

2005

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## Recommended Citation

Constantiou, Ioanna D.; Damsgaard, Jan; and Knutsen, Lars, "Beware of Dane-geld: Even if Paid, M-Service Adoption Can be Slow" (2005). *ECIS 2005 Proceedings*. 153.  
<http://aisel.aisnet.org/ecis2005/153>

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# BEWARE OF DANE-GELD: EVEN IF PAID, M-SERVICE ADOPTION CAN BE SLOW

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## Abstract

*Despite the 83% mobile phone penetration rate, the Danish mobile telecommunications market has witnessed slow uptake of advanced mobile services available over GPRS and 3G. In this paper we report results from a survey of 1,103 respondents. We delineate four categories of mobile users in the Danish market based on the technology in use and explore their differences or similarities in terms of technology experience, service use, innovativeness, and technology-service requirements. We argue that when congruencies across the categories are present, these can be areas of exceptional importance for catalyzing the behavioral changes necessary to make the more advanced service use reach the masses of users. In particular, to limit current Dane-geld problems, mobile e-mail and compatibility between mobile communications, computers and the Internet appear as important factors to direct development efforts for users.*

*Keywords: mobile users' categorisation, service use, technology use, user requirements*

# 1 INTRODUCTION

In Viking history Dane-geld referred to money paid by a city, or a nation to the Vikings in order to avoid plundering and pillage. Rudyard Kipling warns in his famous verse: “That if once you have paid him the Dane-geld. You never get rid of the Dane.”<sup>1</sup> Interestingly, the vivid subsidizing of handsets and the price wars on SMS and voice-calls in the contemporary Danish market can be seen to resemble to a kind of Dane-geld. Mobile operators are paying customers to avoid ‘plundering’ of their customer bases, to facilitate contractual lock-in and continued adoption of new handsets and services. However, we suspect that once this becomes the habit, a vicious cycle may emerge where customers are likely to be reluctant to pay for new mobile services and handsets unless a heavy subsidy is in place. In turn, as this may limit the revenue potential for more advanced services, content and service providers may become hesitant to invest in the development of new mobile services. Thus, it becomes pivotal for operators and service providers to understand usage trajectories for different categories of users so that development and market introduction efforts can be directed toward the most promising part of the mobile population.

Following a stream of observations pertaining to the troubles of WAP, consecutive revisions of world 3G diffusion forecasts, and slow actual 3G uptake, scholars and practitioners have emphasized that technological advances and service availability do not automatically lead to widespread adoption and use (Funk 2001, Baldi & Thaung 2002). Parallel, and resulting from the scant research adopting end-user perspectives in relation to mobile services, there have been augmented calls for research spanning beyond aggregate diffusion models as these have appeared to be “insufficient as bases for understanding the end-user requirements” (Pedersen et al. 2002). Moreover, in roadmaps for future research there are repeated calls for research on factors explaining adoption, acceptance and use of mobile services (Lyytinen & Yoo 2002, Urbaczewski et al. 2002). Anckar and D’Incau argues that further understanding is needed concerning “the consumers’ actual reasons – the primary drivers – for adopting and intending to adopt mobile services” (2002, p.46).

A central feature of mobile device and service provision is the interconnected nature arising from the fact that several services, functions and usage possibilities are enabled over a single interface and device. *Vis-à-vis* traditional diffusion-curve research, which operates under the stringent assumptions of an invariant unit of an innovation and a definable population of potential adopters (Wolfe 1994, Rogers 1995), mobile market present scenarios where multiple services with different scaling properties can diffuse as a result of the diffusions of several devices and services. Consequently, it becomes important not only to identify core characteristics among different adopter categories in terms of users’ degree of innovativeness, but to determine adopter categories based on behavior and how differences in technology and service use can yield variations in the end-user requirements and attitudes. We therefore concur with recent suggestions seeing it apposite to treat end-users as ‘users of technology’ as well as ‘users of services’ (Pedersen & Ling 2002, Pedersen et al. 2002).

In this article we present results from a survey developed to investigate market segments of Danish mobile users. Based on variables pertaining to demographics, technology use, service use, and service-technology requirement, we conduct statistical analysis to identify: (1) mobile services’ user categories; (2) key characteristics in technology and service use that differentiate the categories; and (3) differences among the categories in terms of end-user requirements.

Our study contributes to theory of mobile services’ adoption and use on two separate accounts. First, we exemplify that survey data can be utilized beyond categorization of user segments based on demographic variables and assessing degrees of innovativeness. By exploring current use among the

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<sup>1</sup> For the full verse see:

[http://whitewolf.newcastle.edu.au/words/authors/K/KiplingRudyard/verse/english\\_history/danegeld.html](http://whitewolf.newcastle.edu.au/words/authors/K/KiplingRudyard/verse/english_history/danegeld.html)

sample of mobile users in Denmark, we can also identify migration paths within the overall diffusion of mobile communications. Second, we demonstrate that there is a connection between the user as a ‘user of technology’ and as a ‘user of mobile services’ and that this connection can be of significant importance for understanding users’ technology-service requirements.

The remainder of this paper is organized as follows. Section 2 presents a brief review on related theoretical work on adopter categorization of mobile service users as well as the market trends in the Danish mobile communications market leading to the proposed user categories. Section 3 describes the research method used and the hypotheses. Section 4 presents the results and underlines the key characteristics of the proposed user categories. Finally, section 5 concludes by highlighting the insight generated.

## **2 CATEGORIZATION OF M-SERVICE USERS**

### **2.1 Current theory**

Although the range of foci in current end-user studies span location-aware advertising (Oh & Xu 2003), customer confusion (Turnbull & Leek 2000), consumption styles (Wilska 2003), customer retention/loyalty (Gerpott et al. 2001), market categorization (Aarnio et al. 2002, Gilbert & Kendall 2003), intentions of use/accept/adopt (Khalifa & Cheng 2002, Fogelgren-Pedersen et al. 2003, Hung, et al. 2003), and mobile shopping site selection (Wu, Wang et al. 2004), they can broadly be placed under the three umbrellas of (1) technology acceptance research, (2) consumer behavior research; and (3) adopter categorization research. For the purpose of our research we will focus on the latter.

Adopter categorization is one of the six streams identified in the review by Wolfe (1994) belonging to diffusion of innovation (DoI) research. It aims to divide populations of adopters into different categories. Rogers (1995, p. 257) argues that because a “fertile disarray of adopter categories and methods of categorization” has emerged, standardization is warranted. He suggests standardization into the five adopter categories of innovators, early adopters, early majority, late majority, and laggards. Apparent in this wording is what has become known as the ‘individual-blame bias’ (Rogers 1995) in DoI research. The categories promote stereotyping truisms presenting innovators and early adopters to benefit more from their adoption than the early and late majority and the laggards in particular. However, for telecommunications services and other product-service offerings exhibiting network effects, this can be quite opposite. In fact, value for users will under these circumstances increase with the helix arising from number of other users and complementary offerings available over the network (Beck et al. 2003, Lee & O'Connor 2003). For instance, as SMS and voice telephony introduce one-to-one network scaling properties, the connectivity value will scale slowly with the first adopters, but can then suddenly erupt as the number of connecting others increase. For mobile communications, value will not only be attributable to the value of the offering itself – the intrinsic value – but also to the extrinsic value deriving from network effects and positive-feedback.

Resulting from this, and further fuelled by the multiplicity of different use of technology, use of services, and technology-service requirements pertaining to mobile communications is a departure from the pivotal DoI assumptions. In fact, due to the complex, ambiguous, malleable, and interconnected nature of mobile product-service offerings, it becomes less apposite to determine adopter categories based on aggregate diffusion curves and pure adopter innovativeness characteristics. The challenges arising are recognized by Rogers where he acknowledges that due to the social learning bound to diffusion, re-invention can lead to cases where individuals will not always “exactly mimic the model” (Rogers 1995, p. 331). Hence, we adopt a social learning perspective resting on the assumptions that (1) technology and service use is not completely random but evolves over time as people learn; (2) technology and service adoption requires and instantiates behavioral change; (3) technology and service requirements provide indications on a behavioral change paths; and (4) a multiplicity of behaviors can exist in relation to a mobile product-service offering.

Although similar assumptions are not explicitly stated in current mobile service adopter categorization research, they are nevertheless reflected in recent studies. Based on data from Singapore and Malaysia, Gilbert and Kendall (2003) outlined five needs-based early adopter categories derived from intention to use WAP services, specific service requirements and demographic variables. It was found that needs of 'mobile professionals' centered on services useful in relation to work such as calendaring, e-mail and access to intranet/extranet; 'sophisticates' emphasized material style; 'socialities' focused on interpersonal contact; 'technotoys' were driven by a need to know technological developments hands-on; and 'lifestylers' focused on the always-mobile way of living. Also, two segments unlikely motivated to adopt mobile services were identified; 'misers' were the ones unwilling to pay, while 'laggards' were the last to know and adopt new technologies. Similarly, Aarnio and colleagues (2002) identified five adopter categories and that e-mail was used across all categories. Also, all mobile phone users had adopted SMS text messaging. Moreover, advanced forms of SMS services was utilized by the 12% being deemed 'innovative opinion leaders', the 14% being 'early adopters' and the 40% being 'late adopting students'. The 'innovative opinion leaders' were the only categories of users where WAP and data transmission was utilized.

Furthermore, Anckar and D'Incau (2002) even if they were not aiming to categorize users, have empirically documented a rather low general willingness to use new mobile services among Finnish consumers', but that e-mail, banking, ticket reservation and remote appliance controlling, were services which respondents both attributed value and were willing to use. Moreover, it was also documented that women in general were more willing to use m-services than men; that older age groups were more reluctant than younger people to use m-services; and that m-services catering to spontaneous needs and time-critical needs appeared most interesting; and that internet users were more willing to embrace m-commerce than non-Internet users (Anckar et al. 2002).

In the realm of existing research we propose a categorization of users according to the technology in use. We investigate convergences and differences in demographics, technology and service use, and technology-service requirements among the proposed groups. This is expected to reduce the problems of the individual-blame bias as it opens for categorizing adopters based on their behavior-requirements convergences and not only their predispositions to adopt or not to adopt.

## 2.2 Mobile use in the Danish market

The Danish mobile communications market exhibits one of the world's most vivid price competition on contracts, SMS, and voice services between the five key market players (TDC, Sonofon, Telmore, Orange, and Telia). The mobile phone penetration rate is above 83%. During 2003, GPRS data transfer and MMS use witnessed triple digit growth rates. Comparing the first and second half of 2003, there has been an increase of 105% in the number of GPRS subscribers catalyzing a growth of 145% in the total download/upload GPRS rate. Statistics reveal that the 290,000 GPRS subscribers generated approximately 2.74 MB of traffic during the second half of 2003, but that the traffic in terms of MBs per users has dropped significantly from the end of 2002 where the GPRS users averaged 8.17 MB. Moreover, the average mobile user sent more than 515 SMS in the second half of 2003. This is an increase of 63% from the first half of 2003. Although the overall MMS rates are bleach vis-à-vis the SMS rates, the growth rates are not. From the total 500,000 MMS sent over the Danish mobile infrastructure during the first half of 2003, this number has increased by 355% to approximately 2.3 million MMS in the second half. It is also worth noting that the total minutes of voice calls increased by 10.4% during this period, while the corresponding numbers for fixed networks dropped by 9%. In sum, we note that (1) growth in terms of subscribers and voice is declining and reaching saturation; (2) SMS services continue to show high growth; (3) only 6.06% of total subscribers also subscribed to

GPRS/3G<sup>2</sup>; and that evolutionary paths from voice and SMS towards increased use of more advanced data services can be identified.

### 2.3 Identification of user categories

There is a clear division of subscribers caused by the fact that one must be data enabled in order to utilize MMS. Hence, the Danish mobile users can be broadly divided into GPRS subscribers and non-GPRS subscribers. In order to obtain further understanding of use between the two groups, we conducted four group interviews. The group interviews were conducted during December 2003 and January 2004. They included equal number of GPRS and non-GPRS enabled female and male mobile users. Participants were engaged to speak about how they used their mobile phones, discuss about new services they had encountered or observed; and based on a trial of the first 3G handsets in the Danish market (Motorola A-920). Following the group interviews, we became aware of a sub-division of the non-GPRS subscribers to one group that did not use other mobile services than voice-calls and to a second group that used SMS in addition to voice. For the GPRS enabled users a similar subdivision was discovered to one group that used MMS services but no other data based services and another group that also used data based services. Besides, both of the latter groups used voice and SMS. We thus derived four categories subject for further investigation in the Danish market.

- **Talkers (TA)** adopters of voice services only
- **Writers (WR)** adopters of SMS in addition to voice services
- **Photographers (PH)** adopters of MMS services in addition to voice and SMS
- **Surfers (SU)** adopters of GPRS data services in addition to SMS, MMS and voice services

It follows from the four categories that while ‘talkers’ have taken one primary learning step in terms of mobile communications use, ‘writers’, ‘photographers’ and ‘surfers’ have experienced one, two, or three additional changes in their behaviour. In order to elaborate on the proposed categorisation, we investigate if there are significant differences between groups in terms of their technology experience, usage of different mobile services, and their requirements to new mobile technologies.

## 3 RESEARCH APPROACH

Based on the results from existing m-service categorization studies (see section 2.1) and the four group interviews conducted, we identified central issues that affect adoption and diffusion of mobile services subject to further investigation in the Danish market. In particular, the survey instrument includes 44 questions organised in different categories that include mobile communications’ usage patterns, influences on service, Internet usage patterns demographics, mobile users’ attitudes and perceptions on mobile services, adoption of 3G services and phones.

The set of questions were developed and formatted into an online survey. The survey was then pilot tested among the staff of a university department (25) where 50% had prior experience on mobile data related service usage. Following to the feedback received from the trial survey, the questions were revised, and the survey was then publicly launched on the Internet. The survey ran from February to March 2004.

Miller and Dickson (Miller & Dickson 2001) argue that on-line consumer behaviour research presents a new area of academic study in marketing and strongly encourage further research. With 67% of Internet subscriptions, and Denmark being a leading nation in terms of e-commerce<sup>2</sup>, the Internet was considered an appropriate medium for the survey in order to obtain responses by users with experience of mobile phones, mobile services, and Internet services.

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<sup>2</sup> <http://www.itst.dk/mainpage.asp>

The sample is not representative of the total Danish population since it only includes self-selected Internet users. According to Hair and colleagues (Hair et al. 2001) and Kinnear and Taylor (1996), self-selected sampling is suitable for exploratory research and when ex ante knowledge of the population characteristics is not sufficiently present. The sample is influenced by Internet and mobile penetration as well as the advertising effort for the online survey. However, the intense advertising and the balanced mix of Internet pages hosting links to the survey (e.g. information portal, and university website) have counterbalanced part of this shortcoming. The resulting sample consists of 1.103 usable responses.

### 3.1 Research hypotheses

Having delineated the four user categories, we investigate whether there are significant differences between them in terms of technology use, service use, self-assessment of innovativeness and technology-service requirements.

For exploring differences in terms of technology use, two questions assessing years of experience with a mobile device and the age of current device are included. Thus, we hypothesize that:

$H^I_0$ : *There are no significant differences between the four categories in terms of their years of experience with a mobile phone and the age of their current mobile phone.*

In order to investigate if there are significant differences between the categories in terms of service use, as discussed by Aarnio and colleagues (2002), we include three questions pertaining to voice use, SMS use and MMS use among. Thus, we hypothesize that:

$H^{IIa}_0$ : *There are no significant differences between the four categories in terms of voice use.*

$H^{IIb}_0$ : *There are no significant differences between ‘writers’, ‘photographers’ and ‘surfers’ in terms of SMS use.*

$H^{IIc}_0$ : *There is no significant difference between ‘photographers’ and ‘surfers’ in their use of MMS.*

Moreover, based on DoI research insights (Wolfe 1994, Rogers 1995) we investigate differences in terms of innovativeness, perceived usefulness, ease of use and intention to use mobile services among the four groups, to support the proposed categorisation. Hence, respondents are asked to reveal their perceptions and self assess their innovativeness in terms of mobile services through six statements. Thus, we hypothesize that:

$H^{III}_0$ : *There are no significant differences between the four groups in terms of their assessment of innovativeness, perceived usefulness, ease of use and intention to use mobile services.*

Finally, technology-service requirements, as already discussed in related research (Gilbert & Kendall 2003), may differ for the four categories. Hence, the respondents are asked to indicate the importance of various mobile devices’ features in their decision to buy a new mobile phone. Thus, we hypothesize that:

$H^{IV}_0$ : *The four groups attach the same importance on mobile technology-service requirements.*

## 4 RESULTS

### 4.1 Demographics of the proposed categories

The demographics of the proposed categories are presented in Table 1. Accordingly, ‘talkers’ and ‘surfers’ are mainly men working on the private sector with relatively higher household monthly income. Most of ‘talkers’ are over 50 years old, whereas the majority of ‘writers’ and ‘photographers’ are students between 20 and 30 years old.

		Talkers (TA)	Writers (WR)	Photographers (PH)	Surfers (SU)
Category	size	74 (6%)	619 (56%)	365 (33%)	45 (4%)
Gender	male	82%	58%	59%	92%
	female	18%	42%	41%	8%
Age	>50	42%	14%	9%	10%
	50-41	34%	16%	12%	7%
	40-31	18%	24%	27%	37%
	30-20	5%	45%	49%	37%
	<20	0%	1%	3%	10%
Education	Primary, Secondary & no tertiary	42%	34%	39%	27%
	Tertiary	37%	36%	33%	27%
	Quaternary	21%	30%	29%	46%
Occupation	Privat. sector	53%	28%	33%	42%
	Students	7%	43%	44%	34%
	Public-semi public	40%	29%	23%	24%
Monthly Household Income	<3.500 €	19%	41%	38%	29%
	3.500 €-8.000 €	38%	31%	30%	34%
	> 8.000 €	25%	15%	16%	25%
	No response	18%	13%	16%	12%

Table 1: The demographics of user categories.

#### 4.2 Category differences in mobile technology and service use

In order to investigate whether there are significant differences among the four adopter categories in terms technology and service use we performed median test. The results are indicated in Table 2.

Parameters	Median Test ≈: Cannot reject Ho, ≠: Reject Ho		
Technology Use			
Years of experience with mobile devices	TA ≠ WR TA ≠ PH	TA ≈ SU WR ≠ PH	WR ≠ SU PH ≠ SU
Age of the current device	TA ≈ WR TA ≠ PH	TA ≠ SU WR ≠ PH	WR ≠ SU PH ≠ SU
Service Use			
Voice services (minutes daily)	TA ≈ WR TA ≠ PH	TA ≠ SU WR ≠ PH	WR ≠ SU PH ≈ SU
SMS (number weekly)	WR ≠ PH	WR ≈ SU	PH ≠ SU
MMS	PH ≠ SU		

Table 2: Investigating differences between groups in terms of technology and service use

Table 2 offers initial indications on the differences between the four categories in terms of technology and service use. In particular, we observe that ‘talkers’ and ‘surfers’ have more than 6 years of experience with mobile devices, whereas the two other groups less than 6. Besides, the current devices of ‘talkers’ and ‘writers’ are more than one year old, whereas the other two groups have less than one year old devices. In terms of service use, ‘talkers’ and ‘writers’ use voice services for less than 5 minutes daily whereas ‘photographers’ and ‘surfers’ use them between 5 and 10 minutes daily. For SMS use, ‘writers’ and ‘surfers’ send less than 20 SMS, while the ‘photographers’ send more than 20



SMS weekly. Finally, in terms of MMS use the ‘photographers’ use MMS ‘now and then’, while ‘surfers’ use MMS less than 5 times per week.

#### 4.3 Category differences in mobile services’ innovativeness

The respondents are asked to indicate the extent to which they agree or disagree on a set of six statements that include innovativeness (3 items), perceived usefulness (1 item), ease of use (1 item) as well as intention to use (1 item) mobile services. The responses cannot be used in absolute terms since are based on self-assessment. However, in relative terms we expect a ranking on the average of each group, where more advanced mobile users should assign higher value vis-à-vis the other groups. We perform the Welch’s variance-weighted ANOVA tests to observe whether there is significant difference among the assessments of the group. Then, we use Games Howell post hoc tests, which are recommended in case of different variance and unequal sample sizes. Table 3 indicates the results.

Parameters of innovativeness	Means (1: Com/ly Unimportant – 5: Very Important)				Asympt. F distri.	P-value	Games Howell Post-Hoc Comparisons >>: Significant >: Not Significant	
	TA	WR	PH	SU				
I seek information about new mobile phones on a regular base	2.78	3.18	3.75	4.38	56.15	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
Among my peers, I am usually the first to try out new mobile technologies and services	1.90	2.10	2.71	3.67	45.17	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
I like to experiment with new technologies	2.90	3.12	3.55	4.31	46.14	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
It is easy for me to make my mobile phone do what I want it to do	3.06	3.76	3.86	4.12	12.65	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Besides voice calls and SMS-messaging, mobile phones have other useful functions	2.83	3.36	3.85	4.21	39.97	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
In the future, I will increasingly use mobile services in my personal and working life	2.72	3.4	3.64	4.31	23.73	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU

Table 3: ANOVA and Post-Hoc Results on innovativeness

The clear ranking in the significance of each statement between the categories supports our proposed categorisation. The F-test indicates that the means of the four groups are not equal. The post hoc tests enable a more concrete analysis of the difference between groups. With respect to seeking information on mobile developments on a regular basis, experimentation with new technologies, and future use of mobile services, there are clear distinctions between the groups supporting the proposed categorization. It is indicated that ‘surfers’ are the most active information seekers, experimenters, and foreseers of increased future service use, while ‘talkers’ are found on the opposite side. For the respondents’ self-assessment of innovativeness vis-à-vis peers and self experimentation, post-hoc tests indicate difference between groups except from ‘talkers’ and ‘writers’. An interesting observation relates to the self-assessment of respondents capabilities to use the mobile device the way they want. In this statement we observe no difference between ‘photographers’ and ‘surfers’, indicating that mobile users are maturing or at least regard themselves to be sufficient literate in relation to using their device efficiently.

Moreover, the four categories perceive the main benefit of mobile communications to be the ‘improvement of personal relationships with peers’ and second important benefit to be ‘services make me accessible anywhere and anytime’. Besides, in terms of attitudes towards 3G, 49% of ‘talkers’ and 31% of ‘writers’ see 3G devices and services be of ‘no interest’, whereas 25% of ‘photographers’ and 34% of ‘surfers’ concur with the statement: “they are interesting but I am waiting for new devices and others’ reactions”. Although ‘photographers’ and ‘surfers’ are the most interested in 3G devices and services, operators’ prices and the devices available appear also to influence their attitude.

#### 4.4 Category differences in mobile device requirements

As the technology-service capabilities of mobile devices can enable or impede service use, this may be critical for mobile service adoption and diffusion. For example, in case of photographs, mobile internet pages, and video streaming services, the colour display is an important factor which, as has been learned from Japan (Funk 2001), could affect usage behaviour. In order to explore whether there are significant differences between the groups in terms of mobile technology-service requirements we performed Welch’s variance-weighted ANOVA tests, and post hoc tests. The results are summarized in Table 4.

Requirements for Mobile Devices	Means (1: Completely Unimportant – 5: Very Important)				Asymptotically F distributed	P-value	Games Howell Post-Hoc Comparisons >>: Significant >: Not Significant	
	TA	WR	PH	SU				
Colour Display	2.48	3.15	3.98	4.55	58.42	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Camera	1.99	2.47	3.08	3.48	25.66	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Video	1.44	1.84	2.32	2.79	23.70	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Radio /Music	1.62	2.54	3.14	3.00	39.02	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Polyphonic Ring tones	1.63	2.04	2.80	2.88	34.53	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Broadband Internet	2.60	2.66	3.16	4.26	32.07	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
E-mail	3.01	3.03	3.41	4.45	21.06	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
PC Synchronisation	3.10	3.15	3.63	4.19	14.8	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
Messenger	1.30	1.79	2.16	2.52	29.15	0.000	TA>>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU
Map /Positioning	2.81	2.64	3.09	3.71	15.58	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>>SU
Games	1.26	1.60	2.21	2.45	34.17	0.000	TA>WR TA>>PH TA>>SU	WR>>PH WR>>SU PH>SU

*Table 4: ANOVA and Post-Hoc Results on requirements for mobile devices*

The users' requirements can be broadly distinguished in terms of device's features such as colour display, camera, etc. and enabled services such as messenger, broadband Internet and mobile e-mail etc. The results from the tests show that the most important requirements for the four categories are colour display, e-mail, broadband Internet and PC synchronisation whereas the least important are messenger and games.

A key observation pertaining Table 4 is that 'photographers' and 'surfers' do not significantly differ with respect to their requirements for mobile device's features. However, for enabling services such as broadband Internet access, e-mail and map/positioning services we observe significant differences. This indication supports our argument that 'surfers' have taken an extra behavioural change step and that once taken; it is reflected in their future service requirements. Moreover, the significant differences between 'writers' and 'photographers' on all the device's requirements demarcates the distinction discovered between GPRS and non-GPRS subscribers. Parallel to this, we find that 'talkers' and 'writers' do not have significantly different requirements in terms of colour display, camera, video and messenger. Furthermore, there is a rather high rating among all groups concerning e-mail, which may point to a universally required service. It is worth mentioning at this point that the majority of respondents in all four categories revealed daily use of email, banking and information services on the Internet.

## **5 CONCLUSIONS**

The contemporary Danish mobile device and service market has been described by analysts as "mobile operators' 'hell on earth'"<sup>3</sup>. Although growth in MMS and GPRS represent a new revenue source, the number of users needs to increase dramatically before it gains importance. The proposed user categorisation contributes with insights beyond what can be provided by aggregate diffusion models and categorization purely based on innovativeness. As adoption of mobile devices do not imply homogenous use, we have in this paper identified specific areas in which congruencies can be found and where significant differences exist between 'talkers', 'writers', 'photographers' and 'surfers' with respect to experience, service use, innovativeness and service-technology requirements.

We find that 'talkers', the adopters of the least advanced mobile services do not significantly differ from the adopters of the most advanced services category, the 'surfers', with respect years of experience. Besides, both groups stated intense Internet services usage. Yet, these categories are significantly different when it comes to the age of current device, number of voice minutes used daily, on all accounts of innovativeness and on all technology-service requirements. The large categories of 'writers' and 'photographers' appear to significantly differ on all accounts of innovativeness, years of experience, age of current device, in number of daily voice minutes and on the number of SMS sent weekly. Moreover, they appear to have significantly different mobile technology-service requirements.

When comparing the two most advanced mobile services usage categories, the 'photographers' and 'surfers' we find that there are significant differences with respect to innovativeness, years of experience, age of current device and the number of SMS and MMS sent, but that there is no significant difference in terms of daily voice minutes. In addition, they do not significantly differ in terms of technology-service requirements except on the accounts of broadband Internet, e-mail and map/positioning services. We can thus conclude that the 'photographers' are approaching the 'surfers' and that a usage trajectory moving from voice and SMS to also include MMS and advanced data services is emerging.

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<sup>3</sup> <http://www.strandreports.com/sw695.asp>

The results underline mobile e-mail and synchronization with computers as the two most important requirements among the respondents. It is worth mentioning here that in terms of the Internet usage, the majority of users in all the categories claimed repeated daily or continuous access. Thus, better integration between the Internet, e-mail and PCs can be an important path towards more advanced mobile service usage. In light of the continuous growth of SMS in Denmark and the series of surveys from Europe and North America that have placed mobile e-mail as a key benefit from the users' point of view (Hammond 2001), it is somewhat surprising that mobile operators have not placed more emphasis on using mobile e-mail to stimulate more advanced service usage in Denmark. As experienced in Japan, mobile e-mail has not only been a key driver of network data traffic, but due to html-linking properties has contributed to increased advanced mobile service traffic (Funk 2001, Kitada & Scuka 2001, Sharma & Nakamura 2004). On the other side, mobile operators with SMS success may perceive mobile e-mail to be a threat to current revenues.

Aarnio et al. (2002) argued, based on their results from the Finnish market, that for value added mobile services to reach a critical mass, prices need to come down and services should be integrated with the Internet. The results of our survey enable us to largely concur. As monthly mobile spending is quite low for all four categories (i.e. 'talkers' and 'writers' pay less than 10 Euro whereas the 'photographers' and 'surfers' more than 15 Euro monthly), and price is an important factor for choosing a mobile operator, it is imperative that the prices of value added services are set to attract volume by the masses; the 'writers' and 'photographers'. Yet, there are few among the large categories of 'writers' (16%) and 'photographers' (16%) viewing a good selection of mobile services to be important for their choice of operator, indicating that services need to be customised to meet their actual needs and preferences (Anckar & D'Incau 2002). In a market plagued with Dane-geld, this may be an arduous task as the currently limited number of mobile data enabled users represents relatively small revenue possibilities. However, unless attracting the masses, positive feedback cannot be ignited and thus increase of advanced mobile service use may be inhibited - even if Dane-geld is paid.

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