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Understanding student attitudes of mobile phone features: Rethinking adoption through conjoint, cluster and SEM analyses

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ABSTRACT

Young adults have been labelled as one of the most important segments for mobile phones, however there is little empirical evidence to indicate how these young adults value the feature richness of their devices. This research presents a richer view of mobile phone user preferences and perceptions by applying methodologies from the marketing and information systems domains. Conjoint analysis provides insights into how students value various mobile phone applications and tools. Cluster analysis extracts salient and homogenous consumer segments from the conjoint analysis output. Structural equation modelling then explores how antecedents to attitude may differ by the elicited consumer segments.

1. Introduction

Mobile phone use has been growing dramatically over the last decade. In Europe, mobile operators' revenue has grown at approximately 10% per annum over recent years, such that the mobile sector now ranks among Europe's most important sectors (Jurisic & Azevedo, 2011). Penetration rates for the mobile phone is over 75% in the United States and in certain regions in Hong Kong, Japan and western Europe penetration has already exceeded 100% with subscribers having multiple mobile devices (Hu, Balluz, Frankel, & Battaglia, 2010). Worldwide, there are more than 4 billion mobile phones in use, three-quarters of them in the developing world. Even in Africa, four in 10 people now have a mobile phone (The Economist, 2009).

While mobile phone use has been increasing in all economic and age sectors, university/college students have been labelled as one of the most important target markets (Jurisic & Azevedo, 2011; Totten, Lipscomb, Cook, & Lesch, 2005) and the largest consumer group of mobile phone services (McClatchey, 2006). These young adults have current buying power and potential for huge amounts of future buying power (Jurisic & Azevedo, 2011). For these young adults, researchers have explored multiple facets of mobile phone use, including motivation (Leung, 2007), psychological and health effects (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Johansson, Nordin, Heiden, & Sandström, 2010; Thomee, Harenstam, & Hagberg, 2011), etiquette (Lipscomb, Totten, Cook, & Lesch, 2005), implications on social networks (Auter, 2007; Subrahmanyam, Reich, Waechter, & Espinoza, 2008), impact on campus life (Quan-Haase, 2008), among others. However research that explores how distinct segments within this population shape their attitudes, and value mobile device functionality is underexplored. While mobile phone manufacturers may assume that the more features and functionalities they add to the devices, the better; there is little empirical evidence to indicate that these young adults value this feature richness.

Further, adoption research in the field of information systems tends to focus on developing and validating causal models that seek to explain the relationships between various constructs that ultimately lead to an endogenous variable such as attitude, satisfaction or intention to use. Typically, such models are assumed to be generalizable across consumer populations. Some researchers have explored the influence of various demographic variables (such as age, gender, culture, and experience) on the various constructs and relationships within the proposed adoption models across various contexts. However, little research in the field of information systems has delved to a more fundamental level of segmenting consumer preferences by perceived feature utility of the technology. Consumer segments that are homogenous in their perceptions of feature utilities and motivations of use, may be heterogeneous by basic demographic variables. A "one-size fits all" adoption model may be misleading as different consumer segments (segmented by perceived feature utilities rather than demographics) may value different constructs or experience different causal relationships in the model. By incorporating various methodologies from information systems and marketing domains, we seek to gain a more comprehensive and richer understanding of mobile phone user preferences and perceptions for young adults. Through this investigation, information systems researchers may

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be encouraged to rethink their assumptions around technology consumers and their preferences. A "one-size fits all" adoption model may not be appropriate in certain contexts, even with further refinement by demographic variables.

In the following sections, theoretical background is provided that outlines the concept of 'feature fatigue' and the determinants of attitude formation. An established theoretical model that proposes antecedents to attitude towards use of mobile phones is presented as a basis for investigation. Next, conjoint analysis, which has been widely used in the marketing literature, is used to gain insights into how young adults (specifically university students) value various mobile phone applications and tools. Cluster analysis is performed on the output from the conjoint analysis to extract salient and homogeneous consumer segments that possess similar preferences for mobile phone functionalities. Lastly, structural equation modelling (using PLS analysis), which is widely used in information systems literature, explores how antecedents to attitude may differ by the elicited consumer segments found through the cluster analysis. Conclusions and implications are presented from theoretical and practical perspectives.

2. Theoretical background

While the adage 'more is better' may apply to many things in life, this may not always be the case with complex consumer products, such as electronics. In this section, we examine the concept of 'feature fatigue', especially as it relates to technology products. We also summarise key theoretical underpinnings of attitude formation for information technology products and services, focusing on attitude determination within the mobile phone context.

2.1. Feature fatigue

Consumers around the world can now purchase a single product that functions as a mobile phone, camera, camcorder, calculator, game console, text-messaging device, MP3 player, alarm clock, Web browser and email device. Economic theory suggests that product attributes/features are linked to consumer demand via an additive utility function (Lancaster, 1971). In other words, the addition of each positively valued attribute or feature should increase consumers' utility of that product. Additional features can also help manufacturers to enhance and differentiate their products from competitors (Carpenter, Glazer, & Nakamoto, 1994; Mukherjee & Hoyer, 2001). In the technology sector, the marginal cost of adding features to a product is often very low. Each year consumers are able to purchase various technology products with more features and often at a lower cost than the previous year (Freund, König, & Roth, 1997; Thompson, Hamilton, & Rust, 2005). A feature-rich product that seeks to satisfy the needs of heterogeneous consumers may also be more cost effective for a manufacturer compared to producing several feature-streamlined and more narrowly targeted products. As such, consumers often must purchase features they do not want in order to acquire those features they do want. While the owner of a feature-rich product, such as the mobile device described above, may be able to boast about the technological advancements of her device, are more features necessarily better? Will she be satisfied and have positive feelings about her mobile device with its many diverse and complex featured?

Various researchers have examined consumers' reactions to product feature complexity. Choice task complexity theory (Johnson & Payne, 1985) suggests that greater product feature complexity would require greater consumer effort and that consumers naturally wish to minimise their decision efforts (Wright, 1975). As such, the utility of products that are feature-rich may be negatively impacted by their complexity (Dellaert & Stremersch, 2005). Additionally, consumers may experience negative emotions, such as anxiety or stress, when dealing with highly complex products (Mick & Fournier, 1998). Thompson et al. (2005) coined the term 'feature fatigue' referring to the phenomena that too many features may make a product overwhelming, thus leading to consumer dissatisfaction. They draw on usability research to suggest that adding features to products has a negative effect on consumers' ability to use them and that every additional feature is "one more thing to learn, one more thing to possibly misunderstand" (Nielsen, 1993 p. 155). Thompson et al. (2005) found that increasing the number of features does have a positive impact on consumers' ratings of a product's capability. Perceptions of product capability are important in the initial assessment of products before actual use. In fact, consumers give more weight to capability and less weight to usability in their initial product assessments. Interestingly, after product use, usability becomes more important than capability in product assessment. Feature-rich products are no longer perceived as favourably after use, supporting the 'feature fatigue' notion. While adding product features may improve the initial attractiveness of a product, it appears to decrease consumers' satisfaction after using the product. This decrease of consumers' satisfaction and generation of negative attitudes towards a feature-rich product after use can harm repurchase decisions and lead to lower consumer lifetime values (Thompson et al., 2005).

The above research suggests that a 'one size fits all' feature-rich mobile device may have negative consequences on consumers' attitudes. Consumer segments that are more homogenous in their preferences and use of mobile devices may benefit from smaller feature bundles that match their use. Usability of such devices may be enhanced, as it is not clouded by the addition of unwanted features that make these devices overly complex for consumers.

The next section presents a review of consumer attitude models, in particular within the mobile device domain. An established model is presented as the basis for our investigation. Extant literature has focused on understanding the antecedents of attitude among a heterogeneous population. Here we seek to provide a deeper analysis by identifying more homogenous segments that prefer varying smaller feature bundles and exploring how the antecedents of attitude may differ among such segments.

2.2. Attitude and its antecedents

Attitude is a critical factor in explaining human behaviour. Attitude is not overt behaviour but a disposition that influences behaviour. An individual's attitude towards a particular object influences his/her intention to perform certain behaviours related to that object, which then leads to actual behaviour related to that object (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). A number of theories explain the attitudes humans hold about objects and their behaviours. The theory of reasoned action (TRA) is the most prominent of such theories (Ajzen & Fishbein, 1980). TRA proposes that actual behaviour is determined by intention to perform the behaviour, which, in turn, is determined by attitude towards the behaviour and subjective norm.

The technology acceptance model (TAM) (Davis, 1989) can be viewed as a derivative of TRA, tailored to IT contexts. While TRA is "designed to explain virtually any human behaviour", the goal of TAM is "to provide an explanation of the determinants of computer acceptance across a broad range of end-user computing technologies and user populations" (Davis, Bagozzi, & Warshaw, 1989). According to TAM, IT usage behaviour is determined by behavioural intention, which is a function of attitude, and attitude is determined by both perceived usefulness and perceived ease of use.

Within the context of mobile devices, researchers have proposed various models to help understand adoption behaviour of mobile devices and services (for example: Bruner & Kumar, 2005; Kim, Kwahk, & Lee, 2010; Li & McQueen, 2008; Lin & Liu, 2009; Nysveen, Pedersen, & Thorbjornsen, 2005a, 2005b). The Nysveen et al. model (2005a, 2005b) is commonly cited within the mobile devices domain and it has been successfully replicated under various conditions. The Nysveen et al. (2005a, 2005b) mobile adoption behaviour model is based on TRA (Fishbein & Ajzen, 1975), TAM (Davis, 1989) and two non-utilitarian motives. They propose several antecedents to attitude towards use (perceived expressiveness, perceived enjoyment, perceived usefulness, and perceived ease of use), which, along with normative pressure, determines users' intention to use mobile devices and services.

The Nysveen et al. (2005a, 2005b) model is the basis for investigation in this study. It encapsulates both hedonic and utilitarian motives with the mobile services context. It has been demonstrated to be robust across age groups, gender and mobile service categories. The current investigation seeks to understand the perceptions of young adults that are currently using mobile devices with various applications and tools. Since the group under investigation is already using the mobile devices/services, intention to use is deemed to be an inappropriate endogenous variable. As such, a simplified Nysveen et al. model is used in this investigation that focuses on attitude towards use as the endogenous variable with its antecedents. This simplified model is presented in Fig. 1.

The antecedents to attitude identified by Nysveen et al. (2005a, 2005b) and shown in Fig. 1, are defined as follows:

- *Perceived expressiveness:* The ability of an individual to express his or her emotions or identity (Cassidy, Park, Butovsky, & Braungart, 1992).
- *Perceived enjoyment:* The extent to which an individual perceives using a technology to be "enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis, Bagozzi, & Warshaw, 1992 p. 1113).
- *Perceived usefulness:* The degree to which an individual "believes that using a particular system would enhance his or her performance" (Davis, 1989 p. 320).
- *Perceived ease of use:* The degree to which an individual "believes that using a particular system would be free of efforts" (Davis, 1989 p. 320).

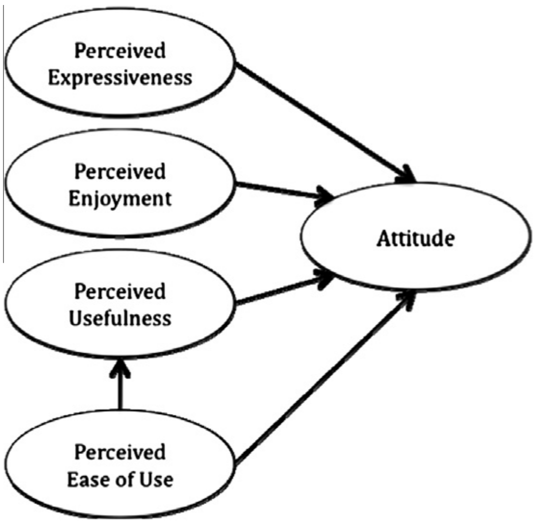

Fig. 1. Theoretical model (simplified from Nysveen et al. (2005a, 2005b)).

3. Methods

3.1. Conjoint analysis

Conjoint analysis is a multivariate technique that can be used to understand how individual's preferences are developed (Hair, Anderson, Tathan, & Black, 1995). Specifically, conjoint analysis is used to gain insights into how consumers value various product attributes based on their valuation of the complete product (Baker & Burnham, 2002). Respondents are asked to make difficult attribute trade-offs with the aim of discovering the value behind their choices.

While rather unexplored in the information systems research, conjoint analysis has been used widely in marketing literature to evaluate consumer preferences for hypothetical products and services (Hair et al., 1995). Conjoint analysis has been applied to understand preferences in different markets including apparel (Dickson, Lennon, Montalto, Shen, & Zhang, 2004), grocery stores (Wilson-Jeanselme & Reynolds, 2006), transportation (Hensher, 2001), and telecommunication services (Kim, 2004). However, few studies have used conjoint analysis within the mobile phone industry.

In the current investigation, conjoint analysis is used to understand how common attributes influence university students' valuation of a mobile phone. Attributes are defined as (i) mobile phone applications, which focus on the actions or functions that can be performed (such as the actions of sending/receiving text messages); and (ii) mobile phone tools, which focus on the features that can be used (such as an alarm clock feature). Each attribute is subdivided into levels as shown in Table 1, based on a thorough scan of the most common applications and tools of the most common mobile phones available. It is important to note that while the term "level" may seem to imply a categorisation that is relative in nature (e.g. low, medium, high), this is not the case in conjoint analysis. There is typically no relative relationship between attribute levels (e.g. a country of origin attribute may list Canada, Germany and Japan as its levels). In this study, voice calling was omitted as a level of the applications attribute as it is considered standard and used by all. Of particular interest to this investigation are those functionalities that are available beyond basic voice calling. The levels shown in Table 1 are used to create hypothetical products based on different combinations of attributes that individuals rate (Hair et al., 1995) in order to determine part-worths. A positive part-worth adds value to the product while a negative part-worth decreases value.

3.1.1. Survey design

Sawtooth Software SSI™ Web programming was used to generate the survey for conjoint analysis based on the mobile phone

Table 1
Mobile phone attributes (applications and tools) and their levels.

Attribute	Level
Applications	Text messaging
	Taking and/or sending pictures
	Downloading ringtones
	Downloading and/or playing music (MP3 or radio)
	Downloading and/or playing games
	Recording and/or sending videos
	Using email
	Web browsing
Tools	Alarm clock
	Calendar
	Personal notes
	Calculator

attributes and levels identified in Fig. 1. Participants had some familiarities of these attributes as they all owned phones that had these attributes. Conjoint analysis questions consisted of five types: (i) rating questions where individuals were asked to rate all levels based on their desirability (7-point scale); (ii) 'importance' questions in which individuals are asked to rate the importance of a change in attribute (for example, if two mobile phones were acceptable in all other ways how important would a change in a particular attribute be); (iii) pair-wise comparison questions where participants are asked to choose between mobile phones with different combinations of attribute levels; (iv) calibration questions in which individuals are asked to rate between 0 and 100 if they would use a mobile phone with given attribute level combinations; and (v) rating most important and least important attribute levels given various combinations of five level bundles. This information is used to generate part-worths for each participant via the Sawtooth Software SSI application. Additionally, various demographic information was gathered for each participant.

3.1.2. Data collection

A survey was completed using Sawtooth Software SSI Web program and was filled out by a representative student population from a major Canadian university. A pilot study was conducted with 20 participants to ensure the time to complete the survey was not onerous and the questions were clear and understandable. Based on the feedback of this pilot study, very minor edits were made to a small subset of the survey questions. Surveys were distributed electronically to the university student population.

In total, 212 individuals answered the survey. Eliminating incomplete surveys and ineligible participants (such as those that did not own a mobile phone or did not own a phone with the attributes indicated in Table 1), 188 eligible surveys were collected. Participants indicated the type of phone they owned at the time of this study. The most popular phone brands were the Blackberry, Samsung and Sony Ericsson. An examination of the specific phones owned by the respondents found that the majority of the phones had large screens. The screens were either half the size of the device with a keyboard underneath or full size with a flip down keyboard. Demographic information is summarised in Table 2. Overall, the sample consisted of slightly more females (60%) with an average age of 20.7. Financially, the university studies of respondents were funded primarily through family contributions (51%). Participants tended to be heavy mobile phone users, where half of them used their phones more than 50 times per week.

Table 2
Demographics.

Category		Count (n = 188)	Percent (%)
Gender	Male/female	76/112	40.4/59.6
Age	17	1	0.53
	18	22	11.70
	19	33	17.55
	20	42	22.34
	21	34	18.09
	22	26	13.83
	23	17	9.04
	24	10	5.32
	25/+	3	1.60
	Average	20.7	
Academic level	Year 1	12	6.38
	Year 2	43	22.87
	Year 3	43	22.87
	Year 4	40	21.28
	Year 5/+	7	3.72
	Post-graduation	43	22.87
University funding	Family	95	50.53
	Employment	38	20.21
	Government	32	17.02
	Scholarships	5	2.66
	Bursaries	3	1.60
	Bank loans	7	3.72
	Not answered	8	4.26
Use (times per week)	<10	14	7.45
	10–29	36	19.15
	30–50	43	22.87
	>50	95	50.53

Table 3
Conjoint analysis results.

Attribute	Level	Part-worth	Relative importance (%)
Mobile phone applications	Text messaging	67.38	63.46
	Taking and/or sending pictures	3.66	
	Downloading ringtones	−20.21	
	Downloading and/or playing music (MP3 or radio)	−8.16	
	Downloading and/or playing games	−19.79	
	Recording and/or sending videos	−14.15	
	Using email	−0.03	
	Web browsing	−8.68	
Mobile phone tools	Alarm clock	26.58	36.54
	Calendar	0.97	
	Personal notes	−25.92	
	Calculator	−1.63	

3.2. Data analysis

A summary of the conjoint results is presented in Table 3. Using ordinary least-squares regression analysis, the estimated model provides the relative importance of the attributes as well as the part-worth of each level of the attributes. As indicated previously, a positive part-worth value indicates that the presence of that level of the attribute adds that amount of utility to the mobile phone product. In contrast, a negative part-worth value indicates that the presence of that level of the attribute in the mobile phone product lessens its utility.

Overall, it appears that the presence of several levels of mobile phone applications and tools decrease utility in the eyes of the student consumer. To maximise utility for this customer segment, it appears that the ideal mobile phone should include the following: (i) text messaging; (ii) alarm clock; (iii) taking and/or sending pictures; and (iv) calendar.

3.3. Cluster analysis

An investigation of part-worths at the individual level revealed wide heterogeneity. Therefore, a cluster analysis was performed to help classify respondents into more homogeneous preference groups. These part-worths are then used as input for cluster analysis. This approach has been conducted by various researchers across industries in order to determine customer segments based on distinct preference profiles (for example: Baker & Burnham, 2002; Haddad et al., 2007; Makila, 2004).

The k-means cluster procedure in SPSS was used to perform the segmentation. Based on the sample size, solutions were searched in two to four clusters. The 4-cluster solution resulted in one segment that was very small in size and could not be statistically reli-

Table 4
Cluster analysis results of mean part-worths.

Attribute	Level	Cluster 1 ($n = 111$)	Cluster 2 ($n = 77$)
Mobile phone applications	Text messaging	3.71	2.59
	Taking and/or sending pictures	0.59	−0.50
	Downloading ringtones	−0.63	−1.18
	Downloading and/or playing music (MP3 or radio)	−0.29	−0.71
	Downloading and/or playing games	−0.73	−1.33
	Recording and/or sending videos	−0.54	−0.82
	Using email	−0.88	1.23
	Web browsing	−1.23	0.71
	Relative importance	*76.3%*	*80.4%*
Mobile phone tools	Alarm clock	1.20	1.02
	Calendar	−0.12	0.09
	Personal notes	−1.23	−0.78
	Calculator	0.15	−0.32
	Relative importance	*23.7%*	*19.6%*

able ($n < 15$). A 2-cluster solution was chosen over the 3-cluster solution due to the size of the segments and statistical significance. An analysis of variance revealed that the segments in the 2-cluster solution differed significantly ($p < .001$) from each other with respect to their part-worth variables generated by the conjoint analysis.

The mean part-worths for each of the levels of the attributes of the two segments are shown in Table 4. Cluster 1 is the larger cluster ($n = 111$) and characterised by very heavy utility allocation on text messaging. While individuals in this cluster also expressed some positive utility of having the ability to take and/or send pictures, all other mobile phone applications had a negative impact on the overall utility of the mobile device. It is evident that this segment utilises their mobile phones for instant communication through texting and, in some cases, sending/receiving pictures as part of that communication. They view additional functionalities as unnecessary hindrances. We call this segment *instant communicators*.

The second cluster ($n = 77$) also views text messaging as being important and valuable. However, individual in this cluster also demonstrated that email and web browsing applications had a positive impact on the overall utility of mobile phones. While they appreciate the ability to instantly communicate via text messaging, this group also seeks to use their mobile devices to search and gather information from the web and asynchronous email communication. We call this segment *communicators/information seekers*. Both segments valued the alarm clock feature and minimal positive utility was attributed to calculator and calendar tools for Clusters 1 and 2, respectively. However, for both segments, mobile phone applications played a much more important role in assessing value compared to mobile phone tools.

From a demographic perspective, it is interesting to note that there were no significant differences between the *instant communicator* group and the *communicator/information seeker* group. The average age for the *instant communicator* group was 20.4%, 60.4% were female and 51% use their mobile phones more than 50 times per week. The average age for the *communicator/information seeker* group was 20.8%, 58.4% were female and 49% use their mobile phones more than 50 times per week. The two groups also demonstrated similar distributions for their academic levels and university funding sources. All participants owned phones with the features listed in Table 1. Since the phones were rather homogeneous by features, the type of phone owned did not significantly impact the elicited groups.

3.4. SEM analysis

Following the conjoint analysis questions of this study, a survey was conducted to capture the perceptions of participants for the constructs outlined in the theoretical model presented in Fig. 1.

3.4.1. Survey design and validation

All items for this part of the survey were constructed as agree–disagree statements on a seven-point Likert scale, as shown in Appendix A. Content validity considers how representative and comprehensive the items are in creating the experimental constructs. To establish content validity, a common method used is a literature review to scope the domain of the construct (Petter, Straub, & Rai, 2007). As shown in Appendix A, the survey items used in this research were adapted from previously validated work, thus satisfying content validity.

A PLS approach to confirmatory factor analysis (CFA) was used to assess the psychometric properties of the multi-item scales, as outlined by Gefen and Straub (2005). Table 5 shows the specification of the outer model for the constructs, which were all reflective in nature. Every item loaded significantly on the construct it was supposed to measure ($p < .001$).

Construct validity assesses the extent to which a construct measures the variable of interest and whether "the measures chosen 'fit' together in such a way as to capture the essence of the construct" (Straub, Boudreau, & Gefen, 2004 p. 388). Table 6 summarises various construct validity measures. Internal consistency is assessed by Cronbach α-values and composite reliability. Cronbach α-values ranged from 0.821 for Expressiveness to 0.918 for Enjoyment, which is well past the thresholds recommended by Nunnally (1978). Similarly, the composite reliability of each reflective construct exceeded the recommended threshold of 0.7 (Straub et al., 2004). Convergent validity is demonstrated as the average variance extracted (AVE) of all reflective constructs and exceeded 0.5 (Fornell & Larcker, 1981).

Table 5
Specifications of the outer model.

Construct	Item	Loading	SE	*t*-Statistic
Expressiveness	Express1	.90	.02	37.38
	Express2	.78	.06	13.37
	Express3	.87	.03	28.52
Enjoyment	Enjoy1	.84	.02	36.13
	Enjoy2	.89	.01	65.60
	Enjoy3	.93	.01	86.42
	Enjoy4	.93	.01	79.61
PU	PU1	.91	.01	85.64
	PU2	.95	.01	113.12
	PU3	.89	.02	48.17
PEOU	PEOU1	.84	.03	31.35
	PEOU2	.94	.01	120.04
	PEOU3	.93	.01	62.86
Attitude	Att1	.92	.01	102.36
	Att1	.94	.01	141.53
	Att3	.87	.02	49.87

Table 6
Construct validity.

Construct	α-Value	Composite reliability	AVE
Expressiveness	.821	.888	.727
Enjoyment	.918	.943	.804
PU	.906	.941	.841
PEOU	.884	.929	.813
Attitude	.897	.936	.830

Table 7
CFA loadings matrix of reflective constructs.

Items	Constructs				
	Expressiveness	Enjoyment	PU	PEOU	Attitude
Express1	.90	.34	.35	.07	.32
Express2	.78	.31	.31	.01	.16
Express3	.87	.29	.34	.00	.24
Enjoy1	.39	.84	.52	.30	.63
Enjoy2	.21	.89	.49	.50	.69
Enjoy3	.37	.93	.54	.33	.65
Enjoy4	.36	.93	.56	.41	.67
PU1	.31	.58	.91	.48	.62
PU2	.37	.53	.95	.39	.57
PU3	.41	.50	.89	.32	.53
PEOU1	.02	.36	.46	.84	.52
PEOU2	.08	.45	.41	.94	.69
PEOU3	.04	.35	.32	.93	.63
Att1	.19	.63	.53	.75	.92
Att1	.27	.66	.59	.65	.94
Att3	.36	.73	.60	.46	.87

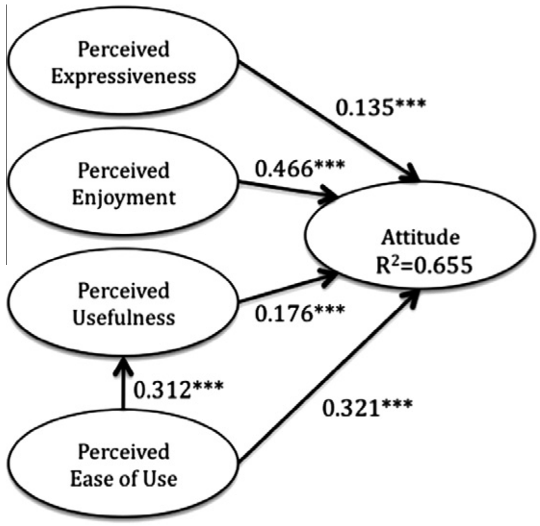

Fig. 2a. Cluster 1 Structural model ($n = 111$) (instant communicators).

Table 8
Discriminant validity of reflective constructs.

	Expressiveness	Enjoyment	PU	PEOU	Attitude
Expressiveness	**.853**				
Enjoyment	.365	**.897**			
PU	.631	.589	**.917**		
PEOU	.040	.431	.438	**.902**	
Attitude	.389	738	.631	.681	**.911**

The diagonal elements in bold (the square root of the average extracted) should exceed the inter-construct correlations below and across them for adequate discriminant validity.

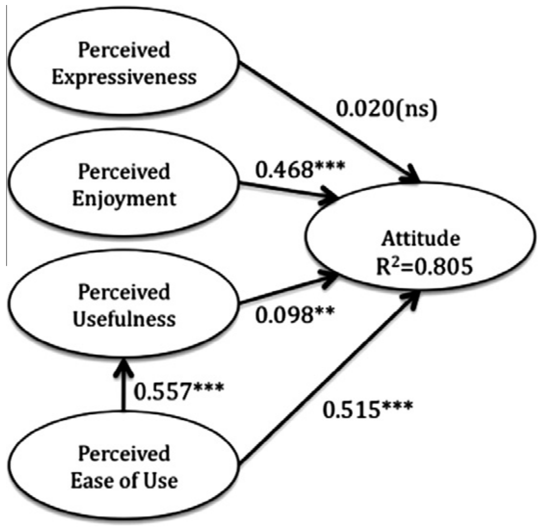

Fig. 2b. Cluster 2 Structural model ($n = 77$) (communicators/information seekers).

Discriminant validity was assessed to ensure that reflective constructs differed from each other. The complete loadings matrix of the reflective constructs is shown in Table 7. When using the PLS CFA method to examine discriminant validity, Gefen and Straub (2005) recommend that the measurement items on their assigned latent variables should be an order of magnitude larger than their loadings on other variables. As evident from Table 7 this criterion is satisfied. As per Fornell and Larcker (1981) the correlations between items in any two constructs should be lower than the square root of the average variance shared by items within a construct. As shown in Table 8, the square root of the variance shared between a construct and its items (appearing in bold along the diagonal) was greater than the correlations between the construct and any other construct in the model, satisfying Fornell and Larcker's (1981) criteria for discriminant validity. In fact, following the suggestion of a more stringent approach, proposed by Gefen, Straub, & Boudreau (2000), of using the AVEs themselves instead of their square roots across the diagonal renders the same conclusion with respect to discriminant validity. Given the above analysis, the scales used in this study demonstrated sufficient evidence of uni-dimensionality, internal consistency, and convergent and discriminant validity to be included in the structural model.

3.5. Data analysis

A structural equation modelling (SEM) approach was used to assess the theoretical model provided in Fig. 1 across the two student customer segments identified in the above conjoint and cluster analyses. SEM possesses many advantages over traditional methods, as it can simultaneously test the structural and measurement model and allows for more complete modelling of theoretical relations (Gefen et al., 2000). Specifically, the variance-based Partial Least Square (PLS) method of SEM was used in this investigation as it has fewer demands on sample size (Chin, 1998) and is more appropriate for testing theories in early stages of development compared to co-variance based methods of SEM (Fornell & Bookstein, 1982).

With regards to sample size, Chin (1998) recommends that the minimum sample size for a PLS analysis should be the larger of (a) 10 times the number of items for the most complex construct; or (b) 10 times the largest number of independent variables impacting a dependent variable. The theoretical model had four items in its most complex construct (enjoyment), and four independent variables impacting the attitude dependent variable. Both cluster sample sizes (111 and 77) exceed the recommended threshold of forty.

Figs. 2a and 2b provide the results of the PLS analysis for the *instant communicator* and the *communicator/information seeker* clusters. PLS does not generate overall goodness-of-fit indices. Therefore, model validity was primarily assessed by examining the structural paths and R^2 values (Chin, 1998). As recommended

Table 9
Descriptive statistics by cluster.

Construct	Cluster 1 (Instant communicators)		Cluster 2 (Communicators/ information seekers)	
	Mean	Std. Dev.	Mean	Std. Dev.
Expressiveness	2.79	1.39	2.95	1.55
Enjoyment	4.83	1.09	4.32	1.34
PU	4.83	1.39	4.57	1.51
PEOU	5.70	1.19	5.18	1.57
Attitude	5.33	1.14	4.83	1.43

Table 10
Summary of results of the multivariate analysis of variance.

Dependent variable	Sum of squares	df	Mean square	*F*	Sig.
Expressiveness	1.072	1	1.072	0.508	.447
Enjoyment	11.751	1	11.751	8.207	.005**
PU	3.083	1	3.083	1.493	.223
PEOU	12.193	1	12.193	6.595	.011*
Attitude	11.663	1	11.660	7.320	.007**

Note: Cluster (instant communicators and communicators/information seekers) is the independent variable.
* *p*-value < 0.05.
** *p*-value < 0.01.

by Chin (1998), bootstrapping (with 500 sub-samples) was performed to test the statistical significance of each path coefficient using *t*-tests. All path coefficients for the *instant communicator* group were significant, however the causal relationship between perceived expressiveness and attitude was not significant for the *communicator/information seeker* group. Approximately 65% and 80% of the variance for attitude is accounted for by the variables in the model for the *instant communicator* and *communicator/information seeker* segments, respectively.

Table 9 provides descriptive statistics for the five perception constructs gathered in this study across the two identified clusters (*instant communicators* and *communications/information seekers*). MANOVA analysis was conducted to examine differences between group means of all constructs in the above model across the two clusters. MANOVA test statistics included Pillari's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root. The *p*-values of these statistics were found to be significant ($p < 0.01$) across the two clusters. Table 10 summarises the MANOVA results, where cluster is the independent variable, and perceived expressiveness, perceived enjoyment, perceived usefulness, perceived ease of use and attitude are the dependent variables.

4. Discussion and contributions

While the use of mobile phones and their available applications and tools have grown dramatically in recent years, research that explores how consumer segments shape their attitudes and value mobile device functionality has been lacking. The research presented in this paper seeks to provide a richer view of consumer preferences and perceptions by applying methodologies from the marketing and information systems domains. First, conjoint analysis, which has been widely used in the marketing literature, is used to gain insights into how young adults (specifically university students) value various mobile phone applications and tools. Second, cluster analysis is performed on the part-worth values derived from the conjoint analysis to extract salient and homogeneous consumer segments that possess similar preferences for mobile phone functionalities. Third, structural equation modelling (using PLS analysis), which is widely used in information systems literature, explores how antecedents to attitude may differ by the elicited consumer segments found through the cluster analysis.

The above process generated two distinct segments of university student consumers of mobile phones: (i) *instant communicators*; and (ii) *communicators/information seekers*. The *instant communicators* have one primary objective for using mobile phones: to instantly communicate in a synchronous fashion. Additional functionality, such as web browsing, email, downloading ringtones, music, and games, actually decreases the overall perceived utility of the device. In contrast, *communicators/information seekers* appreciated the ability to communicate synchronously (text messaging) and asynchronously (email) as well as information searching/gathering on the web. For *instant communicators*, the ability to use their mobile phones to express their emotions and/or identity was a significant determinant to positive attitude towards their devices. However, this ability to express emotion and/or identity is not a determinant to attitude for *communicators/information seekers*. It appears that the latter group tends to perceive their mobile phone as a utilitarian tool, while the former has a more hedonic perspective for their mobile phone. This is further evidenced by the *instant communicators* demonstrating significantly higher levels of enjoyment and positive attitude towards their mobile phones when compared to *communicators/information seekers*.

From a theoretical perspective, it is hoped that the approach utilised in this study will encourage information systems researchers to rethink their assumptions on "one-size fits all" technology adoption models and consider utilising diverse methodologies that elicit understanding of perceptions among consumer segments that are homogeneous in their feature utilities but may be heterogeneous in their demographics. A "one-size fits all" adoption model may be misleading as different consumer segments (segmented by perceived feature utilities rather than demographics) may value different constructs or experience different causal relationships in the model. For example, within the context of mobile phone use, researchers have studied perceptions and adoption across different age groups (for example: O'Riordan, Curran & Woods, 2005), genders (for example: Nysveen et al., 2005b) and nationalities (for example: Srivastava, 2005). Specifically, Nysveen et al. (2005a, 2005b) model has been demonstrated to be robust across age groups, gender and mobile service categories. The research outlined in this paper asks the question if such segmentations, which are common in the information systems field, are always appropriate. Should information systems researchers consider other lenses through which to examine their proposed technology adoption models? Our results indicate that, yes, consumer segmentation by perceived utility of technology features may yield a richer and deeper understanding of preferences and perceptions of feature-rich products. For mobile phones, the impact of perceived expressiveness on attitude in the established Nysveen et al. (2005a, 2005b) model was shown to vary by the two distinct young adult segments identified through conjoint and cluster analyses. Additionally, this study provides further evidence to the notion of 'feature fatigue', as proposed by Thompson et al. (2005). Both segments identified in this study demonstrated clear preferences for streamlined bundling of mobile phone functionalities. Consistent with usability research, the addition of unnecessary or unwanted features has a negative impact on the overall usability and perceived utility of the device.

From a practical perspective, utility segmentation is useful as it provides insights for function and feature bundling, which can shape product development and marketing strategies that best meet the expectations of distinct market segments. Specifically, mobile phone manufacturers that target university/college students should consider streamlining their offerings to provide *instant communicators* with easy to use applications that allow for self expression in a synchronous manner, and *communicators/information seekers* the ability communicate synchronously and asynchronously as well as web browse without the distraction of advanced applications that are not utilised or valued.

In the mobile communications industry, heavy investments are made to attract new customers, whereas fewer efforts are made to retain existing customers and build profitable long-term relationships (Ferguson & Brohaugh, 2008; Jurisic & Azevedo, 2011). Additionally, the cost of attracting new customers in this mature market with high penetration rates is increasing (Jurisic & Azevedo, 2011). While feature-rich mobile devices may help to attract the attention of new customers prior to use, 'feature fatigue' may set in once the phones are used, resulting in negative consumer attitudes (Thompson et al., 2005). Such negative attitudes of existing customers can harm repurchase decisions and lead to lower consumer lifetime values. Positive usage attitudes and satisfaction are likely to discourage mobile users from switching their devices and services, which is noted as critical issue facing firms in the mobile industry (Ranganathan, Seo, & Babad, 2006).

We anticipate that future research will further examine the concept of 'feature fatigue' and look to validate our segmentation across other mobile phone user groups. While Thompson et al. (2005) found that 'feature fatigue' sets in after use of a feature-rich product, at what point do consumers reach a fatigue level? Does this fatigue set in after initial use or after prolonged use? Are the unnecessary and unwanted features simply ignored after extended use of the product such that they no longer have as much of a negative impact on the perceived usability and utility of the product? Longitudinal studies can help us to better understand the impact of feature-richness on attitudes and satisfaction over time. It is unknown if this longitudinal relationship is linear or curvilinear, which may impact feature-bundling decisions for mobile phone manufacturers and providers. Additionally, future research should investigate if the mobile consumer segmentations of *instant communicators* and *communicators/information seekers* hold true for other age groups and cultures. While the young adult demographic has been identified as one of the most important targets for mobile devices, the desired functions and features of these young adults may shift as they progress through various stages of professional and personal development. Similarly, such expectations and preferences may shift with varying circumstances and cultural differences across the globe.

It is important to note that regardless of rapid technological development, the general findings of this investigation hold true. Mobile phone designs, features and functionalities have changed dramatically over the last few years and will likely continue to change dramatically in the future. For example, maps/geolocations and social networks have become readily available on many mobile phones. Future studies can explore how such new categories of applications may fold into or shift consumer segmentations. However, regardless of technological advancements, the key message from this study is that a rich understanding of technology adoption should look beyond the "one-size fits all" model. By incorporating various methodologies from the fields of marketing and information systems, we may be encouraged to rethink our assumptions around technology consumers and their preferences and perceptions. Contrasting consumer groups that are segmented in a meaningful manner relevant to the application or technology under study may provide a richer understanding of behaviour and use that could be lost in a "one-size fits all" adoption model.

Appendix A. PLS survey questions

Perceived expressiveness (Nysveen et al., 2005a):
- I often talk to others about my mobile phone's features
- Using my mobile phone's features is part of how I express my personality
- Other people are often impressed by the way I use my mobile phone

Enjoyment (Davis et al., 1992):
- Using my mobile phone's features is exciting
- Using my mobile phone's features is pleasant
- I have fun using my mobile phone's features
- I find using my mobile phone's features to be enjoyable

Perceived usefulness (Davis, 1989):
- My mobile phone's features help me be more effective
- My mobile phone's features make it easier to accomplish tasks
- My mobile phone's features help me be more productive

Perceived ease of use (Venkatesh, 2000):
- Interacting with my mobile phone's features does not require a lot of mental effort
- I find it easy to get my mobile phone to do what I want to do
- I find my mobile phone's features easy to use

Attitude (Hassanein & Head, 2007):
- I have positive feelings about my mobile phone's features
- Using my mobile phone's features is a good idea
- The thought of using my mobile phone's features is appealing to me

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