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A Short-Form Measure Of Attitude Towards Using A Mobile Information Service

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Abstract

The psychometrical properties are studied of a scale that measures attitudes regarding mobile information services. Starting point is an attitude measure from an earlier research project, in which the HED/UT scale was used to capture hedonic and utilitarian value of an information service. The research design for the new project involved a cross-sectional survey, and data was collected using an online survey tool. The psychometric analysis is based on a sample of students and non-students (total N = 125). Based on the analysis, we propose a new, short-form version of the attitude scale. It contains two subscales of five items each, is available in two languages (English and Dutch) and can be used by other researchers for further refinement.

1 Introduction

In this paper we are concerned with the development and user acceptance of mobile information services. Examples of these services are Short Messaging Services (SMS) with brief but specific information about weather, sports, news, horoscopes, and so on. In recent years, we have seen a plethora of these mobile services on the market, some successful and some not so successful. How consumers respond to these services continues to be a matter of great interest for electronic commerce researchers and practitioners alike.

Our particular focus here is the user's initial evaluation of a new service after a brief verbal introduction or a short moment of exposure. A swift and reliable assessment of positive or negative attitudes towards the service allows researchers and practitioners to infer credible statements about mass user acceptance. It follows that accurate measurement of somebody's initial attitude is of paramount importance. The current paper attempts to address this issue by developing a reliable, short-form measure of attitude towards using a mobile information service.

Much research work is currently available on user attitudes towards information technology (see e.g. Mahmood, Hall, & Swanberg, 2001; Venkatesh, Morris, Davis, &

Davis, 2003 for useful reviews). From this literature, a number of attitudinal constructs and their accompanying scales are available. Examples include well-known constructs such as user satisfaction with an information system (Ives, Olson, & Baroudi, 1983), and perceived usefulness and ease of use (Davis, 1989). Unfortunately, these scales are problematic to apply in the domain of mobile information services. This is because these constructs are geared towards use in the workplace, whereas many mobile information services are developed for entertainment purposes. Consequently, researchers studying mobile information services are in need of a more flexible attitude measure, one that should be able to cover both work and non-work related domains.

Scale development is typically seen as an iterative process, in which researchers purify the scale by administering it to a number of samples (Churchill, 1979; DeVellis, 1991). The paper is part of an ongoing research effort. We build on a previous research project in which students tried out mobile information services and then evaluated them (Van der Heijden & Sørensen, 2002). The previous project used a generic consumer attitude scale covering both workplace and non-workplace domains. Although the study was valuable for its exploratory insights, it had two important limitations. First, the length of the newly proposed scale was still quite long (17 items). Second, the sample was confined to undergraduate students. This damages the external validity of the scale and limits its potential for generalisable findings.

The project described in this paper attempted to address these two limitations of the previous project. Our research objective here is to derive a short-form measure of user attitude towards mobile information services, similar to the short-form user satisfaction scale developed by Baroudi & Orlikowski (1988). For practical purposes, we envisioned a short attitude measure that has a maximum of ten items. To expand the external validity of the scale, we used a new sample that included both students and non-students. In addition, we sought to enrich the attitude scale by replicating it into another language (Dutch). Finally, we used a new mobile information service to verify the ability of the scale to cover different mobile information services.

2 Theory

An attitude is „a summary evaluation of a psychological object captured in such attribute dimensions as good-bad, harmful-beneficial, pleasant-unpleasant, and likable-dislikable“ (Ajzen, 2001, p. 28). The methodology surrounding the measurement of attitudes is a sizable research area in psychology, of which only a small subset will be reviewed here for the sake of brevity.

A number of measurement methods to capture user attitudes are distinguishable (see e.g. Heise, 1970). Modern measurement methods such as conjoint analysis are making inroads, but the conventional way of measuring attitudes continues to be the self-administered survey, often using five or seven point Likert scales. Although a researcher could measure attitude with a single item (e.g. „beneficial“ on a scale ranging from „strongly disagree“ to „strongly agree“), multi-item attitude scales are generally recommended to battle several sources of measurement error (DeVellis, 1991).

One of the first available multi-item measures of attitudes in information systems research was “user satisfaction”, developed by Bailey & Pearson (1983). A number of researchers have since developed similar user satisfaction scales (Doll & Torkzadeh, 1988; Ives et al., 1983). These satisfaction measures have been subject to rigorous methodological tests (see e.g. Doll, Raghunathan, Lim, & Gupta, 1995). As a result, a set of reliable and valid scales is currently available to measure user attitude towards an

information system. Table 1 provides two examples of well-established scales that have arisen out of this body of literature.

Table 1: *Two Examples Of Attitude Scales From Information Systems Research: Perceived Usefulness And End User Computing Satisfaction*

Perceived usefulness (Davis, 1989, p. 340)	End user computing satisfaction (Doll & Torkzadeh, 1988, p. 268)
Using Chartmaster would enable me to accomplish tasks more quickly	Does the system provide the precise information you need?
Using Chartmaster would improve my job performance	Does the information content meet your needs?
Using Chartmaster would increase my productivity	Does the system provide reports that seem to be just about exactly what you need?
Using Chartmaster would enhance my effectiveness on the job	Does the system provide sufficient information?
Using Chartmaster would make it easier to do my job	Is the system accurate?
I would find Chartmaster useful in my job	Are you satisfied with the accuracy of the system?
	Do you think the output is presented in a useful format?
	Is the information clear?
	Is the system user friendly?
	Is the system easy to use?
	Do you get the information you need in time?
	Does the system provide up-to-date information?
NB. Scale response categories range from „extremely likely“ to „extremely unlikely.“	NB. Scale response categories range from „almost never“ to „almost always.“

Adaptations of these attitude scales would seem to qualify for measuring attitudes towards mobile information services. Unfortunately, these attitude scales were developed to measure user acceptance of information systems in work-related environments (for exceptions, see Venkatesh, 1996; Venkatesh & Brown, 2001). Examples include word processing software, business presentation applications, voice-mail systems, and decision support systems. The purpose of these systems is to increase job productivity or, more generally, job performance. Consequently, the measurement scales focus exclusively on the *instrumental* value of the information. Using the information is a means to improve job performance, it is not regarded as an end in itself.

This would have been less problematic if mobile information services serve instrumental purposes as well. And indeed, many mobile information services do: examples include geographical mapping services that people use to find their way to a particular location. Other mobile information services, however, provide information that are hard to categorise as instrumental: examples include TV soap gossip, horoscopes, sports news, human interest stories, etc. Visitors typically “consume” this information for their own

personal pleasure, without any direct intentions to use the information for instrumental purposes. The current attitudinal scales do not capture this non-instrumental value.

In line with consumer behaviour literature that distinguishes between utilitarian and hedonic products (Hirschman & Holbrook, 1982; Holbrook & Hirschman, 1982), we will denote these two types of value *utilitarian* and *hedonic*. Utilitarian value covers the instrumental nature, and hedonic value covers the non-instrumental nature, the “user experience” in and of itself. The term “hedonic” derives from the word “hedonism”, a term used to denote the doctrine that pleasure or happiness is the chief good in life (Merriam-Webster, 2003).

While hedonic attitudes may have been less developed in the information system literature, there is growing appreciation of hedonic value as an important part of user satisfaction (Venkatesh, 1999; Webster & Martocchio, 1992). Empirical evidence suggest that hedonic evaluation is an important part of user acceptance of websites (Van der Heijden, 2003). More generally, hedonic evaluation would seem to have predictive strength for user acceptance of information systems that are voluntary and for systems that aim to serve a hedonic purpose (Kempf, 1999; Van der Heijden, 2002). Again, however, there is no established measurement instrument in information systems research that captures these two sources of value simultaneously.

One potential candidate for a two-factor attitude scale is the HED/UT scale (Spangenberg, Voss, & Crowley, 1997), available in the Handbook of Marketing Scales (1999). This scale was originally designed to capture utilitarian and hedonic value for any generic product or service. It contained 24 items, 12 for utilitarian, and 12 for hedonic. In a recent experiment with mobile information services (Van der Heijden & Sørensen, 2002), this scale was administered to participants in an experiment that involved the use of a mobile information service.

Details of the psychometric analysis of the scale are reported elsewhere (Van der Heijden & Sørensen, 2003). In summary, the original 24-item HED/UT scale did not perform as expected. Its reliability in particular was problematic. After pruning those items that were psychometrically unsound, the researchers obtained a reduced form of the scale that met commonly accepted reliability and validity criteria. This shorter version of the instrument contains 12 items, 9 for utilitarian and 3 for hedonic. Because of the limitations of the sample and the discovery of some peculiarities in the instrument itself (notably confusing horizontal order effects), the researchers proposed a new, shorter version of the scale. This scale is depicted in Table 2.

Table 2: *Items Proposed By Van Der Heijden & Sørensen (2003) To Measure Attitudes Towards Using A Mobile Information Service.*

Utilitarian measures	
Useless	Useful
Impractical	Practical
Unnecesssary	Necessary
Unfunctional	Functional
Unhelpful	Helpful
Inefficient	Efficient
Ineffective	Effective
Harmful	Beneficial
Unproductive	Productive
Hedonic measures	
Dull	Exciting
Disgusting	Delightful
Boring	Fun
Serious	Playful
Unthrilling	Thrilling
Unenjoyable	Enjoyable
Unamusing	Amusing
Cheerless	Cheerful

NB. Scale uses seven response categories with qualifiers “extreme”, “quite”, “slightly”, and “neutral.”

The researchers recommended the proposed scale be validated on a new sample. The current project has followed up on their recommendation and used this new scale for their data collection.

3 Method

The research design was correlational in nature and involved a cross-sectional survey, administered through an online survey tool. In this section we expand on the nature of the participants, the measures used, and the general procedure.

Participants

The questionnaire was advertised by handing out flyers containing the survey URL to selected students at a Dutch university. The resulting sample was supplemented by a non-random convenience sample (total $N = 125$). There was no financial incentive to participate, but respondents were provided a summary of the results if they left their e-mail addresses at the end of the questionnaire. The decidedly non-probabilistic nature of the sample is obviously a reason for concern: among other things, it impedes generalisability. To examine the impact of this design choice, we examined correlations

of the attitude scale with the individual differences in the sample. These correlations will be analysed in detail in the results section.

Measures And Translation

The survey included the attitude instrument along with a set of questions to measure individual differences. Age and gender were measured, along with an ordinal measure of self-reported text frequency, ranging from “multiple times per day” to “never.” The principal researcher translated the measures from the English to the Dutch language. The Dutch survey was then back-translated by an independent translator and the two English versions were double checked, independently, by two English natives. No semantic differences were found. The translation of the antonyms, however, was problematic in that not enough distinct antonyms could be found in Dutch. This caused the Dutch word “saai” to be used three times (for the English words “unthrilling”, “unamusing” and “dull”).

Procedure

To test the scale we used a ‘vignette-based’ questionnaire, also known as the ‘scenario-based survey method.’ Vignettes represent hypothetical situations and call on the respondents’ imaginative powers to picture a future situation in their heads. Respondents are then asked to make an assessment of that situation. In our case, we introduced a specific mobile information service, and presented the respondent with two settings in which the mobile information service could be used. The mobile information service of choice was an SMS translation service.

Here are the two vignettes (English translations of the originals in Dutch):

Vignette A: “Imagine that you are spending your summer holiday in Spain and you decide to have something to eat on a nice terrace. Once sitting at your table you will get the Spanish menu with all kinds of Spanish meals. There are no translations on the menu, you did not bring your dictionary with you and you do not speak Spanish. How can you choose the right meal without getting anything wrong on the table?”

Your mobile phone could be useful as a translator. You could enter the Spanish words or sentences that you do not know in a text message and send it to the translation service. The translation service processes your words and sentences. In just a few seconds you will receive the translated words and sentences back in a new text message.”

Vignette B: “Imagine you are spending your summer holiday with your friends in Greece. You get in touch with a group of Finnish tourists. From that group you are getting to know a nice young Finnish boy/girl. As the evening goes by you are concluding that you want to meet him/her again tomorrow. To be more romantic, you would like to ask him/her in the Finnish language but you did not bring your dictionary and your friends do not speak Finnish either. Now what is your best move?”

Again, your mobile phone could be useful as a translator. You could enter the words or sentences that you do not know in a text message and send it to the translation service. The translation service processes your words and sentences. In just a few seconds you will receive the translated words and sentences back in a new text message.”

The first vignette shows a utilitarian problem situation. This scenario attempted to capture the utilitarian value of the service. The second vignette attempted to appeal to the hedonic value of the service.

4 Results

The structure of this section is as follows. We will first examine the reliability and the validity of the scale as it stands. We then justify our decisions to arrive at the short-form of the scale. A re-run of this scale on the same sample then illustrates reliability and convergent and discriminant validity. This is followed by a set of analyses in which we correlate the attitudes with individual differences. These correlations are illustrative and also clarify the potential impact of the non-probabilistic sampling design.

Reliability And Validity Of Original Scale

The original subscales turned out to be quite reliable. Cronbach alpha of the utilitarian subscale (9 items) was .91, the hedonic subscale (8 items) was .89. To examine the convergent and discriminant validity of the scale, a factor analysis was conducted. The data set met the necessary thresholds for conducting a factor analysis ($KMO = .93$, Bartlett's test of sphericity = 1227, $df = 136$, $p = .000$). The resulting factor structure explained 59% of the variance. Table 3 shows the factor loadings and the communalities for each item.

Table 3: Summary Of Factor Loadings For Varimax Orthogonal Two-Factor Solution For Original Attitude Towards Using A Mobile Information Service Scale (N = 125)

	Item	Factor loading		Communality
		1	2	
1	Useful	.67		.58
2	Practical	.79		.63
3	Necessary	.64		.54
4	Functional	.76		.63
5	Helpful	.74		.63
6	Efficient	.76		.64
7	Effective	.67		.56
8	Beneficial	.67		.51
9	Productive	.63		.54
10	Exciting		.77	.64
11	Delightful		.59	.47
12	Fun	.48	.66	.67
13	Playful		.63	.40
14	Thrilling		.75	.70
15	Enjoyable	.64	.40	.57
16	Amusing		.76	.67
17	Cheerful		.72	.65

The reader will note the cross-loadings of „fun“ and „enjoyable“. This is remarkable given that these items have high face validity as hedonic candidates. In addition, the prior study showed good psychometric diagnostics for „fun“, although not for „enjoyable.“ Enjoyable is a broad-ranging construct and people may interpret this to be closely linked to the utilitarian value of the mobile information service. But it may also be an artefact of the translation because there are a few options to translate „enjoyable“ in Dutch and the one chosen („aangenaam“) may not have been sufficiently distinctive.

To establish the short-form measure for attitudes towards using a mobile information service, we set out to disqualify items from the list. Candidate items should include those that have poor communalities (typically lower than 30%), high cross-factor loadings, and low inter-item correlations (Hair, Anderson, Tatham, & Black, 1998). From the utilitarian subscale, we excluded “necessary”, “effective”, “beneficial” and “practical” because they had the lowest communalities in the factor analysis (see Table 3). From the hedonic scale, we excluded “delightful”, “playful”, and “enjoyable” for the same reason. Despite the concerns raised above, “fun” was retained because of its face validity and its performance in the previous empirical study.

Reliability And Validity Of Short-Form Scale

The resulting scale is listed in Appendix 1. We re-ran the data analysis with the items of the short-form measure. The necessary thresholds for conducting a factor analysis were met ($KMO = .90$, Bartlett’s test of sphericity = 702, $df = 45$, $p = .000$). In total, the resulting factor structure explained 68% of the variance. Table 4 presents the results.

Table 4: Summary Of Factor Loadings For Varimax Orthogonal Two-Factor Solution For Short-Form Measure Of Attitude Towards Using A Mobile Information Service Scale (N = 125)

	Item	Factor loading		Communality
		1	2	
1	Useful	.66		.58
2	Practical	.86		.74
4	Functional	.79		.71
5	Helpful	.73		.64
6	Efficient	.73		.63
10	Exciting		.83	.70
12	Fun	.42	.71	.69
14	Thrilling		.81	.75
16	Amusing		.80	.70
17	Cheerful		.75	.68

Correlations With Individual Differences

Summary scores for hedonic and utilitarian value were computed by averaging the scores on the five selected items for each subscale. We continued by examining these values and comparing them against the individual differences of the respondents. In particular we

examined correlations with age, gender, and mobile service experience. The results are reported in Table 5. The results demonstrate that the two dimensions themselves are strongly, and significantly, correlated. In contrast, no significant relationship could be detected between these individual differences and their attitude towards the mobile service. Perhaps in line with popular belief, there is a significant relationship between age and text message frequency, indicating that younger persons report more frequent texting.

Table 5: Means, Standard Deviations, And Correlations Of Attitude Subscales, Texting Frequency, And Age

	<i>M</i>	<i>SD</i>	1	2	3	4
1 Utilitarian value	4.4	1.0	--			
2 Hedonic value	4.2	.9	.64**	--		
3 Self-Reported texting frequency	-	-	-.01	-.12	--	
4 Age	24.0	6.5	-.02	-.08	.25**	--

Note: * $p < .05$, ** $p < .01$. Pearson's r is reported for all items except correlations that involve ordinal item 3, for which Spearman's Rho is reported

To examine differences in gender composition and student-non student background, a Multiple Analysis of Variance (MANOVA) was conducted with utilitarian and hedonic value as the two correlated dependent variables. As a statistical tool, MANOVA is preferred over a set of independent t-tests because of the inflated type I error that is associated with running multiple t-tests. Descriptives are reported in Table 6.

Table 6: Means And Standard Deviations Of Attitude Subscales As A Function Of Gender And Background

	<i>n</i>	Utilitarian value		Hedonic value	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Males					
Student	66	4.5	1.2	4.2	1.0
Nonstudent	26	4.2	.8	4.2	.7
Females					
Student	24	4.5	.9	4.3	.4
Nonstudent	9	4.8	.9	4.6	.7

Result of the analysis are reported in Table 7. These results should be interpreted with appropriate caution because the cell sizes are unequal, and equal variances tests were negative: Box's M was significant and so was Levene's test for the hedonic subscale.

These results provide ample evidence that the null hypotheses cannot be rejected, i.e. there are no differences in attitude towards using mobile information services across age, gender, experience, and background.

Table 7: Multivariate And Univariate Analyses Of Variance For Attitude Subscales

	ANOVA		
	MANOVA	Utilitarian value	Hedonic value
	$F(2, 120)$	$F(1, 121)$	$F(1,121)$
Gender (G)	1.3	2.3	1.9
Background (B)	.8	.0	1.2
G × B	1.0	2.1	.8

Note. F ratios are Wilk's F s. MANOVA = Multivariate analysis of variance; ANOVA = univariate analysis of variance. Gender is either male or female; background is either student or non-student.

5 Discussion

This research project has examined an instrument-in-development to measure attitudes towards using mobile information services. It has analysed its psychometric properties using a sample of students and non-students. Based on the analysis, we propose a new, short-form version of the attitude scale. This scale contains two subscales, is available in two languages (English and Dutch) and can be used by other researchers for further refinement. Appendix 1 presents our current recommendation for a short-form scale. Note that we have dropped the semantic differentials in favour of a Likert scales. This choice is partly based on difficulties in translating antonyms and partly based on respondent feedback.

It seems to us that the scale is quite general and could perhaps also be applied to the use of non-mobile information services. Perhaps one day it can even serve as a general satisfaction measure for the use of any information service. The scale, however, will need further validation and replication before we are anywhere near the accomplishment of this objective.

A valid question from a practitioner at this stage would be whether the scale is ready for commercial application. That is, can it be used in a practical situation to reliably examine and predict user acceptance? The short answer to this question is "almost." It is important to point out that there are still some limitations associated with the work we have carried out so far.

First, there is the non-probabilistic nature of our sample, albeit that the pool of respondents is no longer confined to students only. We could not detect significant differences between the student subsample and the non-student subsample, which is encouraging if one considers the commonly raised objection that students are not representative for wider populations. This notwithstanding, further research should test the scale on samples that are not based on non-probabilistic, but on probabilistic sampling methods.

Second, there are some methodological concerns with rerunning an analysis on an original sample *after* purification of the items. Our second exploratory factor analysis should be interpreted as a indication of how well the new instrument would perform if administered to the current sample. It is not meant to indicate that the measurement instrument is now sufficiently valid to be used in commercial settings. Again, the instrument should be verified with a new sample to address this issue.

This project has set the stage for a new research project that is being conducted at the time of writing. The new project builds upon the results reported in this paper. First, it examines the reliability and validity of the short-form scale on a new sample, with a new mobile information service. Second, it examines a number of potential antecedents and consequences. The consequences are to provide evidence that the scale has predictive strength, and the antecedents are to provide evidence that the scale is itself predictable. For example, one antecedent that we have selected is the context in which the service is used. Consider, for example, a mobile navigation service for tourists. This service may be useful and enjoyable in a setting in which the tourist is in desperate need to locate his or her hotel. But it may be much less useful and much less enjoyable in settings in which the tourist explores the area and considers the „site exploration“ part of his or her experience. An example of a consequence of attitude are intentions and behaviour, according to the well-established Theory of Reasoned Action (Fishbein & Ajzen, 1975). By placing the attitude measure into a nomological net, and strengthening its external validity again with a new sample, we hope to arrive eventually at a generic attitude measurement, one that is applicable to a broad range of mobile information services and a broad range of consumers.

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Appendix: A Short-Form Measure Of Attitudes Towards A Mobile Information Service

Question: Using <this mobile information service> in <this context> would be ...

	Not at all	Slightly	Moderately	Quite	Extremely
Useful (“Nuttig”)	<input type="radio"/>				
Practical (“Praktisch”)	<input type="radio"/>				
Functional (“Functioneel”)	<input type="radio"/>				
Helpful (“Behulpzaam”)	<input type="radio"/>				
Efficient (“Efficiënt”)	<input type="radio"/>				

	Not at all	Slightly	Moderately	Quite	Extremely
Exciting (“Opwindend”)	<input type="radio"/>				
Fun (“Leuk”)	<input type="radio"/>				
Amusing (“Vermakelijk”)	<input type="radio"/>				
Thrilling (“Spannend”)	<input type="radio"/>				
Cheerful (“Vrolijk”)	<input type="radio"/>				

Note: Words in brackets are proposed Dutch equivalents