

Influence of Usability on Customer Satisfaction: A Case Study on Mobile Phone Services

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ABSTRACT

Designing for better user experiences (*e.g.*, interactions more satisfying, enjoyable) is usually more difficult than aiming for clearer usability goals (*e.g.*, improve systems' efficiency, easy of use). In this paper, we present a conceptual model validated with data from 603 mobile phone users that clarifies the relationship between usability of basic mobile services and the users' satisfaction with them. Our findings indicate that satisfaction is mostly influenced by how users perceive the usability of these services, more specifically their efficiency. We discuss the model and propose three implications that shall increase satisfaction with basic mobile services: a few solutions to minimize routine disruption, personality-based service personalization, and persuasive strategies to raise awareness of one's technology consumption saturation point.

Author Keywords

Big Five; mobile phone services; personality; structural equation modeling; usability.

ACM Classification Keywords

H.1.2 Models and Principles: User/Machine Systems: Human Factors

INTRODUCTION

The Human-Computer Interaction community was once concerned primarily with usability, but has since become more interested in understanding, designing for and evaluating a wider range of user experience aspects. According to Rogers *et al.* [29], interactive systems should now be designed in terms of their objectives classified in terms of usability and user experience goals. Traditionally, usability goals are related to specific usability engineering criteria (*e.g.*, systems designed to be more efficient, effective, easy to use), whereas user experience goals aim to explain the nature of the user experience (*e.g.*, interactions more satisfying, enjoyable, engaging) [29]. Although usability goals are nowadays better established and integrated into Software Engineering, UX goals are still considered somewhat fuzzy, being their connection

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with usability goals even less clear. In this paper we focus on clarifying this connection in the context of mobile phone services, particularly between two key usability goals (*i.e.* efficiency and ease of use) and an important UX goal: user satisfaction. More specifically, we present findings of a conceptual model validated with data from 603 customers of a telecommunication operator that provides insights on the relationship between perceived usability of basic mobile phone services and their satisfaction with them. The model also captures the influence of other variables, such as the users' personality profile and their usage of mobile services. In the following sections we explain how the proposed model was empirically validated and discuss how designers and software engineers could leverage the model towards improving customers' satisfaction with basic mobile services.

CONCEPTUAL MODEL

The way people appropriate technology has been previously studied. Several theoretical models have been introduced and tested to explain user acceptance behavior, such as the *Theory of Reasoned Action* [15], the *Theory of Planned Behavior* [2] and the *Technology Acceptance Model* [11]. While these models have contributed a great deal to our understanding of users' preferences and acceptance behavior of technological artifacts, they fall short in explaining the users' experience with technology.

User experience encompasses the experiential, affective, and cognitive aspects of a person interacting with a product, system or service¹. Therefore it is not limited to the user's intention to use a certain technology. However, user experience models do not typically capture the role of the user's personality when interacting with a certain piece of technology. Ryckman [30] defined personality as a "dynamic and organized set of characteristics possessed by a person that uniquely *influences* his or her cognitions, motivations, and behaviors in various situations". Recent studies have demonstrated that personality influences directly how people experience the world [28]. Hence, we believe that there is an opportunity to better understand the user's interaction with technology by taking into account his/her personality profile.

Personality profiles are typically assessed by means of surveys. Goldberg [17]'s Big Five model is one of today's most well-known, accessible—and of public domain—and empirically validated personality assessment models. It structures a personality profile into five factors (or traits): Extroversion,

¹Adapted from en.wikipedia.org/wiki/User_experience, last retrieved September 2012.

Agreeableness, Conscientiousness, Emotional Stability, and Intellect (also known as Openness). The five factor model is not only well known in Personality Psychology, but also extensively used by the HCI community [25, 14, 6].

Our proposed model aims at explaining the customer’s satisfaction with basic mobile phone services by means of his/her: (1) personality traits, (2) perceived usability of the services, and (3) actual usage of these services. Figure 1 depicts the model with references to prior work related to each of the five hypothesized relationships among the different concepts. Detailed explanations on relationships 4 and 5 from Figure 1 are out of the scope of this paper. Next we therefore concentrate on presenting prior art that sheds light on the first three hypothesized relationships.

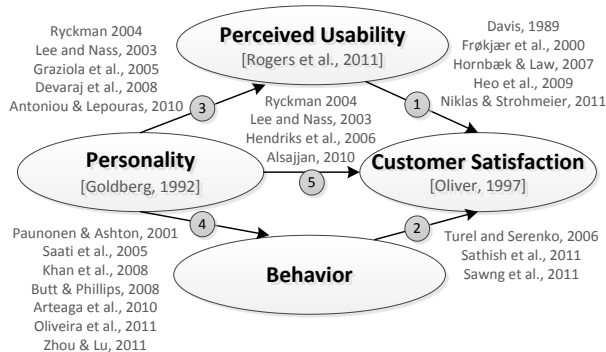


Figure 1. Proposed conceptual model. References that address each relationship are indicated onto the corresponding arrow or ellipse.

Relationship 1: Perceived Usability of mobile phone services influences the customers’ satisfaction with them. Usability goals (*e.g.*, effectiveness, efficiency, learnability) have been said to be positively correlated with how people evaluate their user experience with technology (*e.g.*, satisfying, enjoyable) [29]. However, these correlations depend in a complex way on the application domain, the user’s experience and the context of use [16]. Additionally, effectiveness, efficiency and satisfaction should be considered to be different goals [16, 22]. These recent findings motivate the study of our hypothesis in the case of mobile services. In this regard, Heo *et al.* [21] created a framework to evaluate the usability of mobile services, and showed that there were correlations between usability and user experience constructs, such as satisfaction. Another support for this hypothesis comes from the Technology Acceptance Model [11] that has been adapted to the specific case of mobile services [27]. In both cases significant correlations between usability goals and user satisfaction were found. In this paper we investigate the impact of perceived usability on customer satisfaction with mobile phone services.

Relationship 2: Mobile phone usage influences customer satisfaction with mobile phone services. The way customers use mobile technology influences their experience of the mobile services they use. Turel & Serenko [34] worked on a model that incorporated self-reported behavioral accounts of mobile service usage. They found that it was

possible to use these measures to benchmark service operators in terms of customer satisfaction and loyalty. Similarly, Sawng *et al.* [33] worked on a model that included social benefits, satisfaction and service risks and that could be used to predict customer behavior when using mobile phone services. In market research, behavioral patterns are typically used to predict switching to a different operator (*i.e.*, churn). For instance, Sathish *et al.* [32] studied the factors that affected churn decisions in India. They found that self-reported call frequency was among the most important factors in determining whether customers were satisfied with their carriers. In this paper, we investigate the impact that actual—as recorded by the operator—mobile phone usage has on customer satisfaction with mobile services.

Relationship 3: Personality influences the perception of usability of mobile phone services. Many researchers have worked on the relation between personality and the measures that are usually taken into account to define the usability of a system. Ease of use and usefulness were studied by Devaraj *et al.* [13], who conducted a study with 180 new users of a collaborative technology and found correlations between the personality dimensions and the perceived usefulness and ease of use. Other related measures of usability have been studied for mobile services. Antoniou & Lepouras [5] worked on an adaptive mobile museum guide and showed that personality traits are related to the acceptance of the adaptivity dimensions of the service. A similar study was conducted by Graziola *et al.* [19], who found a relation between personality traits and the user’s preferences of interface modality. Our work builds on these previous findings and investigates whether and how they hold in the context of the proposed model.

METHODOLOGY

According to Rogers *et al.* [29], usability testing has been increasingly performed remotely, thus allowing services to be evaluated with larger samples and improving ecological validity by keeping participants in their own environment. Furthermore, Nielsen & Levy [26]’s work on the relationship between self-reported measures and objective measures of usability have encouraged the community to also consider measuring usability in a subjective manner. We therefore opted for measuring both usability and user satisfaction using an online survey approach. Participants were recruited via email from an online panel with members living in Mexico and who satisfied two filtering criteria: they all owned a Telefonica² pre-paid mobile phone number, and were using basic mobile phone services for at least the past six months (*i.e.*, calls, SMS, MMS, and basic GPRS/3G related services). The online survey had two main sections. The first section included 50 questions [1] to assess their personality traits according to the Big Five model (*i.e.* extroversion, agreeableness, conscientiousness, emotional stability and intellect) [17], whereas the second section collected the participants’ opinions about the basic mobile phone services that they were using.

²Telefonica S.A. is currently the 3rd largest telecommunication company worldwide with over 300 Million customers (21 Million in Mexico). See www.telefonica.com for further details.

Measures. Items were measured either subjectively or objectively. A total of seven constructs were created from survey items and hence *subjectively* measured: extroversion, agreeableness, conscientiousness, emotional stability, intellect, perceived usability, and satisfaction with mobile phone services. Each of the five personality traits were captured by 10 survey items that were later grouped into personality facets using Goldberg’s [18] classification (shown in Table 1). This was performed by computing summated scales for each facet, *i.e.*, summing all positive survey items and reversed negative items related to the same facet. For instance, if one participant gave the ratings 2, 8, and 7 to the survey items $q8r$, $q33$, and $q43$ respectively (see Table 1), then the summated scale for his/her Orderliness personality facet would be: $(10 - 2) + 8 + 7 = 23$. The remaining two subjectively measured factors—customer satisfaction and perceived usability—were assessed in relation to the mobile services contracted by the participants (phone calls, messages, *i.e.* SMS and MMS, Internet access and operator’s mobile Web portal). Finally, mobile phone usage was the only factor composed of items that were measured *objectively*: the total number of mobile phone calls made/received between January and June 2010, the total duration of phone calls, and the total number of messages sent/received during the same period. Table 1 summarizes data and constructs used in the study.

Participants. A total of 603 valid responses (male: 50.2%, controlled for a balanced distribution) were obtained in the final study. Participants’ age ranged between 18 and 35 years old ($\bar{x} = 25.87$, $s = 5.25$)—as per our invitation filtering criteria—and they predominantly belonged to the middle socioeconomic class. The majority reported using computers (93.4%) and the Internet (92.4%) at least once a week. In terms of mobile phone use, 81.6% reported using their mobile phone everyday and 14.8% several times a week. Based on their mobile phone call data, participants made or received an average of 101 calls per month and sent or received an average of 171 messages per month.

Data analysis. The conceptual model depicted in Figure 2—note that we expanded the personality variable from Figure 1 into the Big Five traits—was evaluated using Structural Equation Modeling (SEM) [7]. We highlight at least three reasons for using this approach: (1) SEM models relationships between concepts given that its objective function maximizes the probability of predicting the covariance matrix instead of predicting values of a certain variable; (2) SEM takes measurement unreliability into account by modeling equation errors and non-measurable concepts—*e.g.*, extroversion, satisfaction—as latent variables, thus avoiding unrealistic assumptions of error-free measurements; and (3) SEM allows researchers to leverage previous knowledge given that it uses confirmatory rather than exploratory factor analysis.

The conceptual model was evaluated using Maximum Likelihood (ML) estimation and the data was bootstrapped (1000 samples) to meet the estimation’s assumption of joint multivariate normality of observed variables [7]. The SEM estimation process was split in two steps as recommended by Anderson and Gerbing [4]. First we developed a measurement

model, *i.e.* relationships between each factor construct—*e.g.* usability—and its corresponding items—*e.g.* efficiency and ease of use. Then we estimated the structural paths—*e.g.* between factors usability and satisfaction. The measurement model was evaluated for uni-dimensionality, reliability, convergent and discriminant validity. Finally, the hypothesized structural paths between constructs were included in the model for the final estimation.

RESULTS AND DISCUSSION

Figure 2 depicts the validated conceptual model with the most relevant statistics. Fit measures like SRMR (.05), RMSEA (.05), CFI (.94), and PRATIO (.80) reveal that our model has a good fit according to widely accepted cutoff criteria [23, 7]. Next we discuss only those results related to the influence of perceived usability on customer satisfaction, and how one can leverage the findings of the model in order to propose new design solutions for basic mobile phone services that encompasses both usability and UX goals.

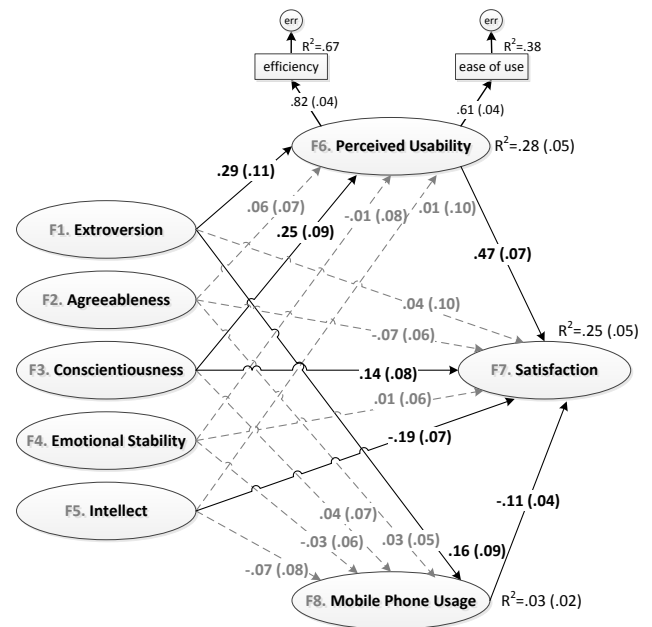


Figure 2. Validated conceptual model. Standardized loadings next to the corresponding arrows with standard errors in parenthesis (bootstrapping to 1000 samples). Significant paths ($p < .05$) indicated by solid black arrows and non-significant paths indicated by grey dashed arrows. Error variables and covariance paths omitted for clarity.

Perceived usability positively influences customer satisfaction with mobile phone services. The validated conceptual model corroborated that the usability of mobile phone services is positively correlated with the customers’ satisfaction with these services ($\beta_{76} = .47$; $p = .002$). The standardized direct effect of perceived usability on satisfaction was .47, which means that when usability goes up by 1 standard deviation, satisfaction goes up by .47 standard deviation, and hence has a very strong influence on it. In fact, this is the strongest direct influence present in the model. With

Table 1. Construct factors and associated items captured subjectively by the survey and objectively by the mobile phone operator.

Construct Factor Item code	Summated item Item name	Survey code ^a	Item description in English / Item description in Spanish (used in the survey)	Removed from the model ^g
Extroversion^b				
x1	Gregariousness	q1	Am the life of the party / Soy el alma de la fiesta	
		q6r	Don't talk a lot / No hablo mucho	
		q16r	Keep in the background / Prefiero mantenerme al margen ^h	•
		q21	Start conversations / Comienzo las conversaciones	
x2	Poise	q31	Talk to a lot of different people at parties / En las fiestas hablo con muchas personas diferentes	
		q36r	Don't like to draw attention to myself / No me gusta llamar la atención	•
x3	Leadership	q46r	Am quiet around strangers / Cuando estoy entre desconocidos me mantengo callado	
x4	Provocativeness	q11	Feel comfortable around people / Me siento cómodo con la gente	
		q26r	Have little to say / No tengo mucho que decir	
x5	Understanding	q41	Don't mind being the center of attention / No me importa ser el centro de atención	•
		q2r	Feel little concern for others / Me preocupo poco por los demás	
		q17	Sympathize with others' feelings / Soy sensible hacia las emociones de otros	
		q22r	Am not interested in other people's problems / No me interesan los problemas de otras personas	
x6	Warmth	q7	Am interested in people / Me intereso por la gente	
		q32r	Am not really interested in others / En realidad no me intereso por los demás	
		q37	Take time out for others / Dedico tiempo a los demás	
		q42	Feel others' emotions / Siento las emociones de los otros	
x7	Pleasantness	q47	Make people feel at ease / Hago sentir cómoda a la gente	
		q12r	Insult people / Ofendo a la gente	•
x8	Nurturance	q27	Have a soft heart / Tengo un corazón sensible	
Conscientiousness^b				
x9	Conscientiousness	q28r	Often forget to put things back in their proper place / A menudo olvido poner las cosas en su lugar	•
x10	Orderliness	q8r	Leave my belongings around / Dejo mis pertenencias en cualquier lado	
		q33	Like order / Me gusta el orden	
		q43	Follow a schedule / Hago un programa y lo sigo	
x11	Organization	q13	Pay attention to details / Pongo atención en los detalles	•
		q23	Get chores done right away / Realizo mis tareas inmediatamente	
x12	Efficiency	q48	Am exacting in my work / Soy perfeccionista en mi trabajo	
		q3	Am always prepared / Siempre estoy preparado	
x13	Purposefulness	q18r	Make a mess of things / Soy desordenado	
		q38r	Shirk my duties / Evado mis obligaciones	
Emotional Stability^b				
x14	Stability	q4r	Get stressed out easily / Me estreso con facilidad	
		q24r	Am easily disturbed / Me molesto fácilmente	
		q29r	Get upset easily / Me disgusto con facilidad	
		q34r	Change my mood a lot / Cambio mucho de humor	
x15	Tranquility	q9	Am relaxed most of the time / Estoy relajado la mayor parte del tiempo	
		q39r	Have frequent mood swings / Tengo cambios frecuentes de estado de ánimo	
x16	Happiness	q14r	Worry about things / Me preocupo por todo	
		q19	Seldom feel blue / Rara vez me siento triste	
x17	Calmness	q49r	Often feel blue / Me siento triste frecuentemente	
		q44r	Get irritated easily / Me irrito fácilmente	•
Intellect^b				
x18	Intellect	q5	Have a rich vocabulary / Tengo un vocabulario amplio	
		q20r	Am not interested in abstract ideas / No me interesan las ideas abstractas	
		q40	Use difficult words / Utilizo palabras difíciles	
x19	Creativity	q10r	Have difficulty understanding abstract ideas / Me cuesta entender ideas abstractas	•
x20	Imagination	q15	Have a vivid imagination / Tengo mucha imaginación	
		q25	Have excellent ideas / Tengo excelentes ideas	
x21	Ingenuity	q30r	Do not have a good imagination / No tengo una buena imaginación	
		q50	Am full of ideas / Estoy lleno de ideas	
x22	Quickness	q35	Am quick to understand things / Soy rápido para entender las cosas	•
x23	Introspection	q45	Spend time reflecting on things / Dedico tiempo a reflexionar	•
Usability^c				
x24	Ease of Use	q51	I find it easy to make mobile phone services do what I need / Me resulta fácil conseguir que los servicios de telefonía celular hagan lo que necesito	
x25	Efficiency	q52	Using mobile phone services saves my time / Utilizar los servicios de telefonía celular me hace ahorrar tiempo	
Satisfaction				
x26	General Satisfaction ^d	q53	What is your general satisfaction level with the mobile phone services that you are paying for? ¿Cuál es tu nivel de satisfacción general con los servicios de telefonía celular que estás pagando?	
x27	Expectations Met ^e	q54	How do you think the mobile phone services that you are paying for meet your expectations? / ¿Cómo consideras que los servicios de telefonía celular que estás pagando cumplen con tus expectativas?	
x28	Ideal Mobile Services ^f	q55	How close are the mobile phone services that you are paying for to your ideal mobile services? ¿Dónde consideras que se encuentran los servicios de telefonía celular que tienes contratados con respecto a tu ideal de servicios de telefonía celular?	
Mobile Phone Usage				
x29	Calls	N/A	[not survey]: Number of mobile phone calls made/received between January and June 2010	
x30	Duration of calls	N/A	[not survey]: Total duration of mobile phone calls made/received between January and June 2010	
x31	Messages	N/A	[not survey]: Number of phone messages (SMS, MMS) sent/received between January and June 2010	

^a Numbers in item code indicate the order of appearance in the survey while the letter "r" indicate the item is reversed.

^b Associated survey items measured in a 9-point scale ranging from 1: "almost never" and 9: "almost always" as suggested by Goldberg (1992).

^c Associated survey items measured in a 9-point scale ranging from 1: "strongly disagree" and 9: "strongly agree".

^d Measured in a 9-point scale ranging from 1: "completely not satisfied" and 9: "completely satisfied".

^e Measured in a 9-point scale ranging from 1: "don't meet my expectations at all" and 9: "meet all of my expectations".

^f Measured in a 9-point scale ranging from 1: "very far" and 9: "very close".

^g Item-analysis suggested that personality facets measured by one survey item were violating unidimensionality of their corresponding factors and should therefore be removed. Furthermore, convergent validity analysis and subjective inspection of questions pointed out that the extroversion factor should be improved by removing items q16r and q36r.

^h When reusing the Spanish translation, change this item for: "Intento no llamar la atención" as suggested by Cupani (2009).

respect to the key usability goals that defined customer satisfaction, service efficiency came in first place ($R^2 = .67$), followed by ease of use ($R^2 = .38$). The model changed significantly when usability loadings for these variables were constrained to be equal ($\chi^2/df = 8.813$, $p = .003$). These results indicate that the efficiency of basic mobile phone services might be the most important usability goal determining user satisfaction—in the context considered herein.

Mobile phone usage influences customer satisfaction with mobile phone services. According to our model, this influence is rather negative ($\beta_{78} = -.11$; $p = .005$), meaning that the more one uses basic mobile phone services, the less satisfied s/he is with them. One possible explanation of this finding is that technology consumption might have a saturation point. Satisfaction could be maintained up to a point where the given technology addresses people's needs without compromising their daily routines and personal values. If by overusing mobile services one jeopardizes these routines and values, then dissatisfaction might be a natural outcome due to several reasons, *e.g.*, realizing that too much time is being wasted using them, creating anxiety to keep up with the flow of messages and calls, *etc.* Note that the construct factor for Mobile Phone Usage comprised more information about synchronous disruptive activities like phone calls ($R^2 = .94$) and their durations ($R^2 = .83$), than about sent/received asynchronous text messages ($R^2 = .45$). Therefore, the mobile phone usage patterns as captured by our model include mostly activities that can break daily routines and hence be more susceptible to the argument of technology consumption saturation point. While previous work demonstrated the existence of a link between usage behavior and satisfaction with mobile services [34, 33], our work goes one step further by finding that these are negatively linked (and quantifying the relationship), suggesting a possible explanation, and considering actual mobile phone usage as captured by the mobile operator.

Personality influences the perception of usability of mobile phone services. More specifically, extroversion ($\beta_{61} = .29$; $p = .004$) and conscientiousness ($\beta_{63} = .25$; $p = .006$) had significant effects on perceived usability of mobile phone services. The interpretation of this finding is grounded on behavior theories associated to personality traits. If today's mobile phone services are useful to shorten distances between people and allow them to efficiently interact more often, it is expected that extroverts—who interact with peers more frequently—will recognize such qualities and hence highly evaluate these services' usability. Likewise, if these services indeed help people save time, one would expect that those who care about efficiency when following daily schedules—*i.e.*, people with high scores on the conscientiousness trait—would positively rate the services' usability. We cannot directly compare our work with previous models because these studies do not group usability goals into one single factor [33, 35]. However, our work offers synergic findings by revealing that extroversion and conscientiousness have a significant effect on the usability construct (composed of efficiency and ease of use).

Limitations of the Study

As described in the methodology section, the conceptual model from Figure 2 was validated using data from 603 subjects living in Mexico with an age range of 18-35 years old, who had a pre-paid cellphone, and were using mobile services for at least six months (calls, messages and basic GPRS/3G related services). Our findings can therefore be safely generalized to this sample profile only ($CL = 95\%$; margin of error: $\pm 4\%$). Note that pre-paid mobile phone services are predominant in developing economies, but it is not in the developed world. Future work should verify whether the model also holds for smartphone users with unlimited data plan.

FROM THEORY TO PRACTICE

The conceptual model validated in the previous section contributes to our understanding of how software engineers and HCI practitioners could improve customers' satisfaction based on more clear usability goals. For example, the perceived usability of the basic mobile phone services used by our participants was the most important factor when explaining customer satisfaction. Moreover, the concept of usability was mostly characterized by efficiency ($R^2 = .67$) rather than ease of use ($R^2 = .38$), thus highlighting an important trend for satisfaction. Note that saving people's time is a recurrent result from our research as mobile phone usage had a significant negative effect on satisfaction. Next, we propose three design solutions:

First, project managers in charge of developing new mobile communication services should focus their efforts on designing more efficient solutions that minimize disruption of the users' routine. For instance we can think about leaving the possibility to request statements of the monthly bill or performing operations on the contract such as enabling (or disabling) options of the call plan via SMS or email instead of requesting the customers to go through call centers that too often require an enormous effort from their side. In terms of minimizing routine disruption, the user's contextual information could be leveraged in order to identify the most suitable periods of the day for sending them notifications or contacting them.

Second, personalized services could be created to help users with low scores on the extroversion and conscientiousness traits better manage their time when overusing mobile phones. For example, less organized people could overuse mobile services during a certain time period without planning much for the additional costs and end up with an unpleasant surprise when receiving their monthly bill. Mobile services with personality-based user models could help these "less organized" users by sending them periodic feedback on how much they have spent with phone calls and text messages, and how close they are to their preferred maximum expense. Recent work by Cherubini *et al.* [9] has revealed that the lack of personalization is actually one of the biggest barriers for the adoption of today's mobile phone contextual services. Although related mostly to basic mobile phone services, our findings are in agreement with these conclusions and further identify new opportunities for personality-based personalization. We expect their practical relevance to increase as tech-

niques for the automatic assessment of personality are more accurate and pervasive [24, 12].

Finally, mobile services should identify and provide awareness of the user's saturation point when consuming mobile phone services. Persuasive techniques (e.g., social support, reminders, etc.) are relevant in this context towards preventing mental/physical stress and hence low satisfaction.

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REFERENCES

1. IPIP 50-item big five questionnaire. Retrieved from: ipip.ori.org/New_IPIP-50-item-scale.htm. Accessed on September 2012.
2. Ajzen, I. The theory of planned behavior. *Org. Behavior and Human Decision Processes*, 50 (1991), 179–211.
3. Alsajjan, B. A. How the big five personality dimensions influence customers trust in uk cellular providers? *Int. J. of Global Business* 3, 1 (June 2010), 102–116.
4. Anderson, J., and Gerbing, D. Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin* 103, 3 (1988).
5. Antoniou, A., and Lepouras, G. Modeling visitors' profiles: A study to investigate adaptation aspects for museum learning technologies. *J. Comput. Cult. Herit.* 3 (Oct 2010), 7:1–7:19.
6. Arteaga, S. M., Kudeki, M., Woodworth, A., and Kurniawan, S. Mobile system to motivate teenagers' physical activity. In *Proc. of IDC '10*, ACM (Barcelona, Spain, Jun 2010), 1–10.
7. Blunch, N. J. *Introduction to structural equation modelling using SPSS and AMOS*. SAGE, Thousand Oaks, Cal., US, 2008.
8. Butt, S., and Phillips, J. G. Personality and self reported mobile phone use. *Comput. Hum. Behav.* 24, 2 (2008), 346–360.
9. Cherubini, M., de Oliveira, R., Hiltunen, A., and Oliver, N. Barriers and bridges in the adoption of today's mobile phone contextual services. In *Proc. MobileHCI '11*, ACM (Stockholm, Sweden, Aug. 30 – Sep. 2 2011).
10. Cupani, M. El cuestionario de personalidad IPIP-FFM: resultados preliminares de una adaptación en una muestra de preadolescentes argentinos. *Perspectivas en Psicología* 6 (Nov. 2009), 51–58.
11. Davis, F. D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* 13, 3 (Sep. 1989), 319–340.
12. de Oliveira, R., Karatzoglou, A., Concejero, P., Armenta, A., and Oliver, N. Towards a psychographic user model from mobile phone usage. In *EA. Proc. CHI '11*, ACM (Vancouver, Canada, May 7-11 2011), 2191–2196.
13. Devaraj, S., Easley, R. F., and Crant, J. M. How does personality matter? Relating the Five-Factor Model to technology acceptance and use. *Inf. Systems Res.* 19, 1 (March 2008), 93–105.
14. Eckschlagel, M., Bernhaupt, R., and Tscheligi, M. NEMESys: neural emotion eliciting system. In *Proc. CHI'05*, ACM (Portland, USA, 2005), 1347–1350.
15. Fishbein, M., and Ajzen, I. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading, MA, USA, 1975.
16. Frøkjær, E., Hertzum, M., and Hornbæk, K. Measuring usability: are effectiveness, efficiency, and satisfaction really correlated? In *Proc. CHI'00*, ACM (The Hague, The Netherlands, April 1-6 2000), 345–352.
17. Goldberg, L. R. The development of markers for the Big-Five Factor structure. *Psych. Assessment* 4 (1992), 26–42.
18. Goldberg, L. R. *Personality psychology in Europe*, vol. 7. Tilburg Univ. Press, Tilburg, The Netherlands, 1999, ch. A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models., 7–28.
19. Graziola, I., Pianesi, F., Zancanaro, M., and Goren-Bar, D. Dimensions of adaptivity in mobile systems: personality and people's attitudes. In *Proc. IUI'05*, ACM (San Diego, USA, January 10-13 2005), 223–230.
20. Hendriks, A., Smets, E., Vrieling, M., Van Es, S., and De Haes, J. Is personality a determinant of patient satisfaction with hospital care? *Int. J. for Qual. in Health Care* 18, 2 (April 2006), 152–158.
21. Heo, J., Ham, D.-H., Park, S., Song, C., and Yoon, W. C. A framework for evaluating the usability of mobile phones based on multi-level, hierarchical model of usability factors. *Interact. Comput.* 21 (August 2009), 263–275.
22. Hornbæk, K., and Lai-Chong Law, E. Meta-analysis of correlations among usability measures. In *Proc. CHI'07*, ACM (San Jose, USA, 2007), 617–626.
23. Hu, L., and Bentler, P. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling* 6, 1 (1999), 1–55.
24. Khan, I., Brinkman, W.-P., Fine, N., and Hierons, R. Measuring personality from keyboard and mouse use. In *Proc. ECCE '08*, ACM (Funchal, Portugal, Sep. 16-19 2008), 1–8.
25. Lee, K., and Nass, C. Designing social presence of social actors in human computer interaction. In *Proc. CHI'03*, ACM (Ft. Lauderdale, USA, 2003), 289–296.
26. Nielsen, J., and Levy, J. Measuring usability: preference vs. performance. *Commun. ACM* 37, 4 (Apr. 1994), 66–75.
27. Niklas, S., and Strohmeier, S. Exploring the impact of usefulness and enjoyment on mobile service acceptance: A comparative study. *Proc. HICSS* (Jan. 4-7 2011), 1–10.
28. Paunonen, S., and Ashton, M. Big Five factors and facets and the prediction of behavior. *J. of Pers. and Social Psych.* 81, 3 (2001), 524–539.
29. Rogers, Y., Sharp, H., and Preece, J. *Interaction Design: Beyond Human-Computer Interaction*, 3rd ed. Wiley, West Sussex, UK, 2011.
30. Ryckman, R. M. *Theories of personality*, 8th ed. Brooks/Cole, Pacific Grove, CA, USA, 2004.
31. Saati, B., Salem, M., and Brinkman, W. Towards customized user interface skins: investigating user personality and skin colour. In *HCI*, vol. 2 (Las Vegas, USA, 2005), 89–93.
32. Sathish, M., Santhosh Kumar, K., Naveen, K., and Jeevanantham, V. A study on consumer switching behaviour in cellular service provider: A study with reference to chennai. *Far East J. of Psych. and Bus.* 2, 2 (February 2011), 71–81.
33. Sawng, Y.-W., Kim, S.-H., Lee, J., and Young, S. Mobile service usage behavior in Korea: An empirical study on consumer acceptance of innovative technologies. *Tech. and Econ. Dev. of Econ.* 17, 1 (August 2011), 151–173.
34. Turel, O., and Serenko, A. Satisfaction with mobile services in canada: An empirical investigation. *Telec. Policy* 30, 5-6 (July 2006), 314–331.
35. Zhou, T., and Lu, Y. The effects of personality traits on user acceptance of mobile commerce. *Int. J. of Human-Computer Int.* 27, 6 (2011), 545–561.