The Effect of Demographics on Seamless Mobile Service Interface

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Abstract— ***The purpose of this paper is to demonstrate the effect of demographic variables on choice of a service delivery channel and on the factors affecting the seamless user experience related in different electronic channels. Profession proved to have the most diverse effect in this study as it affects the usage of all the other channels except the option of personal service. To elaborate the relationship between demographics and dimensions of seamless use experience further, we conducted ANOVA for all the user segments – Fixed-line, Mobile and Combined users. The results are based on a large consumer survey conducted among mobile and fixed-line Internet users in Finland during summer 2003.***

Index Terms— demographical variables, seamless, service interface

1. INTRODUCTION

ADDING digital channels such as mobile and developing more and more commoditized products will clearly help to shift further tasks towards the customer through self-provisioning and thus, will help cutting additional costs [1]. For the sake of successful business models, the service providers and equipment manufacturers must observe the needs of mobile service customers and more importantly, study their willingness to pay. It has been stated that weight which individual users put on performance in relation to their perception of simplicity and acceptability, may not only be very different but may also change over tasks and situations [2].

The number of mobile Internet users is expected to grow up to 730 million to year 2005 [3]. Such a large number of users is bound to consist of a very heterogeneous mass of customers with differing demographic profiles. It has been proposed that mobile Internet services can be categorized under utilitarian services, which offer instrumental benefits, and hedonic services, which offer experiential benefits [4].

2. USAGE AND CURRENT MOBILE SERVICE USERS

Customers have been slow to adopt mobile Internet services. Users prefer fixed-line Internet for communication purposes and content application usage over mobile Internet whereas commerce applications are used via mobile Internet [5]. In Finland, for example, only 15 percent of customers with a GPRS / WAP-enabled mobile phone use mobile Internet services consistently [6]. It has been also found that only half of the customers, who have tried mobile Internet services, continue using them [7]. Continuers may regard the current mobile Internet services as more usable than discontinuers may, because they have used the services enough to overcome frequently occurring usability problems [7]. 73 percent of Web sites studied had at least one accessibility error [8]. Only 15 percent of Web sites are free of accessibility errors [9]. This research finding was based on analyses of 219 home pages.

Actual users are more susceptible to the benefits resulting from the adoption of a new information system while potential users are more vulnerable in terms of usability [10]. This finding is in line with results presented in earlier research reports on this topic [11]. Females are more likely to experience technostress in using computers compared with males [12]. It has been also reported that males are more likely than females to perceive computer usage as fun [13]. It has been examined whether there exists a gender differences between ease of use and complexity of computer usage [14]. Age was chosen as a covariate. Age has been found to be associated with unfavorable perceived usefulness and a decreased attitude towards using computers as well as adoption [15, 16].

3. METHODOLOGY AND DATA COLLECTION

The usability attributes by Nielsen were chosen as the starting point for our seamless use experience investigation as they constitute a generic model and fit in the service context too [17]. The relation between usability and seamless use experience has been described in detail in a previous research report published by the author [18]. Before the actual data collection, focus group interviews among expert users were conducted. The meaning of these interviews was to map the possible options for survey questions. The questionnaire was pre-tested on a group of 60 students and modified accordingly. A postal survey was conducted in May 2003. The sample was drawn from TeliaSonera[1] Finland's customer

[1] Based on the number of customers, TeliaSonera is the largest mobile operator in Sweden and Finland, the second largest operator

database. The sample was stratified in three active user segments of mobile users, fixed-line users and combined users equal in size depending on the main electronic service delivery channel in their use. The questionnaires were tailored respectively.

We call the customers, who did not own according to the database a private fixed-line connection at home, the Mobile users. The customers collected under this sample had the highest volume of mobile data transfers (GPRS, high-speed data) during the last six months in comparison to other customers in the database. They represented in every way the most active mobile Internet users the database had. The Combined users had a private fixed-line Internet connection in use at home. Further, their customer record showed active usage of mobile Internet (GPRS, high-speed data) connection and WAP-services during the last six months. The Fixed-line users owned a mobile phone and they were using regular mobile phone services such as SMS. There was no sign of Internet related activities during the last six months in their customer record. They had a private fixed-line Internet connection (mainly ADSL) in use at home.

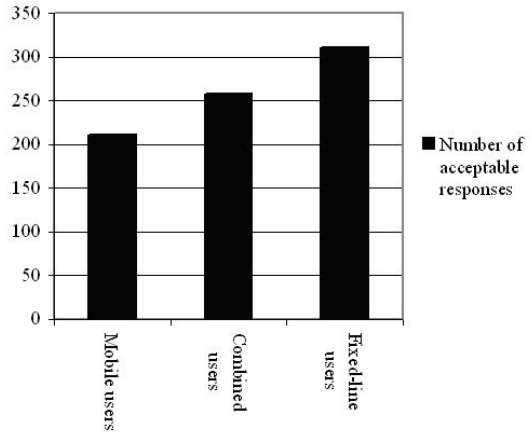

Figure 1: The division of response rate among the different user segments of customers

After a second follow-up, 778 responses were accepted under further analyses. The final response rate was 25.9%, which is acceptable according to economic science standards. The distribution of the responses in different user segments is presented in figure 1.

The respondents were asked to fill out a structured questionnaire on a 7-point Likert scale concerning their preferences, experiences and beliefs towards usage of mobile and Internet services. Literature as well as prior conducted surveys guided us in defining the scales to measure the customers' perceived seamless use experience [19, 20, 21]. There were up to 27 questions in each tailored questionnaire.

4. RESULTS

The demographic profile of the respondents is presented in table 1. One third (33.9%) of the respondents were women and two thirds (64.8%) were men. The majority (59.8%) of the respondents were 25-49 years old and their annual household income (28.1%) before taxes fell within the range of 20 000 – 30 000 euros, which matches with the average annual income of two adults family in Finland [22]. Only every fifth (18.2%) of the respondents had two or more children living at home. The majority of all the respondents were workers (40.6%). This result is compatible with the result of the educational background of the respondents, which was in most cases (29.0%) vocational school. Obviously, Internet and its services are becoming available for all the consumer segments regardless of their annual household income or educational background.

Table 1: Profile of respondents

Demographic characteristics	Mobile users		Combined users		Fixed-line users		Total	
	No	%	No	%	No	%	No	%
Total	211	100.0	257	100.0	310	100.0	778	100.0
Gender								
Male	157	74.4	192	74.7	155	50.0	504	64.8
Female	54	25.6	55	21.4	155	50.0	263	33.9
Missing	0	0	10	3.9	0	0	10	1.3
s.d	*0.437*		*0.417*		*0.501*			
Age								
Under 24 years of age	64	30.3	33	12.9	43	13.9	140	18.0
25-34 years	81	38.4	96	37.4	62	20.0	239	30.7
35-49 years	43	20.4	83	32.3	100	32.3	226	29.1
Over 50 years of age	20	9.5	41	15.9	104	24.5	129	16.6
Missing	3	1.4	4	1.6	1	0.3	8	1.0
s.d	*0.998*		*0.974*		*1.196*			
Annual household income								
Less than 10 000 euros	33	15.6	21	8.2	43	13.9	97	12.3
10 001 – 20 000 euros	54	25.6	48	18.7	82	26.5	184	23.7
20 001 – 30 000 euros	59	28.0	87	33.9	73	23.5	219	28.1
30 001 – 40 000 euros	25	11.8	37	14.4	40	12.9	102	13.1
More than 40 001 euros	29	13.8	53	20.5	60	19.3	142	18.3
Missing	11	5.2	11	4.3	12	3.9	34	4.5
s.d	*1.650*		*1.875*		*1.741*			
Marital status								
Married	27	12.8	101	39.3	128	41.3	256	33.0
Cohabitation	60	28.4	69	26.8	58	18.7	187	24.0
Single (incl. widow, divorced)	115	54.5	80	31.1	116	37.5	311	39.9
Missing	9	4.3	7	2.7	8	2.6	24	3.1
s.d	*0.940*		*1.154*		*1.397*			
Number of children living at home								
0	165	78.2	152	59.1	176	57.0	493	63.4
1	21	10.0	45	17.5	71	23.0	137	17.6
2	14	6.6	29	11.3	42	13.6	85	11.0
3 or more	8	3.8	28	10.9	20	6.5	56	7.2
Missing	3	1.4	3	1.2	1	0.3	7	0.8
s.d	*0.791*		*1.074*		*1.019*			
Education								
Elementary school	24	11.4	31	12.1	48	15.5	103	13.2
Secondary education	34	16.1	63	24.5	64	20.7	161	20.7
Vocational school	69	32.7	85	33.1	72	23.2	226	29.0
University degree	48	22.8	39	15.2	82	26.4	169	21.7
Other	33	15.6	36	14.1	41	13.2	110	14.2
Missing	3	1.4	3	1.2	3	1.0	9	1.2
s.d	*1.952*		*1.916*		*2.063*			
Profession								
Leading position	10	4.7	20	7.8	20	6.5	50	6.4
Worker	96	45.5	116	45.1	104	33.5	316	40.6
Public servant	28	13.3	31	12.1	40	12.9	99	12.7
Other	71	33.6	85	33.0	144	46.3	300	38.5
Missing	6	2.8	5	1.9	2	0.6	13	1.8
s.d	*2.367*		*2.526*		*2.547*			

Over third (37.3%) of the Mobile users use mobile services weekly and four out of five (83.8%) Fixed-line users use fixed-line electronic services weekly. The Mobile users report of using mainly five services. The Fixed-line users suppose that they needed a bundle of two

in Norway, and the fourth largest operator in Denmark. TeliaSonera is also the largest fixed voice and data provider in the region with leading positions in Sweden and Finland and a significant position in Denmark. TeliaSonera International Carrier is the leading IP wholesaler in Europe with a 10% market share. TeliaSonera is listed on the Stockholm Exchange, the Helsinki Exchange and Nasdaq Stock Market in the USA.

services, if they would be daily using mobile services. The most commonly used mobile services used are related to home and family, hobbies and leisure time, and making reservation. Over the fixed-line Internet connection customers access mostly search engine, communication and financial services. Among the customers who are not currently using mobile services, the most tempting service bundle comprises of gender specific services search engine and using mobile service for remote control purposes (e.g. activating burglar alarm).

Besides pure demographic variables, the respondents' level of innovativeness was measured using ethnographic arguments on a scale of -3 (totally disagree) to 3 (totally agree). Figure 2 shows somewhat surprisingly, the Fixed-line users (mean 1.84, s.d. 1.877) appear to value technical improvements over personal service more than the Mobile users (mean 0.53, s.d. 1.873). In overall, the Fixed-line users have more positive perceptions about technology and use of technology than the Mobile users. This might be due to the negative beliefs the Mobile users may have towards WAP-enabled services. Controversially, the Mobile users seem to be more favorable towards automated services (s.d. 1.861) and adapting to changes (s.d. 2.082) more easily than the Fixed-line users. The standard deviations were moderate or high for all arguments.

The effect of demographic variables on the choice of a service delivery channel among different user segments are presented in table 2. Only the significant correlation coefficients are visible on the table to increase its readability. The values for the Mobile users are bolded, for the Combined users on italic and for the Fixed-line users underlined. We can see from the table that all the demographics correlated with one or more service delivery channels. Gender is a significant factor for the Combined (men) and Fixed-line users (female) when choosing mobile phone as a modem via PC as their primary electronic service delivery channel. Age affects the choice of mobile (younger) and fixed-line Internet (younger) and the usage of mobile phone as a modem to connect on the Internet (older). Profession proved to have the most diverse effect in this study as it affects the usage of all the other channels except the option of personal service. There is also a correlation between personal service and marital status, which might be partially also due to the number of children married people may have and children's needs in regard with the service delivery channel choice. Line of business did not correlate with any of the distribution channels.

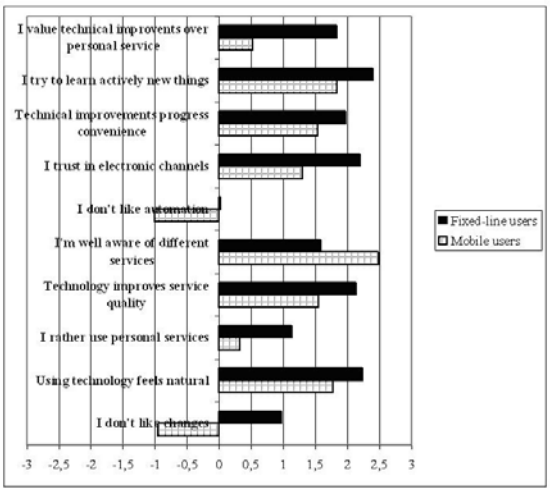

Figure 2: Innovativeness of the respondents

Table 2: Correlation matrix on the effect of demographic variables on service delivery channel choice: MOBILE USERS, COMBINED USERS AND FIXED-LINE USERS

CORRELATION MATRIX **Service delivery channel usage ⇒** **Demographic variables ⇓**	Mobile Internet services α=.68	Fixed-line Internet services α=.64	Mobile phone as a modem (via PC) α=.71	Mobile service usage via PDA α=.62	Self-service, automated services α=.78	Personal service α=.81
Gender			*-.141*, .675***			
Age	*-.170***	*-.227**, -.349***	**.282****			
Marital status		*.124**				*.274**
Education		**.236****, *.317**	**.209****, *.131**			
Income		**.147***	**.213****, *.276***	*.163**		
Profession	*.335**	*-.198***	**.224****,	*.143**	**-.165***	
Line of Business						

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

There are dependencies between all the demographic variables and factors affecting the seamless user experience (see table 3). Mobile users, who perceive mobile service delivery channel as seamless, have a lower level of education. It is usual that as the education level rises, one becomes more critical and analytical towards phenomenon. Married Fixed-line users perceive their primary electronic service delivery channel prone to errors. Females seem to be more affluent to errors than male when they are Mobile or Combined users. The younger and less educated respondents in all the user segments are the most likely to perceive electronic channels as independent from time and place.

Table 3: Correlation matrix on the effect of demographic variables on the factors affecting the seamless user experience related in different electronic channels: MOBILE USERS, COMBINED USERS AND FIXED-LINE USERS

CORRELATION MATRIX Demographic variables ⇒ To which channel you related the following statements ⇓	Gender α=.65	Age α=.75	Marital status α=.72	Education α=.68	Income A=.71	Profession α=.68	Line of Business A=.64
Seamless				-.150*			
Easy to learn		.137*			.132*		
Difficult to remember				.206*			-.181*
Inefficient	.175** -.219*	.228**		-.188**		-.231*	
Prone to errors	.186* .184**		-.234*				
Satisfies my needs	.155*	.156*					
Easy to use when traveling				-.192**			
Easy flowing when I'm busy				-.398**		-.151*	
Popular among my peers		.164*		-.201**			
Independent from time and place		-.226**		-.164* -.383*			

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

To further elaborate the relationship between demographics and dimensions of seamless use experience, we conducted an ANOVA for all the user segments. All the users were asked to visualize the mobile service customer-technology interface in use. Therefore, the results from the Mobile users and Combined users represent the actual user experience whereas the results from the Fixed-line user segment are merely their perceptions about dimensions of seamless mobile service interface. However, as the Fixed-line users may be the potential mobile service users and at least they are used to technology-based services in general, their perceptions and beliefs were thought to be valuable to map.

The variables, which during the follow up analyses showed significant correlations, were identified after close examination. As a result, we are now able to conclude that despite the results of a preliminary testing of interdependence, education does not affect how customers are positioned in the segment of the Mobile users view the memorability of mobile services as part of seamless use experience (see table 4). Line of business was also not found to affect the perceived efficiency of use in this user segment. Men find the memorability of mobile services a more important dimension than females and the more one is educated, the less meaningful the dimension memorability of mobile services becomes.

Table 4: Dimensions of seamless use experience among the Mobile users: ANOVA on demographics

Learnability	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.72			**between groups**		
1. Line of business			2.801	3.713	.002
Heavy industry	51	4.9504			
Public administration	11	4.9798			
Transportation	25	4.3450			
Services sector	48	4.7535			
Computing and Telecommunications	10	4.7444			
Commerce	16	4.6597			
Other	7	3.5397			
Total	168	4.7073			

Efficiency of use	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.72			**between groups**		
1. Line of business			1.675	1.988	.070
Heavy industry	51	4.4575			
Public administration	11	4.4621			
Transportation	24	4.3148			
Services sector	48	4.1780			
Computing and Telecommunications	10	3.7778			
Commerce	16	3.9306			
Other	7	3.5714			
Total	167	4.2286			

Memorability	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.88			**between groups**		
1. Gender			6.154	6.635	.011
Male	148	3.8790			
Female	48	4.2911			
Total	196	3.9799			
1. Education			1.549	1.665	.120
Elementary school	21	4.4101			
Business school	16	4.3194			
Vocational school	63	4.0071			
Technical school	18	4.0123			
Polytechnic institution	21	3.8803			
University degree	24	3.5451			
High school graduate	30	3.8852			
Other	2	3.8333			
Total	195	3.9855			
2. Line of business			1.891	2.177	.048
Heavy industry	51	4.0784			
Public administration	11	4.3712			
Transportation	25	3.7000			
Services sector	48	4.0463			
Computing and Telecommunications	8	3.7500			
Commerce	16	3.6484			
Other	6	3.0556			
Total	165	3.9364			

Satisfaction	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.64			**between groups**		
1. Income			5.183	4.046	.002
Less than 10.000 euros	28	4.2901			
10.001-20.000 euros	52	3.5474			
20.001-30.000 euros	57	4.0750			
30.001-40.000 euros	23	3.8614			
40.001-50.000 euros	12	2.8500			
Over 50.001 euros	14	3.5770			
Total	186	3.8170			

Errors	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.67			**between groups**		
1. Education			1.834	2.132	.042
Elementary school	21	4.9869			
Business school	16	4.9938			
Vocational school	63	4.8501			
Technical school	17	4.8235			
Polytechnic institution	21	4.3762			
University degree	26	4.5068			
High school graduate	29	4.2974			
Other	2	5.0000			
Total	195	4.6968			

Notice Scale between 0 (not at all important) … 6 (very important)

In the user segment of Combined users, the dimension of seamless use experience labeled learnability was affected by marital status, gender and age. The single people find easy learnability of mobile services more important than the married ones. The older respondents perceived

the importance of service's learnability as part of seamless use experience higher. In this user segment, females perceive efficiency of use as well as memorability of electronic service more important than males. The importance of errors lowers as the annual household income level rises. Income as a determinant of efficiency of use and memorability was not found significant. All dimensions of seamless use experience had different influence by demographics than in a segment of Mobile users although they were both asked to describe the seamless use experience of mobile services.

The Fixed-line users presented their perceptions about what they would see as important for seamless mobile service user experience and in table 6 we present the results of the demographic effect for this segment. The learnability shares partially same demographic effect than in the Combined users segment. Only gender is found having significant effect as females find the learnability of mobile services more important than males. There are no significant determinants for the efficiency of use in the Fixed-line user segment and for the memorability, only education is found having significant effect. This finding is typical only for the Fixed-line users according to the data in use. Also, both dimensions of satisfaction and errors have distinctive features compared to other user segments: the older respondents placed higher importance on the satisfaction and the younger ones seemed to be more irritated with their belief of expected errors in mobile service usage.

Table 5: Dimensions of seamless use experience among the Fixed-line users: ANOVA on demographics

Learnability	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.69			**between groups**		
1. Gender			8.497	8.901	.003
Male	138	4.4020			
Female	133	4.7562			
Total	271	4.5759			
2. Age			0.734	0.745	.562
Less than 18-24	41	4.5274			
25-34	56	4.4341			
35-49	86	4.5860			
50-64	66	4.6244			
Over 65 years of age	22	4.8414			
Total	271	4.5759			
3. Education			1.484	1.579	.142
Elementary school	38	4.7675			
Business school	25	4.6129			
Vocational school	64	4.7573			
Technical school	32	4.3635			
Polytechnic institution	26	4.3812			
University degree	46	4.5000			
High school graduate	28	4.3020			
Other	10	5.0300			
Total	269	4.5809			
Efficiency of use	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.76			**between groups**		
1. Age			0.363	0.240	.915
Less than 18-24	40	4.2333			
25-34	55	4.3962			
35-49	87	4.3286			
50-64	58	4.4582			
65 years of age	18	4.2847			
Total	258	4.3543			
Memorability	**N**	**Means**	**Mean square**	**F value**	**Sig.**
α=.74			**between groups**		
1. Marital status			2.702	2.241	.065
Married	95	3.9291			
Cohabitation	52	3.7521			
Single	60	3.7875			
Leski	7	4.2608			
Divorced	246	3.7861			
2. Education			2.857	2.414	.021
Elementary school	33	4.1344			
Business school	25	4.0210			
Vocational school	58	3.9768			
Technical school	31	3.5842			
Polytechnic institution	25	3.6639			
University degree	42	3.3862			
High school graduate	28	3.5857			
Other	8	4.4028			
Total	250	3.7927			

3. Income			1.683	1.412	.211
Less than 10.000 euros	34	3.7418			
10.001-20.000 euros	68	4.0373			
20.001-30.000 euros	57	3.7351			
30.001-40.000 euros	37	3.6843			
40.001-50.000 euros	23	3.5700			
50.001-60.000 euros	11	3.7273			
More than 60.001 euros	13	3.2201			
Total	243	3.7693			
Satisfaction	**N**	**Means**	**Mean square between groups**	**F value**	**Sig.**
α=.82					
1. Age			4.091	3.501	.008
Less than 18-24	42	3.5548			
25-34	61	4.0086			
35-49	86	3.9233			
50-64	62	4.0129			
Over 65 years of age	21	4.6159			
Total	272	3.9594			
2. Profession			1.930	1.622	.119
Leading position	17	3.4876			
Worker	95	3.8124			
Government official	20	4.1944			
Public servant	37	4.1568			
Student	27	3.7704			
Pensioner	37	4.3345			
Entrepreneur	16	3.9813			
Unemployed	14	4.1500			
Other	9	3.7580			
Total	272	3.9594			
Errors	**N**	**Means**	**Mean square between groups**	**F value**	**Sig.**
α=.68					
1. Age			3.8997	3.321	.036
Less than 18-24	47	4.8429			
25-34	60	4.4148			
35-49	66	3.2838			
50-64	63	4.0719			
Over 65 years of age	20	2.7248			
Total	256	3.8676			

Notice Scale between 0 (not at all important)… 6 (very important)

5. CONCLUSIONS

Gender seems to have significant effect as females find the learnability of mobile services more important. The older respondents place higher importance on the satisfaction and the younger ones seem to be more irritated with their belief of expected errors in mobile service usage.

Less educated Mobile users seem to perceive mobile service delivery channel as seamless, and independent from time and place. Female Mobile users seem to be more affluent to errors, and male value memorability of mobile services higher.

Females in the Combined group seem to be more affluent to errors than males. Profession proved to have the most diverse effect in this study as it affects the usage of all the other channels except the option of personal service. The older respondents perceive the importance of service's learnability as part of seamless use experience higher.

The huge mass of potential mobile service customers will need an available and reliable infrastructure to access electronic services. The expected improvements in present and future generations of mobile phones will encourage the uptake of mobile services. Marketers need some directions of future customers' perceptions and likings to be able to focus on right issues in marketing mobile services.

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