in groups, it is encouraged that much research is

[121] Refers here to social systems and innovation systems; as a systemic institutional level.

emphasized at the group and systemic level. Among arenas of particular interest we find social communities and networks on the internet now moving to the mobile phone, e.g. Facebook, Messenger, MySpace, Blogger, and YouTube. The overall specific suggestions for the service/artifact level are presented in the table below.

Table 6-4: Suggestions for Future Research: Service/artifact

	Theme	Individual	Group	Systemic
SERVICE / ARTIFACT	Service specifications	• typification of service specifications • variations in understandings among about service specifications • relations between specifications of different services and their impact on individual engagement	• variations caused by/impacts of specifications contingent on/enabled by group usage or augmented by network effects • effects of specification variations on group use behavior; e.g. in communities • impacts of specification interdependency	• how institutionalized variations in service specifications enable and constrain service engagement and innovation • gestation of industry/global specifications (standards) • variations across social/innovation systems (geo-spatial) • shaping of dominant designs
	Service Properties	• typification of service properties • variations in service properties resulting from idiosyncratic service specifications • properties enabling and/or constraining obtainment of gratifications	• properties emerging/assigned as a result of group/social service use • enabling/constraining effects of properties emerging with group/social engagements	• how institutionalized variations in service properties enable and constrain service engagement and innovation • variations across social/innovation systems
	Service Gratifications	• typification of hedonic and utilitarian data service gratifications for different services and under different use contexts • gratifications rendering positive service spirit and fostering service engagement	• gratifications specific to or augmented by data service use at group level • enabling/constraining effects of gratifications emerging with group/social service engagements and service interdependence	• how institutionalized variations in gratifications enable and constrain service engagement and innovation • variations in valued gratifications across social/innovation systems
	Institutional feedback	• enabling and constraining effects on individual service engagements; hereunder interdependence between services	• enabling and constraining effects on group service engagements • feedback mechanisms of community sites and applications	• mapping of dominant feedback enabling and constraining use and innovation trajectories • social consequences of institutionalized service use

Regulatory conditions and role the role of marketing has not been offered much attention in this thesis. This is deliberate as both issues of the regulatory environment and messages of commercial marketing ultimately will be absorbed in how service specifications appear to the user and interpreted in the process of his/her construction of properties (see discussion under economic conditions of chapter 4). Nevertheless, such impacts are of strong importance for what services are brought to market, or even allowed into the market, and thus what specifications users will confront. Thus, the suggestion to study geo-spatial variations above is a call for researchers to become more explicit in how certain artifact specificities absorb and reflect decisions and agency by regulatory bodies as well as political and commercial actors.

6.6.2 Process

Markus and Robey (1988) warned about incomplete process models which merely explain stages but do not specify the mechanisms by which subsequent stages come about. The Service Engagement Framework is a hybrid framework specifying such mechanisms. Nevertheless, understanding of cognitive and behavioral engagement under the overall explorative engagement process is far from exhaustive and complete. This is also so for mechanisms pulling outcomes either towards recurring engagement or disengagement. Further research on the shaping and typifying of properties and gratifications at multiple levels are particularly important for creating feedback into service development projects. Of central importance is how it can enable us to understand emerging effects on properties and gratifications as use of the service/artifact scales toward the group level or beyond. This concerns particularly shaping of service engagements:

1. at higher social levels
2. under digitally enabled social interaction (technological context)
3. across multiple digital interfaces
4. across computing contexts and modes of mobility

Specifically there is a need to see how cognitions and behavior around services form in social communities (e.g. Facebook, MySpace, MSN, Flickr, etc.) that can transcend the group level and can institutionalize systemically. We are already seeing how internet communities are moving to the mobile and we need to know how properties and gratifications “move” from one

interface to another and if and how they change in the process. Exiting explorative research opportunities exist for providing deeper specification of types of engagements – individual as well as social – as they transcend interfaces and technological contexts. This concerns also the outcomes of recurring engagement and disengagement. Nuanced views of engagements, e.g. defined along continuums such as high-low cognitive engagement, rationed-impulsive behavioral engagement, and abrupt-gradual disengagement etc, will also sharpen operationalizations and chances of appropriate measurement. Specific suggestions for process research are provided in Table 6-5.

Table 6-5: Suggestions for Future Research: Process

	Theme	**Individual**	**Group**	**Systemic**
PROCESS	Cognitive engagement	• shaping and typifying of properties and gratification in minds of individual users • level and role of cognitive engagement prior to behavioral engagement • role of reflexive monitoring of own and others' service engagements	• shaping of properties and gratifications in groups • effects on cognitive engagement from group formations, interactions and communications • shaping of group cognition in digital communities and social networks	• impact of established social structures (signification, domination and legitimation) on cognitive engagement • shaping of social cognition in regional and global user networks
	Behavioral Engagement	• shaping of individual behavioral engagement • impact of individual cognitive engagement • classification of different behavioral engagements	• shaping of use behavior among groups of mobile service users; especially in digital social networks and communities • impact of shared or divergent service imageries • classification of group level engagements	• impact of established social structures (signification, domination and legitimation) on behavioral engagement • classification of social level engagements • shaping of behavioral engagements and the gestation of trajectories in service ecologies

6.6.3 Outcomes

Suggestions for research on outcomes concern gratifications sought from recurring service engagement under various contexts (technological, economic and social). Similarly, we need to further our knowledge about reasons for disengagement. This will complement and inform about service specific expectations regarding dimensions of use essential for determining permanence and stability in engagements and gradual versus abrupt disengagements. It will also enable cross-service comparisons for seeing patterns in gratifications sought by individuals, groups and across social systems.

Second, ubiquitous computing environment requires us to connect engagement with services and contexts. Engagements and gratifications can vary from one service to the other as well as from one context to the other. Addressing context more adequately than what is offered in the present research will help in tackling and understanding the challenge of multi-sphere crossings (cf. section 1.2.2). This should also entail studies on how recurring use in itself can change and create use contexts that in turn affect further engagements and disengagements.

A final suggestion for outcomes concerns analysis at higher levels about the social consequences and larger social shifts regarding recurring engagement and disengagement. Knowledge is needed on social patterns and consequences of recurring service use, and the emergence, endurance and decay of social structures[122] around services. Consequences can, as exposed in research paper 2, be intended as well as unintended. Either type can emerge with growing use in populations and impact further engagement outcomes at all levels. There is also a need to garner further insights on structural shifts, i.e. where emerging recurring use of one service caused substitution and disengagement with what is currently in place. This should also involve investigations on political, economic, social and technological (PEST) agents and agency capable of bringing about structural shifts/changes in service engagements at the systemic level.

Table 6-6 outlines research suggestions on recurring engagement and disengagement. The suggestions orient strongly on generating field realistic insights about mobile service embeddedness in space, time and context (as called for by Markus, 2005) .

[122] May also entail institutions at the widest level.

Table 6-6: Suggestions for Future Research: Outcomes/Outputs

	Theme	Individual	Group	Systemic
OUTPUTS	Recurring engagement	• individual gratifications sought from recurring service engagements • typifications of services based on frequency of recurring engagement • characteristic contexts of recurring use	• group level gratifications sought from recurring service engagement • forming of group use patterns from engagements recurring in time and space • characteristic contexts of recurring use	• forming of social structures from recurring service engagements and what the engagements instantiate • characteristic contexts of recurring use • context creation by scaling recurring use
	Disengagement	• categorization of individual level reasons/factors for disengagement • nature of disengagement; abrubt versus gradual	• group level reasons/factors impacting disengagement • disengagement dynamics of groups/social networks	• disengagement from structural shifts (large scale transitioning in engagement between substitutes) • disengagement as result of PEST factors

6.6.4 Relations

The purpose of this project has been theory generation rather than theory testing. It has not been the key objective to posit stringent causal inferences. Enable-and-constrain relations have been suggested in paper 3, and propositions for relations between constructs and have been described for the Service Engagement Framework. Naturally, there exist several opportunities for further operationalization and validation of the framework. Also, as highlighted in research paper 4 there are several avenues to establish causal inferences between properties and certain gratification outcomes, impacts of contexts, modes of mobility and linkages between properties, gratifications and frequency and variation in service use. Open research opportunities in this area exist on all propositions suggested and summarized under "Logical structure/new proposition" in Table 6-3. It should be mentioned that specific understanding of the role of price on engagement is in need of much more understanding. The data collected during the field study show important signs of how different pricing models (e.g. bundles, flat rate and per use) can have significant impact on engagement.

While briefly included under *context as an economic condition* (cf. section 0) service pricing has not been at heart of this disseratation. Nevertheless pricing is a central sub-topic where IS and marketing scholars can collaborate in order to bring about fruitful understanding of how different service pricing models can influence engagement and disengagement of

various services. This is particularly so for pricing of services where engagement is typically trial-engage/disengage as opposed to high-involvement decision making. Investigations should here look more carefully at interdependence between services – also across typical computing domains, e.g. mobile and PC – in order to assess relations between substitutes and complements and the impact of pricing variations in the different domains. As reflected in the quotes applied in the research it was clear that mobile services often were compared to services on the computer, and that the experience and pricing in the two domains were contrasted in evaluation of value and in participants' rationing over current and future engagements. Understanding these pricing aspects could add central understanding to role of properties and gratifications in environments of service interdependence and account variations in different computing contexts.

6.6.5 Synchronic and diachronic investigations

Adoption outcomes for mobile data services do not automatically follow rational and linear decision making where the output is either immediate acceptance/adoption or rejection. The observations made in this research suggest that true use patterns appear over time with recurring engagements. Careful attention must thus be tuned towards what services people engage and disengage with. Equally, we need to study how and why they engage or disengage with the services subsequent to explorative engagement. This calls for field realistic investigations synchronic to service engagements.

Paper 3 revealed how path dependencies can be created from reverse salients and institutionalization processes that are historically contingent. Thus, there is a clear need for both synchronic and diachronic investigations. The history and life of a service shapes and is shaped from technology enactments diachronically. Shaping takes place, to borrow a term from Giddens (1984) in the 'durée' of time. We need therefore not only to account for aspects of artifacts and engagement synchronic to our time, but assess for such historical path dependencies with respect to specifications, properties and gratifications and social behavior patterns. Only by setting a diachronic focus can we see if the service continue to incorporate into everyday life, if they fade out of everyday life and if an adoption or rejection decision is truly underscored by behavior or not. Guidelines and inspiration for designing synchronic and diachronic research appropriate for issues for further scrutiny suggested in tables 6-4 to 6-6 can be found in DeSanctis and Poole's (1994) Adaptive Structuration Theory.

6.7 Overall conclusions

This dissertation has taken a diachronic and multilevel perspective to research the shaping of mobile service understandings and use. A mixed method research approach was utilized to garner insights on how mobile service understanding and use outcomes shape from inputs and continue their shaping during the service engagement process. The insights from the pre-understanding and the performed research are in this concluding section concerted into the Service Engagement Framework. I will next recapitulate conclusions central to research questions[123] 1-3 raised in the opening chapter.

The first research question seeks to bring answers about how new mobile service understanding and use shapes during early service engagements. It tunes in at the nature of the process. The research findings suggest a process comprised of *cognitive engagements* and *behavioral engagements*. Between these exists not a unidirectional cause and effect relation. Rather they impact bi-directionally. As opposed to the majority of research focusing on perceptions and expectancies *prior* to use, research paper 1 and 2 echoed tenets from social cognitive theory as it was found that cognition shaped service behavior and vice versa. Pre-conceptions such as expectancies, attitudes and perceptions of a service neither always form prior to behavior, nor necessarily stay consistent and unchanged.

Research paper 1 concluded that perceptions prior to use were decisive for forming a positive attitude, but that attitudinal changes took place as services were accessed and tried. The empirical data showed how perceptions changed and re-shaped from experience and how new future-looking use-imageries were rendered. Research paper 2 added details to this by concluding that people actively reflect on previous as well as emerging experiences and observations with related technologies (especially internet services), cues in social surroundings, as well as own and others' activities and expressive actions with mobile services. It was shown how *reflexive monitoring* can throttle reconstruction and deconstruction to currently held expectancies and imageries. Reflexive monitoring is also the faculty from which

[123] For the ease of reading I will repeat the phenomenon of interest and the corresponding research questions here. The phenomenon of interest is: Shaping of user engagements with new mobile data services. Research question 1: *How is user understanding of new mobile services shaped during early mobile service experiences and engagements?* Research question 2: *What characteristic properties, gratifications and adoption/rejection behaviors shape around new mobile data services?* Research question 3 is: *How do service specifications, properties and gratifications enable and/or constrain user engagements with new mobile data services?*

unintended and unacknowledged conditions in user cognizance are illuminated and which later puts direction on de-patronizing and patronizing service engagements.

Research paper 2 and 4 along with other empirical findings underlying the Service Engagement Framework of the present chapter show how mobile services often are stumbled upon during browsing, play or exploration with a mobile device and its software. These findings do not naturally fit with unidirectional acceptance and adoption models generally assuming (often implicitly) high cognitive involvement prior to actual use. This is so as awareness in these cases does not exist prior to use but is first triggered as the user is able to monitor and process cues emanating from own or others' actual service use. From being invisible and unacknowledged such unanticipated consequences of own or others' use trigger acknowledgement of newness. In turn this can fuel cognitive engagement; the shaping of new imageries or the re-shaping of prior service conceptions. If no prior service conceptions exist, it is precisely here cognitive engagement initiates and understanding starts to shape.

From the conclusions about the nature of the process it is a clear need for researchers to include cognitions not only prior to engagements, but also to acknowledge effects of the monitoring of own and others' mobile service behaviors when designing our research. If not, we can risk hastily assuming high cognitive involvement prior to behavioral engagements and bypass behavioral feedback effects and consequences. Or worse still; we may equate acceptance and adoption with continued everyday service use. The research thus illustrates the need to follow the course of the process in order to understand what frequency we should expect regarding recurring engagements for a specific service. By so doing we can determine the degree of faithful, lasting and extended use, appropriation and adoption outcomes.

Conclusions to research question 2, which targets typified conceptions and behaviors, are found mainly in research paper 4 and under the Service Engagement Framework of this chapter. In research paper 4 conceptions concerning qualities and value aspects of the services investigated were typified and rubricated into a matrix of salient properties and gratifications. The services investigated during the field study were typified according to instrumental, aesthetic and expressive *properties* and their content, process and social *gratifications* of both hedonic and utilitarian types (cf. table 1 and 5 in research paper 4).

It is concluded that messaging services such as SMS, MMS and mobile e-mail all have strong expressive properties and are capable of offering gratifications on a large spectrum of

activities in everyday life – especially social and content gratifications. Typically the portal services were found to be narrower and more specialized gratifications scope, mostly offering hedonic and utilitarian content gratifications. The findings induce considerable consequences for how we should see and judge adoption outcomes. Especially expected frequency of recurring behavioral engagements will vary relative to what properties a service exhibits and the gratifications it can bring to users. The greater latitude a service has in providing gratifications to everyday life situations and the higher frequency of recurring use across a wide sphere of human activities, the more ingrained it will become in everyday life. Here expressive service properties are determinative. Of central importance is the expressive reach, i.e. the capability of a service to transmit content across a population mass. Expressive reach was associated with services most widely used – and most so for SMS. In paper 4 this was further underpinned by seeing how MMS, albeit its superior expressive richness compared to SMS, was severely limited with respect to expressive reach. Thus, it can be emphasized and concluded that intrinsic properties, i.e. properties directly related to the inherent specifications of the service, can be overridden by extrinsic properties which first appear and swell in salience as their network of users grow.

For services with expressive properties, as all interpersonal communication services, it is the expressive reach being of utmost importance for providing the most powerful set of social gratifications to users. On the other hand, for the portal services investigated, we found instrumental and aesthetic properties to be decisive for the rendering of compelling content and process gratifications. From studying different mobile service evolutions it was concluded that services with strong expressive properties, such as SMS and mobile e-mail, played dominant roles in catapulting further data-service use and innovation.

Behaviors registered during the research can be typified into three categories; explorative behavioral engagement, recurring engagement and disengagement. Explorative behavioral engagement represents a novel service engagement where a user interacts with a hitherto unfamiliar service. It can range from a swift trial based on thin imagery to more high involvement rational choice and planned behavior. However, and an important finding, was how the usual one-way causal association between cognition and behavior does not automatically apply for the process associated with mobile data services here investigated. It was foundthat explorative behavioral engagement often is unplanned and requires little or no

prior cognitive engagement. Behavior is not necessarily driven by a clear set of expectancies or well formed cognitions about service properties and obtainable gratifications. Instead it is often serendipitous, intuitive and explorative in nature.

Explorative behavioral engagement converts to recurring engagement when the user attempts of known reasons to evoke the essentially same experience as previously encountered. Recurring engagement refers therefore to essentially the same engagement with a certain service repeating itself. Compared to current terminology, recurring engagement is far more precise than the term adoption. Adoption may under the definition of "full use of an innovation" (Rohracher, 2003) span a broader range of behavior in which the service is more or less implied while recurring engagement specifically targets recurrence of a service behavior known by the user to evoke a certain (set of) gratification(s).

The final research question sought answers to how service specifications, properties and gratifications enable and/or constrain engagements with new mobile data services. This is answered largely in research paper 3 but also further theorized upon in the synthesis of the present chapter. The tripartite analysis of service specifications, properties and gratifications under the lenses of new-institutionalism showed how seemingly minor differences in artifacts and supporting wireless infrastructure can engender large scale socio-technical variations throughout service ecologies, e.g. as in Norway and Japan. Paper 3 illuminates how properties and gratifications institutionalize around infrastructural specifications that not only shape service use, but in turn also feed back to affect the further innovation and service use in wireless service ecologies. In its essence the study displays how widespread recurring service use is the root for the further institutional shaping of emerging socio-technical systems and the dynamics and evolution of service use herein. It is through recurring service use specifications, properties and gratifications take social manifest. When this happens the evolution of the system is enabled but also constrained by what has taken manifest.

Paper 3 shows also how service use and innovation is enabled and constrained by the open-endedness of institutional alignments formed around the specifications, properties and gratifications of messaging and the following bridging between institutions. It is alignments between specifications, properties and gratifications and the relative openness of specifications to be expanded upon which exert differentiating effects for systemic innovation and use. The analysis shows particularly how SMS and mobile e-mail, two services with strong expressive

properties, became firmly established in the service ecologies and of which core specifications further enabled the extended mobile data service use in Norway and Japan. It also showed how the underlying service specifications could establish as reverse salients (Hughes, 1987) which later constrained and directed service innovation and use. It is thus to conclude that the institutionalization of seemingly minor artifact differences in service and/or infrastructural specifications play a crucial role in enabling and constraining further service innovation and use.

The above conclusions are brought into the Service Engagement Framework in the present chapter as institutional feedback; an "input" of the framework in Figure 6-4 suggested to impact cognitive and behavioral service engagements. Institutional feedback from established properties and gratifications can both hinder and promote people's engagement with novel services. It hinders when the normative blocks for novelty, but promotes when novelty is facilitated or even propelled by the existing standards and social practices.

The analytical view, framework and approach established in paper 3 allow researchers to make deep level connections between the specifications enabling infrastructural and service capabilities which the overall properties and value of compound product-service offerings brought to market rely on. The tripartite view offers an analytical lens for dealing with the challenges of compoundness introduced in section 1.2.1. That is, it allows us to understand engagements with end-user offerings where properties and gratification are not purely decomposable to particular substances or forms of the artifact itself but also rely on infrastructural components and socio-technical consequences first created as service diffusion expands or services even institutionalize in society. The answers to research question 3 thus underline and echo the importance to theorize more carefully about the artifact of study (Markus, 2005; Orlikowski & Iacono, 2001). Field realistic insights about mobile services require that the challenges presented by compoundness, temporal dynamics and multi-sphere crossings (see chapter 1) are taken into account. The specificities of artifacts and the process of their shaping need to be reflected in our conceptualizations and in the theoretical and methodological apparatus applied to generate theory.

Returning to Weiser's future looking words quoted in Chapter 3, the undertakings of this dissertation have hopefully contributed so our understanding of ubiquitous computing can progress further into its most productive era. In the era of ubiquitous computing the dynamics

of engagements and disengagements of data services will propel. An unlimited array of different services will exist. Some will take manifest as killer applications, some will replace today's killer applications, and others will be fallen trees. This dissertation has offered both ideas and answers but also opened several arteries for which a flow of future research on these dynamics can be directed. The Service Engagement Framework and novel ideas presented in the papers contribute a basis for advancing scholarly and practical understanding of mobile service engagements and disengagements during their shaping. Exciting research opportunities already abound. That said, and as learned during this project, the progress of our understanding hinges on how the worlds of academia and industry engage in collaborative projects.

6.8 Implications for practitioners and scholars

R&D, product management and marketing staff of technology driven organizations constitute target audience positioned best to benefit from the work of this research.

The research should remind product managers and developers that in order for services to be gratifying they need to cater to value-contexts specific for mobile use, offer users freedom from complicated configuration procedures, and ubiquitously serve and support current day-to-day individual and social practices. More specifically it is observed that services with strong expressive properties capable of rendering valued social gratifications, e.g. interpersonal communication services such as messaging services, form the nucleus of mobile service systems. Once manifested, they can conduit engagement with other and more content oriented services. Moreover, the process of engaging with services must itself be gratifying. If not it can easily lead to disengagement. The tricky part here is the compound interplay of specifications from services, networks and devices which all play part in delivering or failing to deliver a gratifying service engagement process. Ensuring service gratifications thus becomes a responsibility for product managers and developers across firms throughout the value chain.

Market orientation and innovation is in management theory strongly coupled to superior performance (Kohli & Jaworski, 1990; Tellefsen, 1999) . In essence such organizational foci require continuous generation, dissemination and responsiveness to reliable market intelligence. The research of this dissertation contributes a perspective, classification categories and framework for gathering and organizing research. Especially specifications,

properties and gratifications as classification categories whereby mobile data services can be typified, ordered and analyzed should be of key value for targeting inquiries and prioritize product development, product management and marketing initiatives. Together with the lessons on institutional feedback and bridging of paper 3 this can unveil similarities and differences between services and highlight interdependencies in need of careful attention for making service use and innovation progress. It is in paper 4 concluded: "Common property interdependences and disruptions identified in this study suggests that alignments in the value system around critical properties may improve the overall value propositions of mobile services and position services more competitively relative to substitutes" (Knutsen & Lyytinen, 2006:76). The research should therefore help managers prioritize R&D activities and focus marketing initiatives.

For market researchers the perspective and results of this study call for a healthy portion of skepticism towards overly optimistic pre-adoption claims. I advocate that industry researchers and practitioners should have a positive and welcoming attitude towards the observation and reactions registered as people engage cognitively and/or behaviorally with services introduced in the marketplace. For contemporary agile and iterative software development processes (see e.g. Cockburn, 2006 for an overview), e.g. scrum, it is pivotal that market researchers most efficiently collect, analyze and disseminate these observations to product management and developers. Research has found that development with iterative reflections on user feedbacks, the system, and its metrics help stabilize development and lower overhead (Talby, Dubinsky, & Keren, 2006). The Service Engagement Framework forms a basis for studying cognitive and behavioral user engagements as they emerge. It should therefore equip practitioners with a better possibility to design conjoint development and research processes.

For service provisioning it was unveiled how important it is to integrate and innovate around the 'killer applications' as advances on service engagements depend heavily on the degree to which novelty naturally aligns with and extends the current or if it collides and forces a departure from it. From the study of SMS, MMS and mobile e-mail we learned that even if inherent specifications of a service are superior, this inherent superiority may be suppressed by extrinsic value factors emanating from widespread social use and service-infrastructure dependencies; e.g. network effects and compatibility. A key task for practitioners will therefore

be to bridge between the institutions of the internet and the world of mobile phones. Today we increasingly see social network services from the internet adapted to mobile environments. Windows Live Messenger, Hotmail, Gmail, Facebook and MySpace are some examples. Interestingly they all support messaging and other forms of interpersonal communication – and they all target social gratifications. Moreover, they all provide arenas for innovation where novel content, process and social gratifications will bridge and perhaps merge with the properties and gratifications users know from the internet. The Service Engagement Framework can here guide this bridging by helping practitioners examining the concrete properties of a service which optimizes user gratifications in a mobile environment.

Scholarly implications primarily rotate around the three key challenges facing research on mobile services identified in chapter 1. In particular, we find theorizing about services subject to the complexity caused by compoundness, multi-sphere crossing/contextual multiplicity and temporal dynamics[124]. The dissertation contributes a framework established on cross-disciplinary insights and grounded on field realistic insights that is tailored to a ubiquitous service environment. The Service Engagement Framework is established from iterative loops in the hermeneutic circle where literature from four research streams (TA, DoI, Domestication and U&G research) has been triangulated with secondary sources and primary field study data. With a service specific and field realistic grounding it constitutes a framework which can aid research on service understanding and use in environments characterized by complexity, multiplicity, interdependence and dynamism. In addition, a methodology and research design has been presented which ensures compliance between ontological and epistemological assumptions and the assumption of the hybrid framework.

Temporal dynamism was in chapter 1 identified as a key challenge and as an issue having received scant attention in current IS research. A central challenge for end-user research is to better account for temporal alterations along with the social learning aspects unfolding as new services are encountered across contexts. Development and application of the methodology and research design in this dissertation showed that multi-level and multi-method analysis can be beneficial for gathering field realistic insights about how services properties and gratifications can alter, emerge and increase in their salience as use of the services grow in

[124] Essentially echoes Markus' concern for dealing with multi-component artifacts, embeddedness and dynamism.

society. Thus, the hybrid framework complements here the dominant pre-adoption approaches of TA and DoI research.

The identification and definitions of engagement types have implications for scholars interested in post-adoption cognitions and behavior (Ahuja & Thatcher, 2005; Black, 1983; Jasperson et al., 2005; Karahanna et al., 1999). Of importance is the separation made between cognitive and behavioral engagement. Along with the concept of reflexive monitoring, it becomes possible to systematically study engagements prior, during and subsequent to service use. Furthermore we can study how explorative behavioral engagements, engagements by chance or unintended consequences of engagements may feed back and alter cognitive engagements. An implication of this is that we are better equipped to conduct studies on adoption and use beyond absolute points of acceptance. We can also assess if cognitions and behavior are faithful vis-à-vis initial perceptions. Researchers are furthermore equipped with terminology which is not based on high-involvement purchase/adoption scenarios, but are suited for an environment where services can easily be encountered serendipitously and where disengagement can follow explorative engagements abruptly or gradually.

Environments with compound product-service offerings increase the importance of specific theorizing about the artifact. The tripartite analytical approach of paper 3 not only helps overcome the tendency in research to focus on services as a 'proxies' or generalized artifact. By specifying and typifying a range of service properties and gratifications as service characteristics we can also discern causes of variations in service engagements and the associated outcomes in various service environments and user populations. Scholars are thereby equipped with a foundation for generating theoretical and empirical insight about different artifacts and their interdependencies. In turn this delineation of the artifiact improves our position for comparing and triangulating findings across and between studies and methods which also can increase research generalizability and validity.

The dissertation offers implications for how researchers can cope with artifacts crossings multiple spheres of everyday life and are used in physical and virtual co-presence. In acknowledging bi-directional influences existing between cognitions and behavior due to how people reflexive monitor own and others' actions and communications with services, we are able to absorb the social learning unfolding under contexts where people and new mobile services interface. Use of services across contexts or changes to the social, technological or

economic context can impact and alter conceptions held about properties and gratifications of services. Both the process 'component' of the Service Engagement Framework and the model presented in research paper 2 (introducing reflexive monitoring) enable scholars to study service engagements across contexts and how properties and gratifications are constructed a result from learning, communication and acts in different use-contexts.

Along with the institutional shaping view of paper 3 the tripartite analytical approach equips researchers to systematically assess how mobile service characteristics and interrelations can institututionalize. Also, we can account for the interdependencies between institutions which develop around provisioning and use. This offers explanations as to why even minute idiosyncrasies in specifications and their integration can forge alternative innovation paths; even at the systemic level. At this point the implication is not specific only to mobile services. Institutional shaping analyses of technological trajectories and shifts with basis in the tripartite analytical approach of paper 3 can be conducted on a large range of infrastructural system dependent artifacts. The institutional shaping perspective may thus shed new light on current explanations of technological trajectories and differences in between innovation.

The above are modest implications compared to the technological advances made since Weiser's projections on ubiquitous computing and his call for cross-disciplinary fertilization to adequately comprehend the new computing landscape. Today we have billions of users and connected devices – and a plethora of wireless services. Nevertheless, with these developments our theorizing has also progressed. With stronger cross-disciplinary frameworks at hand researchers and practitioners now have more substrates in place to thrust into the next era where computing truly is ubiquitous and service engagements vividly unfold. What is certain is that we will find some services with which we will engage, and others with which we disengage. True for all engagements and our learning about their shaping in time and space:

> "One must learn by doing the thing, for though you think you know it,
> you have no certainty until you try."
>
> Sophocles, 400 B.C (cited in Rogers, 2003:168).

Epilogue

The completion of this dissertation has been long underway. Along with the finalizing, I have enjoyed the challenge of being the manager responsible for mobile internet services at TDC A/S, Denmark's incumbent mobile carrier. In other words: I assumed responsibility of the services I researched. It has been an exciting period providing the opportunity to put the knowledge into practice and to further assess the relevance of the framework presented in this dissertation. I have seen how my work influence the specifications and the technological and commercial context, how this influences users and – more importantly – how users offer feedback in how they engage and disengage with the services created.

I clearly benefit from the PhD research undertaken in my everyday work. Over the last two years the research findings and mental frames developed have entered into the formulation of mobile internet and service strategies. It has also guided how new service creation and optimization is undertaken in iterative development and daily refinements. This includes new portals, mobile-TV and other multimedia initiatives. Today I am fed immediate reactions on what users do with the services. This makes it possible to immediately read figures on how people engage and disengage with the growing number of mobile internet services. Nevertheless, it is the voice of the users as they engage or disengage providing the truly interesting and valuable contributions as to how significant improvements can be made to the current – and how their forward looking imageries paint the contours of the future.

With the telecommunications carriers increasingly under a performance pressure it can be hard to devote sufficient resources to product development and innovation of new data services. Just figuring out the role of the carrier in the dynamic and hypercompetitive environment requires cross-enterprise efforts. Nevertheless, the telecommunication industry stands at a crossroad where the decline in traditional revenue sources forces a need to find alternatives. Much disruption is currently unfolding in the value chains. New players in the mobile arena, enter not only with disruptive product offerings but also with business models – many of them bypassing the traditional operator billing points. Apple's iPhone is a strong example. Moreover, existing players such as Nokia and Sony Ericsson and other device manufacturers are pushing hard into operator and internet service terrain with initiatives like OVI and PlayNow Arena. We are also seeing Google and Microsoft pushing ever deeper into control of the internet service experience to capitalize on digital advertising in mobile phones. The most recent initiative has been Google's launch of the Android operating system and their web browser Chrome. Also seeing how banks and payment firms have large mobile payment initiatives running it is clear that the pieces of the checker board are moving rapidly at the moment. With this the pressure of the telecommunications carriers builds and the role of the carrier in the service ecology will be challenged.

It is vital for telecommunications carriers to understand the new reality the mobile internet brings and which revenue points shall sought maintained and captured. The participants in this research called for flat rate data models and for services being more relevant to location, situation, needs in everyday life. They also called for compound product-service offerings that integrate features across services, devices and connectivity.

Even if years have passed since this was uttered, neither of these wishes has been sufficiently served. We are seeing flat rate data packages starting to arrive in the market. This the carriers can decide alone. But to offer a future in the way the participants called for is a far

more complex task which stretches across the value network and internetworkable devices and services. The following dialogue from one of the group interviews epitomizes this and offers strong hints to where the above players move:

> -I don't know if it is Nokia or Sony Ericsson that has a device where you can fold out the keyboard on. Can you remember which one that is?
> -No. But, I can remember there was something about that…
> -But that would be really smart. Immediately you have a PDA interface. But you also have a keyboard if you want to SMS or enter a phone number really quickly. And then I want this device to be fully integrated with location based services; with navigation, route information – plus payment etc. And also all type of synchronization should happen seamlessly and automatic. So that when the phone detects your computer, it will automatically synch. If that was to come in the future, I would also be willing to pay a subscription where you had a form of flat rate of voice and services so I don't have to think about what it will cost to check the different things online. And, it would be really smart – well it may not be necessary if you have flat rate… but I was thinking that it could hook up on the fixed line when you were at home. It is completely ridiculous from a user perspective that you have two phones – the mobile and the fixed – that you consciously have to decide which to use because there are different tariffs. It makes no sense to me that it is not integrated. It should of course also have WiFi and in the future it should support WiMAX so you will have high speed wireless coverage anywhere.
>
> Group Interview, 2004

While we today can know about the future only what knowledge and fantasy permits, it is clear that realization of the converged coumpound solution described above is not under the control or responsibility of one firm. As firms collaborate and compete and the services, networks, and devices come together we will be amidst one of the most interesting and perhaps most prolific periods of socio-technical research yet. Armed with our methodologies, tools, questions and theoretical guidance we stand ready to watch, learn and document the story of the artifacts that users declare winners and losers by their engagements and disengagements. I am intrigued to take part in the journey. I look forward to shaping my own engagements with unwired artifacts in our future everyday life. But even more I look forward to also contribute to the shaping of this future by absorbing, interpreting and applying the knowledge and imageries rendered during user engagements.

Lars Andreas Knutsen
Copenhagen, December 12, 2008

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APPENDICES

Appendix 1: Research papers selected for the dissertation

The papers appear as copies of their original publication.

Appendix 1a: Research Paper 1

M-Service Expectancies and Attitudes: Linkages and Effects of First Impressions

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M-service expectancies and attitudes: Linkages and effects of first impressions[1]

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Abstract

This article explores the relations between expectancies and attitudes towards new mobile services and how perceptions underlying the constructs alter in the immediate period upon trial of the services. First, a simple structural equation model is tested and linkages between performance expectancy, effort expectancy and attitude are verified. Second, to obtain an in-depth understanding of changes pertaining to the respondents' first impressions of the services vis-à-vis the three latent constructs, a qualitative exploration is also undertaken. Together the results from the quantitative and qualitative investigations suggest that attitudes towards new mobile services are fragile and easily subject to alteration based on first experiences and impressions.

1. Introduction

Industry expectations of mobile service diffusion are daunting. It has been estimated that online access over mobile channels will reach 24% of all homes in North America, 33% in North West Europe, and 27% in Eastern Europe by 2010 [1]. In Japan the mobile channel has for years been the most common point of access to online services[2]. Yet, we have not witnessed the same acceptance, adoption and use in most of the western hemisphere. Although many explanations, ranging from cultural or mystic oriental alchemy to deeper analysis of infrastructure, inter-firm collaboration and business models, have been provided, it appears that true mobile – or even ubiquitous – value for users is a core recurring theme [3-5].

A few years have passed since Anckar & D'Incau [6] pointed out that the primary drivers for adoption and intention to adopt mobile services – the consumers' actual reasons – had received superficial empirical scrutiny. While many have suggested paths and roadmaps for future research [7-9], and a growing body of researchers have started to chart out specific factors impacting use and adoption [10-12], empirical evidence is still diminutive.

User acceptance and diffusion studies of mobile services are, however, increasingly gaining credence for inducing the critical factors impacting mobile service provisioning. Several behavioral models currently at core in IS acceptance research, i.e. models recently joined by Venkatesh and colleagues [13] to the Unified Theory of Acceptance and Use of Technology (UTAUT), are now being utilized in a mobile service context. For instance, Hung, Ku and Chang [14], based on the theory of planned behavior (TPB) and diffusion of innovation theory (DoI) [15], examined critical factors affecting WAP services adoption. Similarly, but based on the Theory of Reasoned Action [16] (TRA) and the Theory of Planned Behavior, Khalifa and Cheng [11] analyzed the role of exposure to mobile commerce and linkages to attitude, behavioral control and intention to adopt mobile commerce. These and other studies inform us of the applicability of technology acceptance and use models in an m-service setting. However, with the emergence of ubiquitous service solutions where technology can potentially blend with, permeate and support most everyday practices of social life, critical voices have reminded us that aggregate diffusion models and predictions of future behavioral intentions must be addressed from multiple angles [8, 9].

This article takes a dual approach to analyze attitudes towards new mobile services. First, the statistical relations between expectancies towards new mobile services, expectancies of efforts needed to utilize new mobile services and attitude towards mobile services are analyzed by combining central items from the UTAUT framework with central linkages from TRA/TPB. Second, a qualitative investigation of open ended statements pertaining to each of the latent constructs assessed in the structural model is undertaken to gain insight of how experienced first impressions can alter respondents' perceptions of the latent constructs. Together the two analyses form a basis for understanding attitudes towards new mobile services and how they evolve in the

[1] * This research was conducted as part of the Mobiconomy project at Copenhagen Business School. Mobiconomy is partially supported by the Danish Research Agency, grant number 2054-03-0004.

immediate period after respondents have been provided access to new mobile services.

The empirical evidence in this research is derived from a currently ongoing in-depth and longitudinal investigation of 38 Danish mobile phone users. The results of the statistical investigation are based on data collected from a questionnaire issued to the participants before they were provided a new mobile phone with new mobile service possibilities. The open-ended responses reflect the participants' performance and effort expectancies as well as attitudes two weeks subsequent to project launch.

The paper is organized as follows. First, a review of current theory of user acceptance of mobile services is presented in relation to central constructs from technology acceptance research in the IS field. Second, the research model and hypotheses are presented. Next, the research method is described. Then analytical results are presented in two subsections, the first addressing statistical results form the structural model and the following presenting bracketed results from the open ended responses. The last section concludes the paper.

2. M-service expectancies and attitudes

Repeated calls have been issued for more end-user studies in the context of mobile services [6, 7, 10, 17]. Although progress is being made, for instance with studies of critical success factors of WAP [14], evaluation criteria for mobile shopping site selection [18], impacts of location aware advertising [19], effects of technological exposure [11] and socioeconomic and demographic variables impacting m-service adoption [6, 17], there are still vast empirical landscapes to chart. In rebutting the argument that lack of relevant research has impeded the progress of understanding adoption of mobile internet services, Pedersen and Ling [8] point out that several research constructs already applied in adoption oriented IS research can be modified and deployed in a m-service context. In particular, for micro-level studies they augment the role of combining technology adoption research aiming to explain and describe determinants and behavior with effects and consequences by utilizing gratifications research focusing on the individual adopter. For this approach technology acceptance research will naturally play an important role, but will need to be undertaken from a temporal perspective in order to accommodate consequential effects occurring subsequent to adoption.

Since the initial conceptualizations of technology acceptance models, measures pertaining to the role of perceived usefulness, expectancies towards future utility, relative advantages, ease of use, expectancies towards relative efforts and attitude towards the new technology in question have been central in the eight predominant models which later have emerged [13]. Yet, there are several conflicting views on how the latent construct relates to intentions, acceptance and use of technology.

In TRA and TPB it is stipulated that attitude is antecedent to intentions and that behavior is preceded by behavioral intentions. For instance, in the aforementioned study by Hung et al. [14] the latent constructs of ease of use, usefulness and user satisfaction were the three most significant influencers of attitude towards WAP services and attitude was found to significantly impact intention.

However, in the UTAUT framework by Venkatesh et al. attitude is posited to impact intention to use *through* effort expectancy and performance expectancy and intention is considered to precede actual behavior/use. Thus, attitude is in the latter not considered a direct determinant of intention.

Despite the apparent differences regarding whether or not the latent constructs affect attitude or intentions, it appears to be convergence around the importance of variables reflecting performance and efforts.

The latter is reflected in the recent development and tests of the UTAUT framework where the construct labeled *'Performance Expectancy'* by Venkatesh et al. [13] unites measures from the root-constructs of perceived usefulness, extrinsic motivation, relative advantage and outcome expectations. In their tests, the united measure was found to be the strongest predictor of *intentions to use*. Moreover, a second construct labeled *'Effort Expectancy'* was constructed to accommodate measures from the root constructs of perceived ease of use, complexity and ease of use. This construct was also found significant in both voluntary and mandatory usage settings and particularly significant in the early stages where users first became acquainted with a new technology.

In the context of mobile services, and especially with lessons learned from the troubles of WAP, expectations have been highlighted as a sincere arbiter of a positive or negative attitude towards mobile services and a construct which can alter dramatically if user expectations are not accommodated [5]. Takeshi Natsuno, one of the master architects behind i-mode has proclaimed that "Once you damage subscribers' first perceptions, they never come back to your service… The first impression is very, very important" [20]. The importance of expected user friendliness, usefulness and attitudes is well highlighted in the mobile service evaluation framework presented by Pedersen, Methlie and Thorbjørnsen [9]. They point out that underestimation of user expectations can be particularly troublesome for services exhibiting strong network effects. Concurrent with these scholars, it is therefore argued that more importance should be given to the attitude concept and how it becomes affected by expectations pertaining to mobile service performance and efforts.

Hence, as attitudes and changes in attitudes during the immediate period of initial m-service learning among

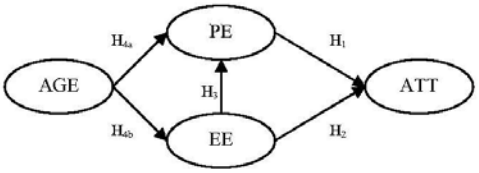
users is at core in this research, a compromise position is taken where suit is followed with the TRA/TPB approach viewing individual attitudes towards mobile services to be affected by measures related to the UTAUT [13] concepts of 'Performance Expectancy' and 'Effort Expectancy'. Performance Expectancy (PE) is in the context of new mobile services defined as *the degree to which an individual perceives new mobile services to provide benefits in everyday situations.* Effort Expectancy (EE) is defined as *the degree to which an individual associates ease – freedom from difficulty or great effort* [21] – *with conc*eived *use of mobile services in everyday usage scenarios.*

3. Research model and hypothesis

Based on prior technology acceptance research a research model was constructed with a small sample scenario in mind. Thus, the number of latent variables (LV) and individual difference variables were selected based on their relative importance in prior research.

The research model with hypotheses between AGE as an individual difference variable and the latent constructs of PE, EE and attitude (ATT) is illustrated in Figure 1.

Figure 1: Constructs and relations of the research model



In prior research, for instance in Hung et al. [14] and Hubona [22] and Burton-Jones, (perceived) *usefulness* was found to have a significant impact on attitude. As usefulness is considered a root construct of performance expectancy in Venkatesh et al.'s UTAUT framework it seems plausible to argue that:

H_1: Performance expectancy has a significant positive influence on an individual's attitude towards mobile services.

Ease of use has in previous research been found to not only have a significant effect on attitude [14, 22], but also to have a significant effect on usefulness [22]. As a root construct of effort expectancy it is therefore suggested that:

H_2: Effort expectancy (ease) has a significant and positive influence on an individual's attitude towards mobile services.

H_3: Effort expectancy (ease) has a significant and positive influence on performance expectancy.

Age, gender and experience have been either treated to yield indirect or moderating effects on performance and effort expectancy and related root constructs [13, 22]. Furthermore, these constructs have been posited to work in concert. However, due to the small-sample scenario and that age in previous research on mobile service adoption has been highlighted to be a central distinguishing parameter for mobile service adoption [17], age will be the only individual difference variable included and is posited to indirectly affect attitude through performance expectancy and effort expectancy.[2] It is expected that younger people will have higher performance expectancy and greater associated levels of ease with new mobile services.

H_{4a}: Age has a significant negative impact on performance expectancy.

H_{4b}: Age has a significant negative impact on effort expectancy.

4. Research method

As the research aims to both measure the constructs and their relations while subsequently gain a more in-depth insight to how the constructs can alter in the first period after m-service trial, a dual set of questions is needed; one for the quantitative part and one set for the qualitative.

4.1. Instrument development

Originally nine questions were utilized to measure PE, four to measure EE and five to measure ATT. The questions were based on the UTAUT items operationalized by Venkatesh et al. [13] but were adapted with appropriate wording for a mobile service context. Due to the small sample scenario only the highest loading items from a factor analysis (cf. appendix 1) were included to estimate the constructs in the structural model. Scale reliability was tested and returned Cronbach's Alfa of .90 for PE, .94 for EE and, .95 for ATT.

[2] Experience and gender was tested for individually and as an integrated variable together with age. However, age alone yielded the strongest effects.

Table 1: Items selected for the latent constructs

Item	Question as formulated in questionnaire
PE1	New mobile services will be useful in my everyday life.
PE2	New mobile services will support my lifestyle.
PE3	New mobile services will make me accomplish everyday tasks more quickly.
EE1	Learning to operate new mobile services will be easy for me
EE2	It will be easy for me to become skillful at utilizing new mobile services in my day-to-day life.
EE3	I will find new mobile services easy to use.
ATT1	Using new mobile services is a good idea.
ATT2	I find mobile services interesting.
ATT3	I welcome new mobile services.

Following suit with Venkatesh et al. [13], seven-point scales were utilized for all items where 1 indicated the negative end (disagree completely) and 7 the positive end of the scale (agree completely).

For the in-depth assessment of the latent constructs, a set of open ended questions were developed. The questions are found in the table below.

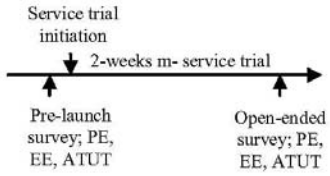
Table 2: Open ended items utilized for in-depth assessment of changes upon m-service trial.

PE	How do you see the new mobile services to affect or contribute to your everyday life?
EE	How would you describe the efforts you have to make in order to utilize the new mobile services?
ATT	How would you describe your attitudes toward using the new mobile services in your everyday life?

4.2. Data collection and sample selection

Data were collected at two points in time (see figure below). For the measurement model data were collected based on an online survey tool (links sent through e-mail) just before the 38 participants were provided a new Nokia mobile phone with a SIM-card opening for access to a range of new mobile services in eight different service categories on a Danish GPRS/WAP based mobile service portal.

Figure 2: Data collection



For the investigation of changes pertaining to the latent constructs, an open ended questionnaire was provided to the participants over an online-survey tool 2 weeks subsequent to the initial survey.

Both data collections are part of the MUSE project longitudinally investigating the emergence of mobile service practices and learning in three target-groups of potential m-service users. The project aims to triangulate data based on the three groups of users' regular answers to questionnaires, discussions in group interviews, and the actual usage statistics registered by a mobile operator. Thus, the data are not aimed to be representative, but rather descriptive for the group being researched. The main criterions used to select the three groups were 1) relevant demographic target groups for mobile service provisioning and 2) frequent social interaction between the participants within each group. Of the participants 57% are male and 43% female and the average age is 29.

4.2. Statistical analysis

Descriptive statistics, scale reliability analyses and factor analysis was performed in SPSS (v. 11.0) whereas PLS-Graph (v. 3.00 b. 1126)[3] was used to estimate the structural equation model and to test hypothesis.

One of the beneficial properties of PLS (partial least square) over other SEM estimation methods is the method's appropriateness for small-size samples. The main underlying condition for the small size sample requirements is that the method does not require restrictive distributional assumptions about the underlying data. Chin [23] explains that for adequate power, the general rule of thumb is that sample size is either to be 5, if a weak regression heuristic is deployed, or 10, if a strong regression heuristic is deployed, times 1) the block (the set of indicators underlying a latent variable) with the largest number of formative indicators (largest measurement equation) or 2) the dependent latent variable with the largest number of independent latent variables impacting it (i.e. the largest structural equation measured

[3] For more information about PLS graph please confer W. Chin's homepage: http://disc-nt.cba.uh.edu/chin/plsfaq/plsfaq.htm

at any time in the regression). With all items in the specified model being reflective (eliminates collinearity within blocks); the largest regression at any time in the model specified will involve 2 independent LVs. Thus the sample size of 38 should secure adequate power.

Standard errors, t-statistics, average variance extracted (AVE) are estimated by utilizing PLS-graphs bootstrapping re-sampling procedure. For the bootstrapping, the number of re-samples was set to 200.

4.3 Open ended analysis

To analyze the open ended results a three step approach was utilized. First the respondents' answers to the three questions were partitioned for key similarities. Second, they were placed into a clustered summary table [24] based on common performance expectancies, effort expectancies and attitudes. Following the clustering, the key findings were extracted and illustrative examples were chosen (cf. appendix 3).

5. Results

5.1. Pre-launch model estimation results

The results from the PLS estimation procedure with 200 re-samples and individual sign change preprocessing is reported in the tables below and illustrated in figure 3.

Table 3: Loadings, significance and composite reliability (ρ)

Construct	Item	Load	SE	t-stat
PE	PE1	0.9154	0.0243	37.7408
ρ = 0.936	PE2	0.9220	0.0274	33.6532
AVE=0.829	PE3	0.8945	0.0360	24.8389
EE	EE1	0.9137	0.0462	19.7812
ρ = 0.963	EE2	0.9678	0.0097	99.7325
AVE=0.896	EE3	0.9576	0.0137	69.8097
ATT	ATT1	0.9354	0.0217	43.0077
ρ = 0.968	ATT2	0.9667	0.0124	77.7687
AVE=0.909	ATT3	0.9578	0.0185	51.7021

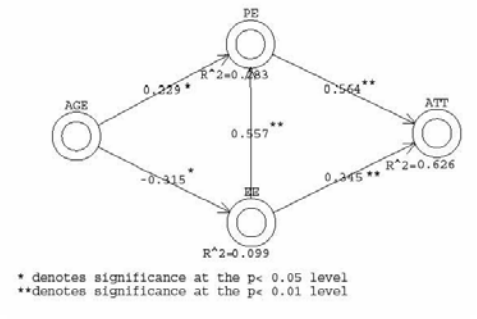
All loadings of the outer model indicators are significant and larger than 0.70. Moreover, the indicators are internally consistent with composite reliabilities larger than 0.70 and the AVE extracted from the latent constructs are all larger than the correlations between constructs (cf. appendix 2).

To assess the significance of the coefficients (table 4) the t-statistics computed by the series of PLS evaluations made against several partitions of the data set in the bootstrap procedure are used.

Table 4: Significance of Path Coefficients (T-Statistic)

	PE	EE	ATT	AGE
PE	0.0000	5.5260	0.0000	2.4468
EE	0.0000	0.0000	0.0000	2.3479
ATT	5.4640	3.1548	0.0000	0.0000
AGE	0.0000	0.0000	0.0000	0.0000

Figure 3: The PLS-model



As seen in the figure above, the path coefficients from PE to ATT, EE to ATT, and EE to PE appear significant at the $p<0.01$ level and H_1, H_2, and H_3 are supported. The loading of AGE towards PE is just short of being significant at the $p<0.01$ level, but is, as for AGE towards EE significant at the $p<0.05$ level. As expected, increased age seems to connect to lower levels of anticipated ease with new mobile services. However, contrary to H_{4a} age appear to have a positive effect on performance expectancy indicating that older participants have higher expectations towards new mobile services.

Overall the independent variables explain 62.6 per cent of the variance of ATT. The percentage of the variance AGE and EE together explains of PE is estimated at 28.3 while AGE only answers for 0.099 of the variance of EE.

5.2. Post-launch – open-ended response assessment

The results from the open ended responses reveal noteworthy findings concerning how experienced first impressions moderate the perceptions pertaining to each of the latent constructs. The observations pertaining to each variable will be discussed consecutively. Results are also reported in appendix 3.

5.2.1. Performance Expectancy. For PE there are four findings which warrant emphasis.

First, the convenience and speed experienced from surfing on the Internet appear to be instantiated in the participants' performance expectancies of new mobile services. In fact, in eleven open ended responses is it

explicitly indicated that when it comes to information and entertainment services these are better served by the Internet. Also, spending money on service and traffic charges is compared to the relative price of accessing 'the net'. Interestingly, this is almost perceived as free, while to obtain 'the same information' on the mobile phone is considered expensive. Not only is it indicated that the first impression is moderated by experiences with substituting technologies, but also by the perceived performance/price ratio of the reference technology.

Second, for information services the experienced possibility of obtaining information while 'on-the-go' is considered useful. Specifically, if the information can support other 'nomadic' undertakings, it is considered to have increased usefulness. Similar to expectancies towards entertainment based services, the information related services are often expected to benefit everyday life in typical 'time-to-kill' situations (i.e. while in transit, under transport etc.).

Third, although the participants have the possibility to use voice calls, SMS and MMS for interpersonal communication, the possibility to access e-mail anywhere and at anytime is explicitly emphasized in 19 of the open ended responses to be a benefit to the participants' everyday life. This is consistent with the findings of a survey among 1103 Danish respondents where e-mail together with closer interoperability and synchronization with calendar and mail on the computer was the most wanted service/feature on a mobile phone [25].

Finally, and reflecting the above, the greatest common expectancy towards new mobile services is ubiquitous communication and information retrieval; access to context relevant information that support everyday life practices and communication. However, although high expectations are registered concerning this, the responses pertaining to PE appear to be moderated by the first impressions pertaining to EE.

5.2.2. Effort Expectancy. For the efforts needed to utilize new mobile services, the participants' responses were easily divided into three categories.

First, only a group of six participants found new services to be easy and convenient to use and did not require any learning to utilize them.

However, and to the second category of EE responses, taking time appeared to be an effort. More than half of the open ended responses reflect difficulties accepting the time needed to access the services as well as the time-efforts spent waiting for services to download. With the Internet as a point of reference, the first impressions of the speed of the GPRS/WAP based mobile services clearly contrasted expectations.

The third important observation pertaining to EE is efforts relating to configuration and set-up. It was mentioned explicitly in about a third of the responses that obtaining the knowledge necessary to finding the procedure on the Internet to enable configuration of MMS was deemed nothing but easy and convenient. In fact, several respondents indicated little understanding for why this was not pre-configured. Similarly, obtaining the knowledge of e-mail possibilities as well as setting up the e-mail function was also highlighted among the cumbersome efforts needed in order to utilize new mobile services. Thus, the first impressions concerning configuration efforts experienced during the trial period appeared to negatively moderate the level of ease associated with using new mobile services.

5.2.3. Attitudes towards mobile services. The results from the open ended responses and the effects of first impressions on attitude are also threefold.

First, there is a set 14 responses which explicitly express an increased negative attitude towards using new mobile services as their experience have not lived up to their expectations. Among these it is reported that while the attitude was positive before trying the services, disappointment and negative surprises have colored their attitudes: "…I have been negatively surprised when i started using them." With the significant linkages found between PE, EE and ATT, it is presumably so that slow service functioning, service-situation fit, and cumbersome configuration has contributed to these changes in attitude.

The second group, encompassing a quarter of the responses pertaining to ATT, reflects a quite unchanged attitude of either little interest in new mobile services or having a quite positive and welcoming attitude. Common for these is that more useful services that appeal to the users' true needs are warranted for a more positive attitude to be present.

The latter point is also reflected in the third set of ATT responses where use of services has triggered an urge for services that are more useful in everyday situations and that support day-to-day activities. However, while the second set of responses indicated a rather indifferent attitude towards new mobile services, the third set of responses, housing nine similar responses, reflect an increasingly positive attitude. For both sets it is interesting to note their responses reflect expectations of services that better serve, as Anckar & D'Incau [6] puts it, true mobile and wireless value. As indicated by one: "I am looking forward to services which can support my interaction with contacts and services helping me to find way to locations."

6. Conclusion

The purpose of this article has been (1) to explore the relations between expectancies related to performance of new mobile services, the efforts needed in order to utilize new mobile services and to see how these constructs affect attitudes toward new mobile services, and (2) to

qualitatively assess perceptions related to these constructs as first impressions of the mobile services are generated.

For the first purpose, a simple structural equation model was developed and measured. The empirical results significantly verified the hypothesis between PE, EE and ATT as well as between EE and PE at the .01 level, while the personal difference variable of age was only significant on PE and EE at the .05 level.

However, and for the second purpose, as the results suggest that PE and EE are strong determinants of attitudes towards new mobile services, the factors affecting these constructs in a mobile service setting were subject to further scrutiny. Specifically, to obtain in-depth insights on how the PE, EE and ATT can change during the initial period of new mobile services trial, as first impressions are formed, each construct was also investigated from a qualitative perspective. The analysis of the open ended responses revealed important indications where (1) the Internet was used as a point of reference for participants' expectancies towards mobile services, (2) information services are expected to serve day-to-day undertakings in order to be more useful, (3) integrated interpersonal communication channels (e.g. e-mail) was important for performance expectancy despite access and use of SMS, MMS and regular voice telephony, and (4) seamless integrated connectivity and context-supported mobiles services – succinctly put – more ubiquitous mobile services were expected. For Effort Expectancy the open ended responses revealed that few project participants found the services very easy to use. In fact, a large section of the answers revealed that just taking the time to access and use the services was associated with great effort. Moreover, efforts needed to obtain the knowledge and configuration settings necessary to utilize some of the mobile service functions was considered unnecessary hard.

Overall, the findings from the open ended questions pertaining to EE and PE indicated to have effect on the respondents' attitudes. Specifically, as first impressions were generated from the participants' experiences, increased negative attitudes were recorded among respondents that prior to service use had stated that they were positive towards new mobile services. On the other hand, there were also several of the participants issuing responses where their attitude had not changed significantly. What is more, about half of the participants explicitly responded that they would be even more welcoming towards new mobile services if they would be more useful in everyday situations and provide true wireless and mobile value.

In sum, the findings of this research suggest that in order to promote and enable the creation of positive attitudes around mobile services, the services need to cater to value-contexts specific for mobile use, provide users freedom from complicated configuration procedures, and ubiquitously serve and support current day-to-day individual and social practices. Unless these issues are augmented, the reflections of first impressions on attitude are likely to result in negative rather than positive feedback effects.

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Appendices

Appendix 1: Factor loadings of test panel questionnaire items

	Component		
	PE	EE	ATT
PE1	**0,717**	-0,155	0,406
PE2	**0,834**	0,066	0,127
PE3	**0,825**	0,241	0,002
EE1	-0,043	**0,916**	0,075
EE2	0,102	**0,866**	0,131
EE3	0,160	**0,842**	0,115
ATT1	0,073	0,106	**0,859**
ATT2	0,119	0,151	**0,831**
ATT3	0,156	0,178	**0,782**

The table shows the results of a factor analysis (principal component) with oblique rotation performed to provide evidence of the factorial validity for the items and scales at for each of the latent constructs.

Appendix 2: Correlations between constructs and AVE

	PE	EE	ATT
PE	*0.829*		
EE	0.496	*0.896*	
ATT	0.741	0.614	*0.909*

On-diagonal numbers present average variance extracted (AVE). Off-diagonal – correlations between constructs

Appendix 3: Clustered Summary Table of open-ended responses

Performance Expectancy	Key Observations	Illustrations
No or little	- see little or no contributions - expect no benefits/value - greater benefit from the Internet - mobile phone not more than a communications device	"I don't think they affect or contribute to my everyday live. All the information and services I need can be found on the Internet and since I have access to the net almost 24-7 I don't want to spend additional money on mobile services." "I don't think they have great influence on my everyday life. This may be because I cannot find out of using all the services, but also because I don't find them as interesting as I first thought they would be."
Information	- see benefit in being updated - freedom to access information anytime and anywhere	"They can help make many different kinds of information easier available to me. They can help me act faster, e.g. make me able to receive information while on the go." "It makes receiving relevant information easy: It does not matter what time it is or where you are - you can always get the information you need."
Entertainment	- see value in being entertained - expect the services to spur joy in dull moments - expect funny content	"If you are bored or haven't anything better to do e.g. on your way home from work which takes you near 30 min. in the train. Then one can enjoy the ride by using the many services to kill time with :)" "In the fun way!" "I have been downloading ringtones and games for entertainment reasons."
New forms of communication	- seek additional means of communication - enjoy the freedom to access mail anytime and anywhere	"Checking my mail on the mobile gives me freedom of movement." "I do like to have the e-mail send directly to the phone"
Multiple	- expect useful services - have expectations towards better situation-service fit - greatest expectations related to ubiquity - entertainment and joy sought	"If the mobile services are relevant/practical of usage such as the road or telephone directory ('find place/way') then I'm definitely sure that it can be helpful in many situations. Fun services such as games jokes horoscopes dating etc. can only be useful in situations when you are bored" "I find it highly convenient that I can go on the internet on the go. Moreover games and downloads are fine time killers … In short, they provide me information, entertainment and pleasure."

Effort Expectancy	Key Observations	Illustrations
No or little	- found services to be easy to use - no hurdles in order to access - no/little learning needed	"Nothing was difficult as far as utilizing the mobile services were concerned." "I have used the mobile services without any problems and I find them easy and convenient to use."
Time	- taking time to use the services experienced as an effort - expect easy and fast access to content and services	"There is too much effort involved as services work poorly sometimes and the connection the speed is slow - the result does not live up to my expectations." "Patience patience patience. The services are simply to slow. It takes to long to surf around." "It takes too much time. Download of apps and content is too slow and is quite cumbersome. In general, the conclusion is: SLOW"

Configuration / set-up	- obtaining the knowledge of how to configure the phone in order to use services considered an effort - Expect less efforts needed to use services; i.e. 'pre-installed' and ready to use functions	"It's annoying that MMS functions etc. are not pre-installed in the mobile phones. " "I think that sometimes it can be pretty cumbersome to install and exploit the services/features. It's rather annoying to set up my e-mail client" "Until I found out how to set up the possibility to send MMS on a homepage it was pretty frustrating. Also it is a annoying that I'm not able to check work mail on it because of the potential security risk."

Attitude towards MS	Key Observations	Illustrations
Increasingly negative	- Negative attitude emerged after having tried the services. - Attitude changed from positive to negative - Disappointed over limited usefulness	"I was in general positive to begin with but more than often I have been negatively surprised when i started using them." "I have tried most of the services in a positive spirit, but have in general become disappointed that most of the services are rather useless."
Little interest	- Have limited interest and indifferent attitude towards in using new mobile services	"I don't really take the time to explore the new services. I guess that's my limitation to using them – but this may say something about my attitude and interest." "My attitude is still pretty much the same. I rarely use them as I'm not used to use them - I kind of forget them."
Still positive	- Attitude remained unchanged	"I'm still positive." "I am still welcoming" "I consider myself as open minded toward new services. However, the services have to appeal to me! If it can help my everyday tasks in any way I will apply it. On the other hand I am not interested in horoscopes and ringtones etc."
Growing interest	- Attitude has become more welcoming with use of mobile services	"The more I use the phone, the more needs and interest emerge." "I find it interesting because it's new to me. If I get a hang of it and it isn't too expensive I predict that I will use it more "
Increasingly Positive	- Attitude has grown considerably positive - Would be even more positive if services were more useful to everyday situations.	"Very positive. I think the services provided are very useful in my everyday life and plan on using them frequently. Some of them I could do without (the ones I only use for fun like the camera and MMS functions). But overall I'm very positive towards using the services in my everyday life." "My attitude is positive. I am looking forward to services which can support my interaction with contacts and services helping me to find way to locations."

Appendix 1b: Research Paper 2

Reflexivity, the Social Actor and M-service Domestication: Linking the Human, Technological and Contextual

Published: Proceedings of the IFIP 8.2 Working Conference on Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges

Available via CBS library

Blechar, Jennifer, Knutsen, Lars & Damsgaard, Jan (2005): Reflexivity, the Social Actor, and M-Service Domestication: Linking the Human, Technological, and Contextual. In: Designing Ubiquitous Information Environments. Socio-Technical Issues and Challenges. IFIP Tc8 WG 8.2 International Working Conference, pp. 57-181.

Appendix 1c: Research Paper 3

Messaging Specifications, Properties and Gratifications as Institutions: How Messaging Institutions Shaped Wireless Service Diffusion in Norway and Japan.

Published: Information and Organization

Available online via ScienceDirect:

http://www.science-direct.com/science/journal/14717727

Knutsen, Lars A., Lyytinen, Kalle (2008): *Messaging specifications, properties and gratifications as institutions: How messaging institutions shaped wireless service diffusion in Norway and Japan.* Information and Organization 18(2), pp. 101-131.

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Appendix 1d: Research Paper 4

Properties and Gratifications of Mobile Services: An Explorative Investigation

Published: SIM – Systèmes d'Information et Management (SIM). Special Issue on Mobile Information Systems and m-business

Available online via ABI Inform.

Knutsen, Lars A., Lyytinen, Kalle (2006): *Properties and Gratifications of Mobile Data Services: An Explorative Investigation*. Systèmes d´Information et Management, 11(2), pp. 51-112.

Appendix 2: Papers authored/co-authored during PhD project

Knutsen, L. A., & Lyytinen, K. (2008). Specifications, Properties and Gratifications as Social Institutions: How Messaging Institutions Shaped Wireless Service Diffusion in Norway and Japan. Information & Organization, 18 (2)

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Constantiou,I.D., Damsgaard J. and Knutsen, L. (2006)."Exploring perceptions and use of mobile services: User differences in an advancing market". International Journal of Mobile Communications. 4 (3) 231–247.

Knutsen, L. A., & Lyytinen, K. (2005). The Difference is in Messaging: Specifications, Properties and Gratifications Affecting the Japanese Wireless Service Evolution. Paper presented at the MOBIS IFIP 8.6 conference, Leeds, UK. / Also published as a Sprouts Working paper.

Knutsen, L. A. (2005). M-Service Expectancies and Attitudes: Linkages and Effects of First Impressions. Paper presented at the Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS '05). The Big Island, Hawaii.

Blechar, J., Knutsen, L. A., & Damsgaard, J. (2005). Reflexivity, the social actor and m-service domestication: Linking the human, technological and contextual. In Proceedings of the IFIP 8.2 Working Conference on Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges, Cleveland, OH, USA. Available via CBS Library

Knutsen, L. A., Constantiou, I., & Damsgaard, J. (2005). Acceptance and perceptions of advanced mobile services. Paper presented at the Proceedings of The Fourth International Conference on Mobile Business (ICMB 2005), Sydney, Australia. Abstract

Knutsen, L. A., & Overby, M. L. (2004, July 12-13th). Strategic Postures and Compound Product-Service Offerings: Supply and Demand-side Implications. Paper presented at the International Conference on Mobile Business (ICMB 2004), New York, USA.

Constantiou, I. D., Damsgaard, J., & Knutsen, L. A. (2005). Beware of Dane-Geld: Even if Paid, M-Service Adoption Can be Slow. Paper presented at the European Conference on Information Systems (ECIS), Regensburg, Germany.

Appendix 3: Description of MUSE I Research Approach

Quoted text is excerpt from our article published in International Journal of Mobile Communication (Constantiou, Damsgaard and Knutsen, 2006) describing the research approach:

The survey was created with basis in a series of similar studies on m-service behaviour conducted in Finland, Germany and Greece (Vrechopoulos *et al.*, 2003; 2002). We adapted the survey instrument of the previous study to the Danish market conditions. "In order to ensure baseline and relevance on the key attributes, four exploratory focus groups were conducted during December 2003 and January 2004. The groups had an equal distribution of female and male mobile users with GPRS and non-GPRS enabled devices. Participants were students aged 19 to 28. They were engaged to discuss how they used their mobile phones and about new services they had encountered or observed. Moreover, based on a trial of the first 3G handsets in the Danish market (the Motorola A-920), we recorded and analysed their reactions, interactions and arising discussions. Combined, the insights enabled the construction of the survey instrument.

3.1 The survey instrument

The survey instrument was initially developed in English and was then translated into Danish. It was pre-tested among the participants of the research group (11) and then pilot-tested using the staff of a university department (25), where 50% has prior experience on advanced m-services' usage. The questions were revised based on their written and oral feedback. Following the revisions, the survey was launched on the internet (using an online tool). An intense advertising campaign (including announcements in newsletters, newspapers and business meetings) was made. Also, a balanced mix of web pages hosted the link to the survey (*i.e.*, the leading Danish online newspaper specialising on financial news, the consumer agency, the Business School and the IT University of Copenhagen, and a mobile device vendor), which ran in Denmark from February to March 2004.

The survey instrument included 43 questions organised in different categories. We collected information on mobile communications' usage patterns such as contract type, monthly expenditure, choice of operator, daily use of voice services, weekly use of SMS as well as familiarisation with mobile technologies (*e.g.*, knowledge of WAP, GPRS). Influences on m-service diffusion were explored based on two questions about the passive and active means used for the dissemination of information (pertaining to new m-services and device's features). Respondents' experience with the internet was also investigated in order to obtain insights on potential relations between internet and m-services usage. Lastly, demographic data was collected.

M-services usage was investigated through 11 questions, that not only includes items such as the use of SMS for information purposes but also more advanced services such as location-based ones. We also explored specific issues pertaining to the adoption of 3G services and phones by filtering users who own a 3G phone and presenting them with a tailored set of questions.

To address the research questions of whether there are distinct user categories and what their perceptions on m-services' attributes are that affect consumer behaviour, we asked respondents to rate three sets of items. Items were rated on a scale of one to five, where one represented 'strongly disagree' and five 'strongly agree'. The first set included five items that demanded respondents to self-assess their innovativeness, perceived usefulness and intention to use m-services. These items were used for classification and not for structurally measuring acceptance. The second set included key attributes affecting consumer behaviour in m-services market and respondents were asked to reveal their perceptions. The third set included mobile device's features and properties (*e.g.* colour display, PC synchronisation, *etc.*) and respondents were asked to indicate their importance when it comes to deciding which mobile device to purchase.

In light of reports on falling response rates of surveys (Taurangeau, 2003), and in order to compensate the internet users' opportunity costs of spending time online (Brennan *et al.*, 1999), we offered incentives in the form of participation in a lottery of two popular Nokia mobile phones. We acknowledge that these incentives might have attracted early adopters interested in new technologies and might have affected the quality of responses (*i.e.*, the primary reason of participating in the survey is to win the prize). However, we believe that the high number of respondents possessing similar phones to the ones offered by the lottery indicates that these impairing effects are limited."

Appendix 4: Provisional Start List for Interpretive Procedures

Performance Expectancy -expected/perceived performance and use-outcomes of an artifact promote a (potential) users' intention to use/use	Usefulness Relative Advantage
Effort Expectancy -expected/perceived efforts reduce intention to use/use and (can) moderate expected perceived performance	Ease of use Complexity Service costs Risk
Social influence -expected/perceived influences from important others and normative technology use promotes intention to use/use	Subjective norm
Facilitating conditions -expected/perceived beneficial conditions in the environment (e.g. technical and resources) relative to personal conditions (e.g. ability) can augment intention to use/use	Behavioral control (self-efficacy) Compatibility Trialability Observability
Attitude -users overall affective reaction towards a technology reflect and/or mediate motivations and influence relative degree of intention to use/use	Attitude
Gratifications -pleasures, delights and fulfillments associated with, obtained from and/or sought from the use of technology which motivates use	Instrumentality Sociability Mobility Reassurance Status/fashion Relaxation Immediacy Enjoyment/Fun Identity and self expression Micro-coordination Emancipation Safety & Security
Context	Co-presence Economic Social Technological
Process	Imagination & Attitude Exploration & Experimentation Assessment of Experience
Adoption outcomes	Rate of use Variety of Use Rejection

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