4-10-2008

The Difference is in Messaging: Specifications, Properties and Gratifications Affecting the Japanese Wireless Service Evolution

Lars A. Knutsen
Copenhagen Business School

Kalle Lyytinen
Case Western Reserve University, kalle@case.edu

芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

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Lars A. Knutsen
Copenhagen Business School, Denmark

Kalle Lyytinen
Case Western Reserve University, USA

Abstract
We present a competing claim why the mobile Internet has been widely embraced in Japan but obtained lukewarm reaction in most countries deploying GSM. We extend common contentions for such discrepancy by analyzing commonalities and differences pertaining to the wireless killer application in both the west and the east â short-messaging. A framework is developed to analyze service specifications, service properties and gratifications of messaging and multimedia messaging in Scandinavia and Japan. We find that an architecture which better supports interlinking, integrating and transitioning of interpersonal and data based communications over the service platform and its supporting devices was successfully established in Japan while the disjointed nature of messaging, multimedia messaging and other data services has inhibited Scandinavian users to fully embrace the mobile Internet in interpersonal communication exchanges. In Japan mobile e-mail enabled integration of instrumental and aesthetic service properties on top of the powerful expressive service properties of messaging. Accordingly, instrumental, aesthetic and hedonic gratifications have been augmenting the powerful social gratifications which have initially been driving m-service use in both places. Specific idiosyncrasies identified across services and their integration do not only distinguish between service types but provide insight to significant enabling and constraining factors that shape the further development mobile service ecologies.

Keywords: Mobile Services, Adoption, Diffusion, Institutional Theory, Service Specifications, Gratifications, Mobile Standards

Permanent URL: http://sprouts.aisnet.org/5-20

Reference: Knutsen, L.A., Lyytinen, K. (2005). "The Difference is in Messaging: Specifications, Properties and Gratifications Affecting the Japanese Wireless Service Evolution," Case Western Reserve University, USA . *Sprouts: Working Papers on Information Systems*, 5(20). http://sprouts.aisnet.org/5-20

Introduction

Despite significant interest among scholars and practitioners we have yet to answer what constitutes the main characteristics of a "killer application" in wireless services and how these characteristics impact the further development of wireless ecologies. A wide array of explanations has been offered why wireless data services blossom in Japan. Explanations with varying empirical grounding that pinpoint either to the unique nature of the Japanese socio-economic environment or architectural specificities of NTT Docomo's i-mode service abound (Baldi et al. 2002; Mitzukoshi et al. 2001; Nielsen et al. 2003; Ratliff 2002; Sharma et al. 2004; Sigurdson 2001). Lack of business models, insensitive pricing of services, functional features of handsets, choice of specific mark-up language, cultural idiosyncrasies of Japanese city life, and multiform alliances versus hierarchical governance are among but few issues that have been pointed as root causes in divergence in wireless service adoption (Elliott et al. 2004; MacDonald 2002). At the same time the scrutiny of the set of services and their properties in different contexts has received scant attention. To our knowledge, rigorous investigations that connect services adoption and success to particular specification features, service properties and gratifications are currently not available.

Studies tend to categorize wireless services based on the content they provide, i.e. news and entertainment (Aarnio et al. 2002; Baldi et al. 2002). While this is useful for statistics regarding use, such categorizing can be problematic as today's wireless services often are hybrids born out of the integration of services crossing the typical content categories. For instance, in *infotainment* it is the factual and searchable information that is merged with entertainment data that make infotainment services different. The connections between different data services in terms of their typical content and functions constitute critical features which can affect both the ease of use and perceived usefulness of those services. We first observed this trend where content services increasingly merge with other forms of data and interaction services with tethered communications services. However, as the variety of wireless services has expanded, the interconnections between an overall set of services are also gaining importance. Toshiaharu Nishioka, the former manager of NTT DoCoMo's gateway business (where i-mode was developed) recently stated this fact crisply: "the *package of content* [emphasis added] that we put together was our killer application that helped i-mode take off" (Sharma et al. 2004:47).

But although a variety of well packaged quality content constitutes a critical element for an overall mobile service success, we argue that this aspect *alone,* as with service categorizing, reveals little of the critical characteristics of a mobile 'killer application' and its impact to the ecology of wireless services. Rather, we propose to look beyond categories and the holistic package and look deeper at specific services, those initially scaling and catalyzing mobile data service use, those of emerging importance, their bindings as well as their role in the service ecology.

Interestingly, Sigurdson (2001), Nielsen and Mahnke (2003) as well as Funk (2001) in their analyses of i-mode ignore the fact that *messaging services* (i.e. what is called SMS in the GSM dominated world and what is denoted mobile e-mail in Japan) are the most successful of all services – also with i-mode. At the same time, SMS has been a huge success in Europe and other parts of the world (excluding North America). Yet, the portal based data services use in Japan has not been mirrored in the GSM world (Elliott et al. 2004; Sigurdson 2001).

These seemingly trivial observations has received little attention in explanations that account for variations in wireless data service diffusion. In this article we will focus on connections between messaging services and other types of data services and explain how the gestation of killer applications in Japan and Scandinavia differed in terms of how messaging and other data services were organized together in the overall ecology of services. To this end we present a present a framework to analyze wireless services based upon *service specifications, service properties and services gratifications*. The tripartite framework is then applied to illustrate why seemingly small relative differences can radically impact service evolution paths.

Global Killer Applications: Profound Growth of SMS and Mobile E-mail

Defining "Killer Application"

The idea of a 'killer application' has been widely disputed in the popular and academic writing (Dey 2005; Lyman et al. 1996; Middleton 2003; Stroborn et al. 2004). Some claim that 'voice' telephony – the pinnacle service of 1G and 2G mobile phone – is the killer application. Some highlight messaging: SMS and e-mail. Some highlight ringtones. Some suggest data connectivity in itself. Others say no such application exists and refer instead to the relevance of systemic service configurations in which certain applications are only enabling constituent parts (i.e. Funk 2001; Sharma et al. 2003).

In order to outline the texture of a killer application, we need a more specific definition. In this context we refer to a killer application as *a distinct data service which has scaled or is scaling towards dominance over other applications or services within a growing population of users. Moreover its properties and name has achieved pervasive awareness*. As such, voice telephony falls outside our definition in that it is not considered a data service. Furthermore, connectivity is too vague to achieve pervasive awareness regarding the name and properties of service. In contrast various types of specific news services, personalization services, gaming services, and video and photography services can fall naturally within the scope of the definition. Although some of these services have achieved or are achieving dominance and have reached pervasive awareness within certain segments, their degree of meeting our criteria of pervasive awareness across a broader population is more nebulous. In fact, as we suggest below, only messaging services seem, as of now, to fully comply with this definition. We will next explore how this killer application has emerged and grown in two leading regions in the world: Scandinavia and Japan.

Evolution of Mobile Data Services in Scandinavia and Japan

During January 2000 to May 2002 the total worldwide monthly SMS traffic had grown from approximately 3.5 billion messages to 24 billion[1]. A previously unanticipated business (Trosby 2004) yielded at this point $36 billion in worldwide revenues[2]. Alone in Europe the service amounted about 10%[3] of the operator's revenue[4]. In the Philippines, Globe and Smart,

[1] Nokia. 2003. A history of third generation networks: Nokia Networks. Available at: http://www.3gnewsroom.com/html/whitepapers/year_2003.shtml
[2] Check: Newsweek? Oct 11, 2003. Vol. 369, Iss. 8345; p. 7
[3] Nokia estimates 10-20%, op cit footnote 1.

two GSM MNOs, derived 35% of their revenues from data services – primarily SMS – in 2002. According to Rheingold (2002), in the Philippines[5] as many as 50 million text messages were exchanged per day in 2001. Next to the Philippines the top data revenue generating operators globally and populations sending most messages were predominantly European and Japanese. In contrast, the US operators were completely absent from this list[6] in 2002.

Mobile Data Services in Scandinavia

Scandinavians, in particular the Norwegians and Danes, are among the most text happy inhabitants on the planet (2001). In Norway users averaged almost 36 short messages per month during 2000. The Norwegians remained the most edacious 'texters' in Scandinavia during the two consecutive years in which the average sending of short messages per month almost doubled. However, from 2002-2004 the Danes, probably attributable to one of the fiercest price competitions on SMS in the world and introduction of flat rate SMS pricing schemes[7], drastically leapfrogged their neighbors reaching an average of 102 short messages per subscriber per month during the first half of 2004. With relatively higher prices on SMS[8], the growth rates in Sweden have not paralleled that of Norway and Denmark.

	2.000	**2.001**	**2.002**	**2.003**	**2004 1. half**
Norway[9]	35,9	49,9	56,6	66,1	66,6
Denmark[10]	21,5	30,7	39,9	71,6	102,1
Sweden[11]	7,1	12,9	14,9	18,4	17,9

Table 1. SMS per subscriber per month in Norway, Denmark and Sweden 2000 - 1st half 2004

Congruent with findings from a study on SMS use in Europe in 2000 (Smoreda and Thomas (2001), research from Denmark (Constantiou et al. 2004) and Norway (Ling 2004) reveal that young users consume most data services. Ling (ibid.) reports of teens and adolescents (between 13-24 years) being the most enthusiastic users sending between 6-9 messages per week, while people of ages 25-44 send between 1-3 messages per week. Interestingly, women, in particular the younger, are consistently higher users of messaging.

Whereas the text epidemic has had profound impact in Norway and Denmark, it has not transmuted into other data services. Long predicted outbreaks of data services based on WAP Internet access and multimedia messaging (MMS) are absent. The official statistics reveal that MMS is starting to gain some momentum, but is still of miniscule significance. GPRS traffic statistics, which indicate the data traffic generated by mobile Internet and gateway services, are

[4] Today, based on numbers suggested by a Vodafone representative at the Mobile Interaction, SSIT 5, workshop in London, we suggest this rate is likely to be somewhere between 15-20%.
[5] Population of approximately 85 million.
[6] Nokia. 2003. A history of third generation networks: Nokia Networks. Available at: http://www.3gnewsroom.com/html/whitepapers/year_2003.shtml
[7] From 2001 Denmark's five incumbent MNOs faced competition from several virtual mobile network operators (VMNOs) offering mobile communications services over the incumbents' networks.
[8] I.e. see the report from PTS in Sweden (avaible in Swedish only): http://www.pts.se/Nyheter/pressmeddelande.asp?ItemID=2859
[9] Official statistics from Post- og Teletilsynet
[10] Official statistics from IT- og Telestyrelsen
[11] Official statistics from Post & Telestyrelsen

insufficient for general comparison. Yet, in 2003 and the first half of 2004 the average Swedish GPRS subscriber generated respectively 0.65 MB and 0.64 in mobile data traffic per user per month. The biannual statistics for in Denmark show 0.25 MB for the first half of 2004 and 0.45 MB for the second[12]. In practice, these amounts of data typically answer to the sending and receiving of a few multimedia messages or a couple of mobile Internet surfing sessions over the six month period per subscriber.

	2.002	**2.003**	**2004 1. half**
Norway[13]	0,03	0,39	1,00
Denmark[14]	0,01	0,04	0,15
Sweden[15]	0,02	0,06	0,19

Table 2. MMS per subscriber per month in Norway, Denmark and Sweden 2000 - 1st half 2004

In Norway, Telenor and NetCom have experienced gains with so called CPA – content provider access – based services. These include premium SMS (PSMS), MMS (PMMS) and WAP services for voting in relation to TV and radio shows, and purchasing of ringtones, logos, backgrounds and screensavers etc. No official statistics are available documenting the growth of premium content sales in Norway.

However, a Danish telecommunications analyst (2004:13) contends the "PSMS market in Norway exploded" after attractive pricing schemes for content providers and when unified access over the CPA platform was granted for third party content providers. Moreover, its success has led to export the Norwegian CPA model to US and Canada. The revenues from premium content in Norway in 2003 was estimated in the range of 460-570 million NOK[16]. Estimates for 2004 also indicate near a doubling of premium content service revenues in Denmark from 180 million DKK in 2003 to 300-350 million in 2004[17]. PTS[18] in Sweden concludes that the basic service model for premium content services is now solid, but that growth has yet to occur.

We can conclude that the much expected growth in more advanced m-services than SMS is still pending in Scandinavia. Yet, innovation and new revenue sources has emerged and blossomed around SMS. As such, SMS is continuing to be embodied as a dominant medium not only for social interactions, but also for data service delivery.

Japan

Globally, two Japanese operators, NTT DoCoMo and J-Phone[19] held in 2002 the third and fourth positions in the amount of revenues derived from data traffic over cellular networks[20]. Boston Consulting Group found that a considerable share of NTT DoCoMo's data revenues are attributable to content services, i.e. games, screen savers and phone-ringing tones together

[12] These statistics also include data traffic for the first 3G operator in Denmark.
[13] Op cit. ref.9.
[14] Op cit. ref.10.
[15] Op cit. footnote 11.
[16] Økonomisk Rapport: http://www.orapp.no/oversikt/Argang_2003/8614/teknologi/8653
[17] BT: http://www.bt.dk/mobil/artikel:aid=251258:fid=100300070/
[18] PTS report on Mobile Content: http://www.pts.se/Archive/Documents/SE/Slutrapport_mobilainnehallstjanster_2005_8_feb05.pdf
[19] Vodafone holds a total economic interest of approximately 69.7% in J-Phone; majority stake obtained in 2001.
[20] Op cit. footnote 1.

comprising more than 50% of i-mode user activity. At the same time, however, they explicitly underline that "e-mail is the killer app" which "initially attracted users to i-mode" and that mobile e-mail "remains critical to i-mode's appeal" (Mitzukoshi et al. 2001:93). Also for J-phone – first through its Skywalker[21] mail services which launched before i-mode but which remained in the shadow of i-mode's huge success (Quigley 2002) and later through its J-SKY e-mail and m-service portal – revenues from data services were well above the average for leading world mobile network operators (MNO) in 2002[22]. For KDDI on the other hand, the only of the operators in Japan at that time utilizing WAP in its cdmaONE based network, data revenues were reported to be just at par with the average (approximately the same level as Telenor of Norway).

For all Japanese MNOs e-mail is persistently identified as the most important data service (Hoffmann 2001). Although mobile e-mail has gained position as SMS' successful sibling, SMS also has presence in Japan. Sigurdson (2001) reported that, SMS - branded Cmail by KDDI – dominated the use of EZweb, KDDI in Japan's WAP based mobile Internet gateway. However, with the launch of mobile e-mail and the tremendous market share gains by NTT DoCoMo, SMS has almost disappeared in Japan to mildly resurface with the recent desire from users to send and receive SMS overseas[23].

Ishii's (2004:48) research conducted in Japan in 2002 documents that "half of all mobile Internet users used email (excluding non-Internet short messages)" and further that "the main usage of the mobile Internet is email". Sharma & Nakamura (2004:49) also argues that "Japan's growing band of e-mail junkies have driven the phenomenal growth in i-mode". On average, 87 e-mails were sent from a mobile phone on a monthly basis in Japan in 2002; 19 more than that what was sent over regular PCs (Ishii 2004). This is also 30 more messages from a mobile phone than the Norwegians sent. Although we are unable to find official statistics, Boston Consulting Group reports of an average of more than 100 messages *sent and received* per month in 2000 (Mitzukoshi et al. 2001). Relative to Ishii's (2004) findings from 2002, given a 50/50 average send-receive ratio, we therefore find it plausible to expect similarities in the growth rates for mobile e-mail in Japan as witnessed with SMS in Norway and Denmark. Furthermore, in line with the findings from Norway and Denmark, use of i-mode initiated with younger users to later transcend to the older (Funk 2001; Sharma et al. 2004). Contrary to first estimates that messaging would first emerge among business and professionals accessing e-mail, 50% of the users were in their 20s or younger. Males (59%) were the dominant gender but 6% more females were found in the age group 19-24 (Ishii 2004).

Japan has also witnessed the most substantial growth in mobile Internet content, applications and multimedia communications (Funk 2001). At the end of 2001 there were 30 million subscribers to i-mode while J-sky and *au* each had 9 million subscribers. Currently, 86% of the near 85 million[24] Japanese mobile phone subscribers are also subscribing to mobile Internet services such as i-mode (NTT DoCoMo), J-Sky (J-phone/Vodafone) or *au* (KDDI). According to Ishii (2004) the most accessed service types over the mobile Internet were, (next to e-mail): 1) search engines, 2) weather, 3) transportation information and maps, 4) music/concerts information, 5) news, 6) fortune telling, 7) sports, 8) computer games, 9) competitions prize/gift and 10) TV program/guide (Ishii 2004). This presents a more nuanced individual service level

[21] Evolved into and was replaced by J-Sky
[22] Op cit. footnote 1
[23] NTT DoCoMo press release. NTT DoCoMo to Expand 3G International Short Messaging Service. Feb. 1st, 2005.
[24] Official statistics from the Telecommunications Authority of Japan: http://www.tca.or.jp/eng/database/daisu/index.html. Accessed March 2005.

perspective to the distribution of content services. NTT DoCoMo reported at the end of 2002 another classification where ring tones and screensavers captured 39% of i-mode use followed by entertainment information (21%), gaming and horoscope (20%), information services (11%), database services (5%) and transaction services (4%).

Two other innovations have boosted mobile data revenue growth in Japan. First, picture mail, the Japanese sister service of MMS was introduced by J-Phone in November 2000. By July 2002, 60% of J-Phone subscribers owned a camera phone and were subscribers to the so-called sha-mail service which enabled sending and receiving of pictures. The same year sha-mail was extended to encompass an online photo gallery service granting 20mb space on the Internet to store pictures. Subscribers to sha-mail generated on average 44% more revenue per user than a non-user (Nielsen et al. 2003). A similar service was launched by KDDI in April 2002 and had gained 2.5 million subscribers by December 2002. Being a follower, NTT DoCoMo first launched their counterpart, the i-shot service, in June 2002. By December same year 10% of its subscribers (4 million) had signed up for the service (ibid.). The different e-mail solutions have later been expanded to handle video-clips as well as other attachments (including Microsoft Office files).

The other significant innovation was NTT DoCoMo's introduction of i-appli in January 2001. This enabled stand alone Java[25] applications (i.e. games, animations, karaoke, and tailored software applets) to be used on mobile handsets and was embraced by 4 million subscribers in June 2001. At the end of the year this had increased to 15 million. The average i-appli user generated double the data revenue of regular i-mode users. To respond, both KDDI and J-Phone launched Java extensions to their mobile Internet platforms in June 2001 (ibid.).

Comparison of Data Service Evolution in Scandinavia and Japan

We recognize two distinct paths in the use and innovation of mobile data services. Whereas the Scandinavian approach, subsequent to widely failing with introducing WAP based mobile Internet services, concentrated on enhancing data services by innovating around SMS and MMS, the Japanese operators have sought to innovate within and through the ecology of services of which e-mail as well as their mobile Internet based content delivery are fundamental constituents.

The tremendous growth of mobile Internet sites in Japan, where NTT DoCoMo alone grants access to more than 4,500 official i-mode sites and 84,000 unofficial sites[26] constitute a clear witness of a successful road towards mobile Internet use. It is important to note, however, that mobile e-mail is also available over 2G and 3G networks in Scandinavia. For 2G networks e-mail clients have been available mainly as an application supplied with handset manufacturers contingent upon using an MNO provided GPRS connection. The recent launches of 3G networks in Scandinavia, i.e. by Telenor and '3', enabled the provisioning of mobile e-mail similar to Japan. However, as far as can be observed from statistics from Denmark[27], SMS use among the subscribers of '3' is at par with that of TDC, the Danish MNO with the highest subscriber base. We see this as a sign of mobile e-mail not substituting SMS as of now and allow suggesting this development is ascribable to the relative stronger technical and social pervasiveness of SMS.

Having established an understanding of the important role of interpersonal communications as the baseline service for enhancing the use of other data services, we will next

[25] Java is a proprietary run-time environment technology from SUN Microsystems.
[26] http://www.i-mode.com/companyinfo/subscriber.html
[27] The statistics from the Danish Ministry of Technology and Innovation.

develop a framework to understand on a more fine grained level the variations in messaging services using the categories of specifications, properties and gratifications. The analysis will help address the question why the messaging services in Japan have enabled and still promote a richer innovation path than SMS and MMS based messaging architectures.

A Framework for Mobile Service Analysis

Any mobile data service needs to be understood from a multifaceted yet integrated perspective. A triangular approach is therefore proposed. First, we need to carefully understand the *specifications of the services* as inscribed by the technical architects and corporate designers of the services/applications. Second, in order to capture the features of the *expected actual services* as they appear when an artifact is given life through interpretation in use communities, we need to understand the *expected and ascribed use properties* of the service. Finally, because all service specifications and properties do not result in widespread use, we need to assess how actual use properties of a service enable certain *gratifications* to be perceived by users (Stafford et al. 2004). While the two former together bear resemblance to the terminology of technology spirit (DeSanctis et al. 1994), gratifications sets focus on the construction of the perceived technology value during the 'consumption' of services.

Specifications

Specifications refer to the specific texts that characterize the service as given by its architects. They are the objective inscriptions of technical details and capacities pertaining to a given service. In many ways specifications represent a fact sheet explicating the service through technical terminology and concrete measures and heuristics. Examples of specifications[28] include payload, bit type characters (for alphabet), interface support, transfer and access support, format support etc. Their representations are manifests of the understandings and actions constituting the institutional environment putting them forth (Hargadon et al. 2001). The inscriptions form the basis, together with the service representation, for the decoding and re-coding of service meaning through direct or indirect interactions with constituents which fall outside the innovation domain that generated the artifact. Hence, in order to tap into the interpretive flexibility (Bijker et al. 1987) on the user side specifications need to be assessed in relation to properties and gratifications.

Properties

Whereas specifications constitute the texts written by engineers and system architects, properties convey the expected effects of service specifications upon humans or other artifacts. Drawing upon Orlikowski (2000) properties encompass the embodied symbol and virtual[29] properties of services that are subjectively constructed and re-constructed by actors interacting with the service or perceiving instantiations of it. Three general categories of properties can be distinguished.

[28] See for instance OMA specifications for MMS: http://www.wapforum.com/release_program/docs/mms/v1_2-20050301-a/oma-ereld-mms-v1_2-20050301-a.pdf

[29] For material artifacts, this would also include material properties (i.e. Orlikowski, 2000). Although dependent upon material artifacts, services are analytically distinguishable as virtual artifacts.

First, *instrumental properties* encompass the capacity of services to support efficient interactions between humans or other technologies. Examples of such properties include faster transmissions speed, augmented mass distribution capabilities, simpler text entry, reduced download/upload time, and reduced coordination time.

Second, services can obtain *aesthetic properties*. Such properties inform the relative capability of a service to provide an aesthetically appealing human experience and/or enable the appearance of other artifacts (i.e. from background images on a mobile phone, ringtones etc.) with such features. For services the most relevant aesthetic properties involve the capacity to evoke visual, audible and physical sensing and 'decorate' artifacts that can convey the identity of the service or the identity of the service consumer.

Expressive properties constitute the third type of properties in our framework. This type of property informs of the potential of a service to express to users and other artifacts of social values or connections. Among expressive properties is the relative capacity of mobile service to pervasively establish connectivity and deliver content in a network of humans and artifacts.

Gratifications

We introduce the concept of gratification to refer to pleasures, delights, and fulfillments users can perceive from using a mobile service based on their 'needs' and motivations (Blumler et al. 1974; Cutler et al. 1980). While properties attend to potential effects, gratifications seek to understand how these effects can translate (or do not translate) into perceived user value. We draw upon Stafford et al.'s (2004) threefold separation of gratification types. First, *content gratifications* refer to pleasures, delights and fulfillments experienced from the 'consumption' of messages offered through services. This may be 'consumption' of content crafted by a professional service provider, i.e. news, infotainment etc. But presently of more importance is the 'consumption' of content crafted by other individual users- weakly or strongly tied.

Second, services may also yield *process gratifications*. This type of gratification arises from the actual use of the service itself; from the actual experience of using a certain service (ibid.). Playing, experimenting, and learning by exploring how services operate may itself be gratifying. As more latitude is being offered by services in terms of personalization, the crafting of personalized content and messages increasingly bring new features for such gratifications to be formed around. As such, process gratifications arise from a form of hedonic consumption (ibid.) where users perceive pleasure from the technology activities themselves.

The final type of gratifications, introduced is *social gratifications*. From Stafford and colleagues' study of tethered Internet services (ibid.), associations to words such as friends, interaction and people were found to be highly associated with social gratifications. Having recognized the role of interpersonal communications in mobile services we assume that social gratifications can be particularly important in understanding the sort of pleasures, delights, and fulfillments users perceive from using mobile services such SMS, MMS, and mobile e-mail.

Specifications, properties and gratifications can be conceived to form a triangular relationship: 1) specifications have bearing upon properties and gratifications whereas 2) properties will influence the space of potential gratifications which 'consumption' of services enables to perceive (see Figure 1.). Whereas specifications are primarily objectified and constructed within the sphere of development, properties and gratifications are culturally bound socially constructed valuations of technology primarily associated with those the enactment of specifications affect.

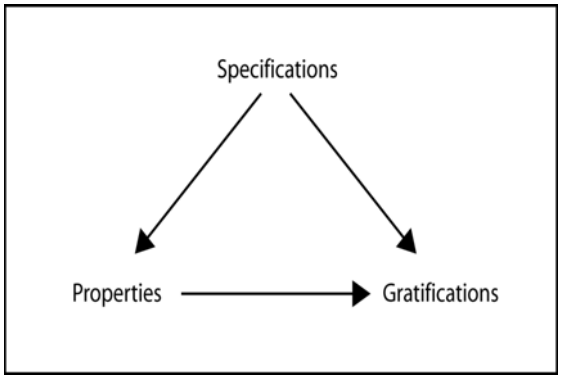

Figure 1. Relations between specifications, properties and gratifications

Specifications, as representations of technology design institutions, mediate in the creation of users life-world experience with technology (Hill 1988). From a structuration perspective (Giddens 1984) we can thus say that specifications become instantiated in the enactment enabled and constrained by modalities drawn upon to create meaning and legitimacy of technology use based on the monitoring of own and others direct and communicative actions pertaining to a particular technology (Blechar et al. forthcoming). Interpretations and enactment of properties and associated gratifications thus bring in a perspective which allows us to analyze each tripartite element in isolation. At the same time it also allows us to assess the relations between them in order to uncover what technical specifications and corresponding institutional arrangements enable and constrain interpretations of properties, the construction of gratifications and their evolution. Moreover, we can analyze the specificities of wireless services which may reveal similarities and discrepancies in the text of specifications and to what degree the associated 'grammar' and 'text' of properties and gratifications match and promote evolution of mobile service use. In the following we apply the framework to analyze the key mobile messaging technologies of SMS, MMS and mobile e-mail.

Analyzing Messaging Technologies Using the Tripartite Model

Specifications

We analyze next specifications to determine the enabling and constraining aspects of SMS, MMS and mobile e-mail architectures. With respect to the latter we choose to focus on the specifications of NTT DoCoMo's e-mail service as this has taken the strongest manifest in Japan[30]. Differences pertaining to payload, text character limits, supported formats, transmission protocols and addressing standards are widely available for SMS, MMS and mobile e-mail. SMS is by far the simplest service with a fraction of payload and character limit to that of MMS and mobile e-mail. Furthermore, SMS supports only text format and is dependent on conversion for transfers, i.e. to/from e-mail over de facto Internet standards such as HTTP.

Whereas MMS has far richer specifications than SMS it is not as advanced as the mobile e-mail service provided by NTT DoCoMo. In particular, the limitations in payload, i.e. the 100kb

[30] We primarily draw upon the mobile e-mail services offered by NTT DoCoMo over 2G and 3G networks. To the best of our judgement specifications of close correspondence to these can be found for KDDI and J-Phone (Vodafone) as well.

limit for TDC customers in Denmark, is a fifth of what FOMA customers of NTT DoCoMo can currently send and receive. In terms of formats supported, MMS and mobile e-mail are quite similar. Both support several advanced multimedia formats and HTML as the mark up language. However, the attachment function of mobile e-mail also opens for transmission of other file formats such as Microsoft Word and Adobe PDF. With regard to addressing standards SMS and MMS support the E-164 phone number standards. MMS also supports the addressing to e-mail addresses of the RFC 2822 standard. Mobile e-mail, on the other hand, primarily supports the latter and includes, if not changed by the user, the phone number as part of the default e-mail address[31]. Finally, the transmission protocols for the respective services differ considerably. Whereas MMS need to utilize either WAP WSP or HTTP/TCP/IP, mobile e-mail has from its beginning utilized the latter. SMS utilizes X.25 which demands a message router appliance in order to convert and transfer data over such transfer protocol standards. It is also central to note that MMS uses a different access point name (APN) than WAP and that this disables the simultaneous use of WAP and MMS.

	SMS	**MMS**	**Mobile e-mail**
Maximum payload	140 bytes[32]	100 kb[33]	500 kb[34]
Text character limit	160 (7-bit) 140 (8-bit) 70 (double-byte)	Limited to maximum payload enabled by operator, MMSC and handset.	i-mode – i-mode: 4,000/2,000 Foma – Foma: 10,000/5,000[35]
Formats supported	Text	Text MPEG4 HTML Gif / Animated GIF JPEG, WBMP, PNG, MP3	Text MPEG4 HTML Gif / Animated GIF JPEG, WBMP, PNG Microsoft Word, Excel, PowerPoint, and Adobe PDF
Transmission protocols	X.25	WAP WSP stack or HTTP/TCP/IP WAP push	HTTP/TCP/IP
Addressing standards	164 phone numbers[36]	E.164 phone numbers and RFC 2822 e-mail addresses	RFC 2822 e-mail addresses

Table 3. Comparison of selected specifications of SMS, MMS and Mobile e-mail

[31] I.E ; phonenumber@operatorname.institution.country
[32] GSM Association. GSMworld.com
[33] Limited by MMSC – multimedia messaging center –, operator and handset; i.e. 100kb by TDC, Denmark: http://erhverv.tdc.dk/artikel.php?dogtag=tdc_e_mobil_mms_fakt
[34] Operator/handset limited (single-byte/double-byte). Limit for NTT DoCoMo FOMA services (NTT DoCoMo's 3G service); www.i-mode.com
[35] Op cit footnote 34
[36] E-mail, fax and pager conversion possible. Operator/handset contingent.

Properties

Instrumental Properties. The specifications yield variations in types and degrees of instrumental, aesthetic and expressive service properties. With respect to the capacity of the services to promote efficient interactions between human beings and other artifacts – *instrumental properties* – there are important parallels as well as distinctions which can be derived from the service specifications. First, the one-to-one and one-to-many properties to quickly exchange messages with other networked people are shared among all three. A central difference, however, is that MMS and mobile e-mail to a higher degree facilitate ease in horizontal network bridging between mobile phone users and computer based e-mail users. With respect to the instrumental property to efficiently facilitate interactions we therefore see augmented properties for MMS and mobile e-mail to assist micro/social coordination (Ling 2004).

Second, mobile e-mail and MMS have enhanced capacity to supply content to other human beings through the support of HTML and multimedia. In the initial versions of MMS this was limited to text and images (incl. animated) but has been expanded to support video-clips, and the MP3 audio format which is popular format on Internet networks (i.e. music sharing and podcasting). Relative to the capacities of mobile e-mail, with exception of MP3, MMS does not have the capacity to attach other third party file formats such NTT DoCoMo's support for Microsoft and Adobe files. This yields an advantage for mobile e-mail in terms of supporting an expanded range of human activities in both leisure and business.

Third, all messaging services have instrumental properties to support interactions between artifacts. This includes configuration (i.e. installation/set-up scripts) as well as service specific scripts, i.e. for payment, ticketing, and content purchases. However, the richer format support of MMS and mobile e-mail enable expanded opportunities for instrumental support like integration to calendar and other applications. This is particularly useful with file attachments of mobile e-mail.

Aesthetic Properties. Much of the success of content personalization, i.e. PSMS content in Norway and ringtone purchases over i-mode in Japan, can be attributed to the role of augmented *aesthetic properties*. We have previously mentioned personalization content supplied over SMS as an important example of service properties potentially enhancing the aesthetic effect of messages. But 'generation txt' has also invented novel forms of using alphanumeric characters to display emotions (i.e. smileys :-), has added aesthetic richness to SMS (Ling 2004; Rheingold 2002).

Relative to MMS and mobile e-mail, however, the specifications of SMS impose severe constraints to the continuation of such further aesthetically oriented innovations. Extended multimedia capabilities (i.e. attachments) and HTML add dimensions to the virtual aesthetic property spectrum beyond that of SMS by introducing multimedia tailoring. NTT DoCoMo increased mobile e-mail attachment payloads at the same time it enhanced the Deco-mail client specifications for the launch of their latest 901i series handsets[37]. This is but one example of how enriched aesthetic service properties enable increased virtual aestheticism in user interactions.

[37] Presentation of the 901i series handsets: http://www.nttdocomo.co.jp/english/corporate/investor_relations/referenc/presentations/041117/20041117_p_e.html

Expressive Properties. The expressive properties are high for all three, but some demarcating elements constitute important differences. They all posit expressive properties to powerfully, pervasively and rapidly spread messages across millions of users through simple clicks. The expressive latitude to construct messages may however be somewhat lesser for SMS taken the more limited number of characters into account. However, the findings from Ling's (2004) study in number of words written in SMS in Norway suggest that the limitations are seldom reached in practice. On the other hand, the emergence of the abbreviated form of language – 'texting' (Rheingold 2002) – may also suggest that there are situations in which the increased payload capacity of MMS and e-mail more advantageous expressive properties.

Furthermore, the messaging technologies all exhibit network effects (Katz et al. 1985; Katz et al. 1986) as each service becomes more valuable when the number of users increases. As opposed to content supply which tend to scale according to Sarnoff's law, the messaging services have properties to scale exponentially according to Metcalfe's law for two-way communications services and Reed's law for group forming network services (Reed 2001). At current SMS and e-mail has the advantage over MMS due to the sheer magnitude of the networks of users. On a worldwide basis, with at approximately two thirds of the world's population being GSM customers and the fact that SMS is also available over other networks[38] – even the Japanese – it may even hold stronger expressive properties than that of mobile e-mail in terms of pervasively delivering messages. Yet, if considering the enormous network of computer based e-mail users around the world[39], contours of a powerful network externality bridging enabled by mobile e-mail and other TCP/IP based e-mail networks emerges.

When it comes to the second element of expressive properties, content delivery, mobile e-mail is stronger. This is not only a result of the enhanced multimedia capabilities, but it also arises from the capacity of HTML to link to other types of networked content. For years, NTT DoCoMo have offered 'send to' and 'web to' capabilities that are integrated with e-mail clients so that hyperlinks to content sites can be incorporated in messages and sent to others over mobile e-mail. Together this builds a helix effect, a form of positive feedback effect (Funk 2001; Lee et al. 2003), thus augmenting expressive properties of mobile e-mail. Similar capabilities can be possible with MMS, but considering the relatively more limited MMS use and the limited number of mobile content sites in Scandinavia, such externality effects and positive feedback effects currently do not promote the actualization of the powerful expressive properties of MMS.

Gratifications

Whereas the researcher's interpretation is more prominent in discussing properties, understanding gratifications should come from listening to the authentic voice of users through ethnographic or interpretive inquiry. For the analysis of gratifications we therefore review field research conducted in Scandinavia and Japan to record current understanding of the content, process and social gratifications associated with different types of mobile services.

Content. Disappointingly to many corporate plans and strategies the success of mobile data services has been driven primarily by the individualized and personalized messages produced by regular users. The variety of content subject for messaging offers a tremendously

[38] The GSM Association, www.gsmworld.com

[39] ITU – www.itu.org - reported of close to 700 million Internet users (in terms of subscribers) in 2003. With multiple person access to computers and Internet lines, it is likely that the number of e-mail users is far larger than this.

versatile set of possible pleasures, delights and fulfillments to be derived from its 'consumption'. However, empirical investigations point to *individualized interaction* and *social relations supporting* content to be mostly used service and probably the most gratifying. In his investigations among Norwegian SMS users, Ling (2004) found that about two thirds of the 882 SMS messages investigated contained simple statements most often associated with micro/social-coordination (33%). Next to this, content aimed at what he calls grooming (17%) – nurturing of friendships, relations and romances – seem to be the second most important content of SMS. This was followed by answers (14%), questions (11%), information (6%), and personal news (5%). The considerable proportion of coordination and grooming type of messages also appear to correspond to findings from Japan in which a majority of e-mails sent from mobile phones go to a more limited number of people in immediate vicinity and with whom face-to-face interactions are frequent (Ishii 2004)[40]. Toshiharu Nishioka, from Docomo's gateway business has also argued that "Sending short messages, such as saying goodnight to a friend, is one of the most popular uses of i-mode" (Sharma et al. 2004)[41]. The personal specificity and adaptability of messaging content is superior to that of any third-party information, entertainment or location sensitive service provider can offer. However, as has been witnessed with sha-mail in Japan (Ishii 2004), third party content providers can support such gratifications further by offering graphical content that increase use of the endearing, emotional and experiential content; i.e. emoticons, pictures and sound. As prices on MMS over time will approximate SMS, we may see a similar path of developments in Scandinavia. As of now, however, SMS does not appear to be severely disadvantaged with respect to the prevailing type of contents used.

Process. There are two contrasting issues pertaining to gratifications derived from process of using the three types of messaging technologies. On one hand, the efficiency and simplicity of writing short messages can make this to be the most gratifying process aspect. On the other, such instrumentally oriented fulfillments can sometimes be foreshadowed by gratifications derived from carefully crafting an aesthetically appealing message. Interestingly, the messaging technologies (MMS and e-mail more than SMS), can support both ends of the spectrum. Ling's (2004) research provides empirical support to this: younger users, men in particular, tend to write short messages. The average length of the messages was found to be 5.54 words for men and 6.32 for the women. Women also seemed to take more care in crafting and editing messages with appropriate punctuation and capitalization. Furthermore, abbreviations as well as emoticons were more commonly used by young women of ages 13-25. Not only does this signify that women's relatively stronger social interaction skills appear to be instantiated in messaging processes (ibid.), but it may also be a sign that women in general receive higher gratifications from engaging in advanced messaging processes. As the enhanced multimedia capabilities of MMS or mobile e-mail do not compromise process efficiency, the enriched multimedia capabilities of MMS and mobile e-mail should offer a set of complementary process gratifications for both genders. We also suggest that the process gratifications gained from crafting own content can be considerably larger than process gratifications gained from 'surfing', 'browsing', or 'clicking' the mobile Internet.

Social. Some of the social dimensions of messaging have already surfaced above; the majority of SMS' in Norway being aimed at social-coordination and grooming (Ling, 2004); the

[40] Although there is an indication concerning this, this issue warrants further comparative studies.

[41] Notice that messaging is here considered an inherent and inseparable function of i-mode.

majority of e-mail in Japan sent to a close set of frequently socially interacting individuals (Ishii, 2004). In general, the mobile phone has become the most intimate personal and social communication tool. Messaging technologies have become interwoven with the socio-cultural context as to create new socio-communicative textures of interaction. This may take place in culturally distinct ways. Yet, several commonalities in terms of social gratifications can be identified. In both Japan and Norway messaging is used to establish and maintain relationships; Ling (2004) reports for example terminations of relationships by SMS in Norway. Ishii (2004) finds that the use of mobile e-mail provides a double fulfillment. It supports the communication of personal feelings while at the same time it secures that face-to-face interaction can be minimized. The flexibility of engaging in face or faceless communication is also pointed to by Ling (2004). He sees the asynchronous nature of messaging to fulfill an important role in breaking down barriers between people in the beginnings of relationship and help transition to synchronous forms later. It is also suitable for erecting barriers if one party chooses to disengage. Although most social gratifications will arise from the everyday person-to-person communications, i.e. (boy/girl-) friends, spouse, other family members, and peers, the versatility of mobile messaging also introduces hybrid forms of inter-personal communications. This is not only significant for social gratifications related to the virtual nurturing of group relations, but is also important for understanding how group forming networks operate (Reed 2001). Not only can they scale exponentially, but they can have a potent effect on the velocity at which messages can traverse and how these messages constitute mechanisms to bind or unbind people's physical or social ties. Research from several countries documents that the crafting as well as consuming of messages take place as a social activity among co-present people, i.e. local social interaction in sharing and reading aloud, passing digital devices around etc. (Ling 2004). Hence, gratifications associated with group membership[42], feelings of belonging, participation and identity across wider time and space spans are enabled by mobile messaging. In a recent study we found independence of time and space (21%), contact with friends and peers (21%) and contact with family members (17%) being the top three contributions associated with mobile service (Constantiou et al. 2004). Correspondingly, Ling (2004) reports independence to be of particular significance among teens during their emancipation from parents. The enabling of social communication under circumstances of very limited private space has furthermore been illuminated as a reason for the success of messaging in Japan (Sharma et al. 2004). Albeit cultural idiosyncrasies exist across user groups the freedom of being able to connect socially while simultaneously disconnect from constraints of physical space appear to be fundamental to social gratifications associated with mobile messaging use.

SMS, MMS and mobile e-mail are all posited to bring social gratifications. As of current, few details exist pertaining to added gratifications potentially achievable from using MMS. However, the rapid adoption and use of animation, photo and video documented in Japan (Ishii 2004; Nielsen et al. 2003) suggest that sending and receiving of aesthetically enhanced content can augment social gratifications, i.e. provide a new range of identity forming content such as "personalized" music and pictures. In particular the ability to using 'mail to' and 'web to' type functions over e-mail clients in connection to content on the mobile Internet enables to draw upon the amalgam of service specifications and properties which *together* integrate content in new ways in messages. Coupled with interpersonal communication, new forms of social gratifications will thus emerge. So called moblogging is one example where users are able to

[42] We choose not to discuss security aspects as this is primarily connected to synchronous communication.

post pictures, messages and mp3 files from mobile phones onto their own Internet pages (Brown 2004).

E-mail: The Socio-technical Configuration Explaining the Japanese Service Success

In the above we have highlighted the role of HTML and multimedia specifications to enable enhanced properties and new gratifications. However, if we examine use statistics, we can observe, due to lacking use, that such expanded properties and gratifications have not obtained omnipresence in Scandinavia- despite increases in MMS use. In contrast, statistics from Japan suggest greater use, and thus greater cultural and social embodiment of such enhanced properties and gratifications. Yet, the striking similarities between the "west" and the "east" in terms of technical specifications and gratifications connected to sheer text based messaging open the question why the multimedia messaging content developments and mobile Internet use still are so different?

First, as opposed to SMS, MMS and WAP solutions, NTT DoCoMo managed to supply one integrated solution which did not erect a barrier between messaging and content browsing. This was primarily facilitated by the choice of de-facto Internet standards (Funk 2001). Not only did this create a compound solution promoting seamless service migration, but also opened possibilities for unleashing the power of content and hyperlink-interchange to follow the flow of interpersonal and group forming communications. The parallel launch of the i-mode service portal provided a natural connection between data services and mobile e-mail and constituted an important ecological element in the process of 'service synthesis'. Mobile e-mail became the killer application that glued together a service-smorgasboard that embodied the broadest set of instrumental, aesthetic and expressive properties available. Hence, we find it relevant to conclude that mobile e-mail can yield gratifications beyond any other free-standing data service, i.e. news, entertainment etc. due to its superior aesthetic and expressive service properties and associated ability to provide social gratifications.

Second. Using packet based technology from the inception of i-mode has been an advantage not only for fast connectivity and cheaper access but also for establishing scalable pricing. Even despite whopping marketing campaigns announcing "Free MMS use" or "MMS to SMS price", and efforts to pre-configure phones for MMS, this has not yielded a lasting growth in MMS usage in Scandinavia. Service uptake is thus not only an issue of relative pricing, but also of whether the technologies are considered substitutes or complements - among users as well as among operators. MMS as a separate service does not only create two messaging technologies which MNOs need to promote to users, but also two or more pricing schemes. With this comes potential confusion as well as a new acronym to penetrate user vocabulary. New learning is forced upon users and new associations and new choices must be made. It also creates confusion as to how this new service relates to the scripts and meanings associated with the earlier types of service use rather than evoking "interpretations among potential adopters that are based on adopters' past understandings and experiences" (Hargadon et al. 2001:478).

Here, the choice of e-mail in Japan has provided a less bumpy ride as its pricing scheme – calculated based upon the size of messages – made users not choose either between prices A or B, but could decide their price based upon the relative perceived gratification perceived during composition. Moreover, users had to learn only one type of service with specific scripts and

meanings which offered over time a set of extensions at the level of specification and properties which just could be incrementally adapted to existing use scripts.

Third, cultural differences, i.e. differences in language, relative private space, commuting habits, perspectives on time, and the role of electronic gadgets (Baldi et al. 2002), between Japan and the Western Hemisphere have some bearing. However, such explanations have been discredited by Sharma and Nakamura (2004:46) who contend that such explanations (i.e. pertaining to pedestrian oriented society, gadgetophilia, PC concentration and language) are "partly true – but mostly false". Thus, contrary to what has been predominantly proclaimed to result from differences in life-style, we want emphasize that the institutional and cultural differences in organizing business related to wireless services may be more important. One of the master-minds behind i-mode, Takeshi Natsuno, proclaimed that: "The true mechanism of the great success is that the operator has made a function of coordination of the total value chain" (Sharma et al. 2004). Interestingly, this coordination has concentrated on enabling an integrated service infrastructure together with handset and content providers by seamlessly combining mobile messaging and mobile Internet services. Such organizing sharply contrasts the more "silver bullet" based vertical orientation adopted by major players in the West. In its essence, the former approach appears to create horizontal and vertical bridging of specifications and properties and an extended line of achievable gratifications.

Conclusion

SMS, MMS and e-mail extend, augment and complement the path of extensive communications that dates back over a century to paging, fax, telephone, telex and non-electronic exchanges such as letter writing, note-passing, card sending, gift-giving of drawings and probably many more. They build on some of the strongest institutions of man. Yet, the new wireless services are both similar but also distinct in their technical specifications. These seemingly subtle differences become amplified when they are taken to the levels of properties and gratifications where the services need to be adapted and implemented within an institutional and cultural context. Our analysis reveals that whereas the rift erected between SMS and MMS breaks down a natural path to extended service use, the original Japanese architecture promotes an incremental evolution and enabling of more advanced service use through its robust architectural design which is flexible and rigid as well as extensible and simple (Hargadon et al. 2001).

Recently, Smoreda & Thomas (2001) suggested that due to "certain proximity between written modes of communication in the worlds of the Internet (e-mail, chats, etc.) and of the mobile phone" the Internet and SMS should be brought together in order to "further stimulate the use of SMS". Our analysis points out that e-mail forms the most promising technology to facilitate this bridging. But reluctance among operators to jeopardize their harvesting of SMS profits and to continue on to embrace e-mail seems to prevail, even though all the signs indicate that e-mail is highly desirable among mobile users. For instance, survey data from Denmark revealed mobile e-mail and the related service of synchronization of calendar and e-mail to/from a computer[43] to be the most desirable service (Constantiou et al. 2004). Analogous, Mante-Meijer and Ling (2003:9) conclude in their studies on European ICT use that "apart from email, there is not killer service for the Internet" but that next to e-mail, search engines were the most

[43] n=1087 – non-representative Internet survey

used. This is almost a superimposing of Ishii's (2004) similar findings concerning the mobile Internet in Japan in 2001. Furthermore, empirical research from Finland by Anckar and D'Incau (2002) shows that e-mail was by far the most desired mobile phone feature across all age groups *because* it held the potential to serve multiple different needs; time-critical needs, spontaneous needs and efficiency needs. It was considered superior in offering gratifications. While assessing services promoted during failed WAP and troubled 3G launches in Europe with a subset in the framework presented here, we can find that there are no other services than MMS, e-mail and instant messaging supporting social-relational communications. Hence, no other service has the property to function as the socio-technical glue that will bind other services together.

But who dares to rock the profits of the SMS Juggernaut? Whilst acknowledging the split between SMS, MMS and e-mail, the GSM Association recently initiated a new standardization effort of what they call the "Integrated Messaging Initiative"[44]. The aim is to create an integrated user experience for SMS, MMS and mobile e-mail. But is such integration truly needed? If our analyses hold water, it would suggest that the future is already here. The future is also starting to unfold even in one of the slowest markets to adopt wireless messaging, USA. In the U.S, three million Blackberry's, with primary functions being e-mail and calendar, have been sold in 2004. And Blackberries are increasingly gaining support in Europe and even among corporate customers in Japan (Gibbs 2005).

There is an opportunity for revenue hungry operators to unleash the power of mobile e-mail to grow the use of the mobile Internet. Mobile e-mail will enable organizing for a robust technical platform which helps maximize interpersonal as well as data communications. E-mail by itself is not sufficient. One must also count in the need for a sufficient range of handset providers and content providers who are tied into a united business model with attractive innovation fostering revenue sharing (Baldi et al. 2002; Funk 2001; Kodama 1999; Mitzukoshi et al. 2001; Ratliff 2002). This need to be supplemented by a strong value proposition which will enable value creation both at the supply and demand sides and which is sufficiently transparent and geared towards demand and supply side economics of scale. In Japan, mobile e-mail was the key service to enable this. Elsewhere, the innovations of the mobile Internet has largely failed to be adopted because they have been disentangled from the previous logics of both the institutional arrangements of production as well as use.

Acknowledgments

This article results partly from research conducted during the Mobiconomy project at Copenhagen Business School. Mobiconomy is partially supported by the Danish Research Agency, grant number 2054-03-0004.

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Office:
Sprouts
University of Amsterdam
Roetersstraat 11, Room E 2.74
1018 WB Amsterdam, Netherlands
Email: admin@sprouts.aisnet.org

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