Effects of Mental Model and Intrinsic Motivation on Behavioral Intention of Smartphone Application Users

Wonjin Jung and Hyung Rok Yim

An application that has a simple user interface not only motivates a user to continue using the application, but also enables the user to develop their mental model for the application — the like of which is a product of their interaction with the application. In the information systems literature, little empirical research has been undertaken on the effects of the mental model and motivation on smartphone users' behavioral beliefs. Therefore, the aim of this study is to suggest a research model that can examine the following: 1) the effects that the mental model has not only on smartphone users' behavioral beliefs (that is, perceived usefulness and ease of use of an application) but also on their behavioral intention to use an application and 2) the effects that smartphone users' intrinsic motivation has on their behavioral beliefs through an expansion of the mental model. A survey is conducted, and structural equation modeling is then used to analyze the survey data. The results, through consideration of variables such as intrinsic motivation, perceived usefulness, perceived ease of use, and user satisfaction, indicate that the mental model has an indirect effect on a user's intention to use an application.

Keywords: Smartphone, application, mental model, motivation, intention.

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I. Introduction

Apple introduced the iPhone in 2007, and the first phone to use Android was released the following year. Since then, the global smartphone market has grown exponentially. A recent study revealed that more than one billion smartphones were in use worldwide in 2012 [1]. The rapid penetration of smartphones accelerated the introduction of a wide range of uses for smartphone applications [2]. In 2008, Apple introduced the App Store as an online distribution platform to allow third parties to provide native applications. Meanwhile, Open Handset Alliance (OHA), which is backed by Google and major hardware and software developers, started to provide their own applications in addition to third-party applications in 2008 via the Android Market, which has now been renamed Google Play. In 2014, 1.2 million applications were available in the App Store [3], [4] and over 1.3 million applications were available in Google Play [5]. With such numbers, today's mobile users spend more time on mobile devices than ever before. According to the market research firm Flurry, as of March 2014, the average smartphone user spends 2 h and 42 min per day on their mobile device, up 4 min per day as of a year ago [3], [4]. Another industry report, conducted by Nielsen [6], revealed that, in 2014, smartphone users spend 65% more time on applications than they did just two years ago. These industry figures make it clear that mobile application usage is on the rise. The reasons for this rise include not only the fact that mobile applications are easy to use and are useful, but also that they have resulted in the introduction of many technological innovations and advances; consequently,

such applications continue to draw interest and excite users.

At the same time, applications grow larger as more functionality is added to them, and their user interfaces also become more complicated. In general, an application that has a complex user interface is less usable than one that doesn't; however, on the other hand, an application that has a simple user interface not only motivates a user to continue to use it, but also enables a user to develop their mental model for the application — the like of which is a product of their interaction with the application [7].

In the literature, motivation is known not only as a theoretical construct that is used to explain the reasons for our behavior, but also an important source of enjoyment and vitality [8], [9]. The mental model is a cognitive structure comprising specific knowledge and experience and is the basis of specific behaviors [10], [11]. These cognitive concepts play a decisive role in the way in which a smartphone user adopts and uses an application.

When an application's user interface is complex and difficult to use, then the application itself is less usable. If applications are less usable, then users are rarely motivated to use them. At worst, users can get confused, which results in difficulty for them to form an accurate mental model of an application. Furthermore, less-usable applications may have a negative impact on users' behavioral beliefs and intentions to use such applications.

A comprehensive review of the information systems (IS) literature reveals that little empirical research has been performed with respect to the effects of the mental model and motivation on smartphone users' behavioral beliefs (that is, perceived usefulness and ease of use of an application). These behavioral beliefs are the two main determinants of user IT acceptance in the technology acceptance model (TAM). Therefore, the aim of this study is to suggest a research model that is capable of addressing the following: 1) the effects that the mental model has not only on smartphone users' behavioral beliefs (that is, perceived usefulness and ease of use of an application) but also on their behavioral intentions to use applications and 2) the effects that smartphone users' intrinsic motivations have on their behavioral beliefs through an expansion of the is mental models.

The remainder of this paper is organized as follows. Section II provides a literature review and related research hypotheses. Section III presents the research methodology, data analysis, and results. Section IV provides the discussion, and Section V, the conclusion.

II. Literature Review and Research Hypotheses

A usable user interface is critical to any application because users interact with systems through such an interface [12], [13]. According to Lauesen [14], a user interface is the part of a system that users can see, hear, and feel. Similarly, Moran [15] describes a user interface as composed of everything that users can use perceptually, conceptually, and physically. These definitions serve to highlight the importance of a user interface in general. For a user interface to be deemed usable, it should not only be simple enough to understand but also easy enough to use; otherwise, users could have difficulty when interacting with a given system. Another reason as to why a user interface should be simple and easy to use is that users are expected (by researchers in the IS field) to develop their mental models while using systems that employ the user interface in question. Users create mental models of a system based upon their interaction with the system; therefore, when a user interface is simple and easy to use, it facilitates interaction with the systems it serves, which in turn leads to the development of more accurate mental models. On the other hand, when a user interface is less usable, users have difficulty in properly interacting with the systems it serves. As a result, users are not able to generate precise mental models.

The literature reveals that the mental model is a kind of cognitive structure that is comprised of specific knowledge and experience [11]. Rouse and Morris [11] noted that people understand their surrounding world through the use of mental models. Johnson-Laird [10] explained that this is possible because the mental model is a kind of internal representation of one's external reality (in general, this is something that is quite complicated).

Hmelo-Silver and Pfeffer [16] found that people formulate different mental models to solve problems they encounter within a given domain. In addition, mental models have been found to influence peoples' thoughts and cognitive activities during skill acquisition, information search and encoding, idea generation and evaluation, learning and problem-solving, spatial analysis, and creative thought [17]–[23].

These findings, therefore, make it possible to infer that a user's mental model of a smartphone application can play an important role in how the user chooses to interact with the application. In brief, smartphone users use an application according to the mental model that is generated and developed while interacting with the application. Accordingly, when users use an application, their behavioral beliefs and intentions (in terms of the perceived usefulness of, perceived ease of use of, and intention to use an application; that is, the three main constructs of TAM) can be affected by the mental model that has been created while interacting with the application.

Nevertheless, not every user interface is usable. Some are neither simple enough to understand nor easy enough to use;

furthermore, some are not interesting enough to motivate users. Motivation is a natural inclination toward mastery and interest [24] and is also known to be an important source of enjoyment and vitality. According to Holbrook and Hirschman [9], motivated people use products or services due to the interest, joy, and satisfaction that they experience. In addition, some researchers have found that particular beliefs are related to motivation [25], [26].

These perceptions and findings of mental models and motivation can be applied to smartphone users. When smartphone users are motivated because of their behavioral beliefs about an application (for example, perceived usefulness and perceived ease of use), they tend to use that application more frequently than when they are not–with frequency of use comes familiarity. Knowing more about the application expands the mental model the user has created for the application. Therefore, it may also be possible to infer that a user's intrinsic motivation appears to have a positive impact on cognitive function in terms of the expansion of the mental model. This inference can be also drawn from some research done by Tao [27] and Wells and others [28]. They found that motivation is one of the principal internal components that fundamentally influences an individual's cognitive activities.

Furthermore, it is well known in the motivation literature that motivation enhances working-memory capacity [29]–[31]. If motivation enhances a user's working-memory capacity, then it may have a positive impact on the expansion of the mental model, since such an expansion takes place at the boundary of the user's working-memory capacity.

Furthermore, when users know more about applications, they have a greater opportunity to perceive the usefulness and ease of use of such applications. According to the 80/20 rule, 80% of the use of an application involves 20% of the functionality contained within [32]. In general, most users are likely to know less than 20% of the functionality of an application, but if they know a bit more than 20% of the functionality, then they will be able to find greater use for the application. If they are able to find greater use, then they will have a greater opportunity to perceive the usefulness and ease of use, which in turn may lead to a greater intention to use the application.

In sum, both the literature review and the discussion above suggest that the mental model is critical not only to smartphone users' behavioral beliefs in terms of the perceived usefulness and perceived ease of use but also to smartphone users' behavioral intentions to use applications. In addition, a user's intrinsic motivation seems to influence the mental model by improving the working memory. Therefore, the following hypotheses are proposed with the corresponding research model presented above in Fig. 1:

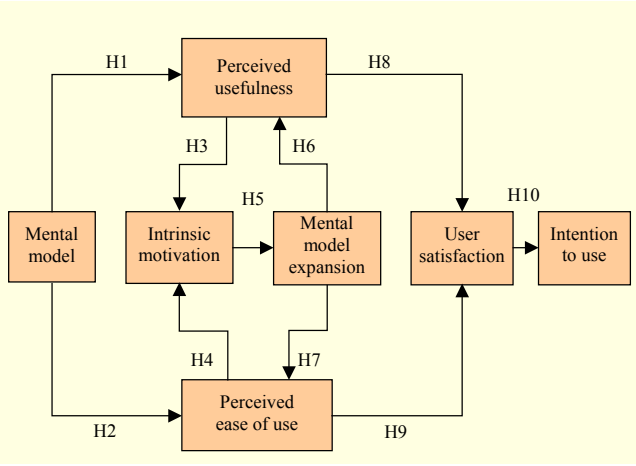

Fig. 1. Proposed research model.

- H1: The mental model that a smartphone user has of an application positively affects the user's perceived usefulness of the application (a behavioral belief).
- H2: The mental model that a smartphone user has of an application positively affects the user's perceived ease of use of the application (a behavioral belief).
- H3: A smartphone user's behavioural beliefs of an application positively affects the user's intrinsic motivation to use the application.
- H4: A smartphone user's perceived usefulness of an application (a behavioral belief) positively affects the user's intrinsic motivation to use the application.
- H5: A smartphone user's intrinsic motivation to use an application positively affects the expansion of the mental model that the user has created for the application.
- H6: The expansion of a smartphone user's mental model for an application positively affects the user's perceived usefulness of the application (a behavioral belief).
- H7: The expansion of a smartphone user's mental model for an application positively affects the user's perceived ease of use of the application (a behavioral belief).
- H8: A smartphone user's perceived usefulness of an application (a behavioral belief) positively affects the user's satisfaction with the application.
- H9: A smartphone user's perceived ease of use of an application (a behavioral belief) positively affects the user's satisfaction with the application.
- H10: A smartphone user's satisfaction with a given application positively affects the user's behavioural intention to use the application.

III. Research Methodology, Data Analysis, and Results

This study aims to examine the effect that the mental model

Table 1. Participant characteristics.

	Characteristics	Freq.	%
Gender	Males	119	50.4
	Females	117	49.6
Age	20–29	189	80.1
	30–39	35	14.8
	40 or above	12	5.1
Job	Students	158	66.9
	Practitioners	78	33.1
Application categories	SNS & communications	146	61.9
	News/Internet/Browsing/Searching	27	11.4
	Games/Entertainment	23	9.7
	Maps/Navigation	16	6.8
	Mobile banking/Finance/Shopping	12	5.1
	Utilities and other	12	5.1

held by a smartphone user has on the user's behavioral intention to use an application by mediating certain variables, including behavioral beliefs and user satisfaction. In addition, this study also aims to investigate the effect that a user's intrinsic motivation to use an application has on the user's behavioral beliefs through an expansion of the mental model.

A survey was conducted to collect data from a total of 236 participants. Of all the participants, 66.9% were undergraduate students, attending one of three major universities in the Rep. of Korea, and 33.1% were practitioners (see Table 1). This study used a convenient sampling method and recruited students from different majors, including business, economics, and computer science. Despite the use of a convenient sample, efforts were made to gather data from a population that was diverse in terms of both gender and age. One of the main reasons for using college students and practitioners for this study is that they usually are more flexible in their thinking, especially concerning new technologies. They often actively seek out new and varied technologies. Furthermore, they are more likely to have positive attitudes and cognitions toward adopting a variety of new technologies. Thus, these groups of students and practitioners were considered suitable subjects for this study, which has to examine a variety of smartphone applications to minimize the influence of potential extraneous variances. Of the total number of participants, 50.4% were male and 80.1% were in their twenties; 61.9% of the applications that the participants had used just before the survey were related to social networking and communication.

While structural equation modeling (SEM) has been used traditionally to analyze multivariate models, factor analysis has been used to reduce a large number of variables to a more manageable number, prior to the multivariate analysis of variance. Hence, factor analysis was conducted first. This study employed exploratory factor analysis because it is often used to explore the inter-relationships among a set of variables. Then, this study used SEM to test the proposed research model. The SPSS Statistics with AMOS ver. 18 was used as a statistical software for these analyses.

Table 2. Total variance explained.

Component	Rotation sums of squared loadings		
	Total	Variance (%)	Cumulative (%)
1	2.638	12.561	12.561
2	2.610	12.429	24.990
3	2.596	12.364	37.354
4	2.537	12.082	49.436
5	2.366	11.265	60.702
6	2.242	10.675	71.377
7	2.072	9.865	81.242

First, the eigenvalues are listed in Table 2. The seven components with an eigenvalue of 1.0 or more explain a total of 81.242% of the variance. In addition, the *scree plot* also showed a clear break after the seven components. Therefore, it was decided to retain the seven components for further analyses. After the number of factors was determined, the factors were rotated using a *varimax rotation*. In Table 3, the main loadings on the components are identified, and correlation coefficients of 0.3 or above are shown. There is no item that loads strongly on more than one component.

The reliabilities of the scales were also checked. The Cronbach's alpha coefficients were 0.916, 0.816, 0.903, 0.850, 0.878, 0.852, and 0.898 for mental model, perceived usefulness, perceived ease of use, intrinsic motivation, mental model expansion, user satisfaction, and intention to use, respectively. Thus, the scales are quite reliable.

SEM was then performed. First, the construct validity was tested in terms of the reliability of the individual instrument items. All of the reliability measures (namely, the loadings of the items on their respective constructs) should be above 0.6 or ideally 0.7 [33], [34]. The results show that all of the loadings were 0.7 or higher, which is in fact above the recommended level of 0.6, suggesting that the reliability is adequate (see Table 4).

Next, the construct validity was also tested in terms of both the convergent validity and the discriminant validity of the instrument items. While the convergent validity was examined

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Table 3. Rotated component matrix.

	Component						
	1	2	3	4	5	6	7
MM1	0.854						
MM2	0.838		0.313				
MM3	0.770						
US1		0.775					
US2		0.755					
US3		0.625	0.383				
EU1			0.835				
EU2	0.309		0.804				
EU3			0.794				
MT1				0.919			
MT2				0.845			
MT3				0.787			
ME1					0.865		
ME2					0.848		
ME3					0.830		
SF1						0.800	
SF2						0.745	0.332
SF3						0.733	
IN1							0.824
IN2						0.300	0.807
IN3							0.796

Table 4. Standardized regression weights of observable variables, CR, and AVE.

Latent variables	Estimates	Variance CR	CR	AVE
Mental model	0.876	7.856	0.948	0.787
	0.930	5.316		
	0.853	8.475		
Perceived usefulness	0.801	7.192	0.838	0.576
	0.742	8.339		
	0.732	8.487		
Perceived ease of use	0.900	5.876	0.938	0.745
	0.856	7.558		
	0.831	8.236		
Intrinsic motivation	0.727	9.160	0.849	0.677
	0.942	2.493		
	0.785	8.104		
Mental model expansion	0.800	8.132	0.906	0.705
	0.853	6.607		
	0.865	6.160		
User satisfaction	0.757	8.782	0.893	0.634
	0.803	8.036		
	0.827	7.507		
Intention to use	0.917	5.297	0.927	0.743
	0.854	7.811		
	0.811	8.782		

by two measurements, composite reliability (CR) and average variance extracted (AVE) (of the latent variables), the discriminant validity was checked by making a comparison between the square root of the AVE and the correlations among the constructs. Since AMOS ver. 18 does not provide the values for CR and AVE, they were manually calculated using the two formulas below, as suggested by Fornell and Larcker [35] and Hair and others [36].

$$\mathrm{CR} = \Sigma\left(\text{standardized regression weights}\right)^2 / \left[\Sigma\left(\text{standardized regression weights}\right)^2 + \Sigma \text{ variance}\right],$$

$$\mathrm{AVE} = \Sigma\left(\text{standardized regression weights}^2\right) / N,$$

where N is then number of items for each variable. The results show that all constructs had values of CR greater than the recommended cutoff of 0.7 (see Table 4). The results also show that the estimates of the AVE for all constructs were equal to 0.5 or higher, which is well above the recommended tolerance of 0.5. Therefore, the items demonstrated a satisfactory conversant validity.

Table 5. Correlation coefficient value between constructs and AVE.

Constructs	AVE	ø²	ø²	ø²	ø²	ø²	ø²	ø²
Mental model	0.787	0.232	0.261	0.221	0.033	0.470	0.394	1.000
Perceived usefulness	0.576	0.394	0.455	0.264	0.103	0.504	1.000	
Perceived ease of use	0.745	0.297	0.258	0.160	0.019	1.000		
Intrinsic motivation	0.677	0.033	0.061	0.139	1.000			
Men. model expansion	0.705	0.062	0.113	1.000				
User satisfaction	0.634	0.599	1.000					
Intention to use	0.743	1.000						

The discriminant validity of the constructs was also examined. To obtain satisfactory discriminant validity, the square root of

Table 6. Hypotheses tests.

	Paths	Coeff.	Stand. coeff.	P	Results
H1	Mental model → Perceived usefulness	0.599	0.604	***	Accept
H2	Mental model → Perceived ease of use	0.665	0.660	***	Accept
H3	Perceived usefulness → Intrinsic motivation	0.449	0.362	***	Accept
H4	Perceived ease of use → Intrinsic motivation	–0.155	–0.127	0.135	Reject
H5	Intrinsic motivation → Mental model expansion	0.276	0.342	***	Accept
H6	Mental model expansion → Perceived usefulness	0.195	0.195	0.006	Accept
H7	Mental model expansion → Perceived ease of use	0.162	0.159	0.009	Accept
H8	Perceived usefulness → User satisfaction	0.547	0.603	***	Accept
H9	Perceived ease of use → User satisfaction	0.142	0.159	0.023	Accept
H10	User satisfaction → Intention to use	0.995	0.787	***	Accept

the AVE of a construct should be greater than the correlation between it and the other constructs in the model [30]. Table 5 indicates that the square root of the AVE for each construct is greater than the correlation of the construct with the other constructs in the model. Thus, the discriminant validity is also confirmed.

After that, the structural model was tested. First, a goodness of fit was verified; to do so, indices such as x^2/df, GFI, AGFI, NFI, TLI, CFI, and RMSEA were examined. The results are as follows: x^2/df = 2.053, GFI = 0.876, AGFI = 0.839, NFI = 0.897, TLI = 0.934, CFI = 0.944, and RMSEA = 0.067. The overall fit statistics indicate that the proposed model has a fairly good fit.

Finally, the estimates of the path coefficients were examined to analyze the significance and strength of the relationships between the dependent and independent variables in the model. Table 6 shows the results of the test of the structural model. As predicted, "mental model" had a significant influence on both "perceived usefulness" (β = 0.599) and "ease of use" (β = 0.665). "Perceived usefulness" had a significant influence on "intrinsic motivation" (β = 0.449), and "intrinsic motivation" was a significant determinant of "mental model expansion" (β = 0.276). "Mental model expansion" had a positive impact both on "perceived usefulness" (β = 0.195) and "ease of use" (β = 0.162). In addition, "perceived usefulness" (β = 0.547) and "ease of use" (β = 0.142) both positively influenced "user satisfaction." Finally, "user satisfaction" positively affected "intention to use" (β = 0.995). Thus, hypotheses 1, 2, 3, 5, 6, 7, 8, 9, and 10 were supported.

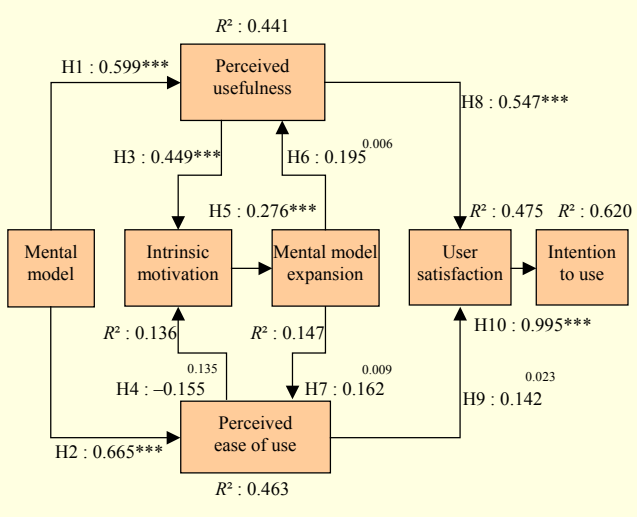

Fig. 2. Structural model results.

However, there was no significant effect of "perceived ease of use" on "motivation" (β = −0.155). This result is contrary to that which is hypothesized in H4. Thus, H4 is rejected. The results of the structural model, with R^2 values representing the amount of variance, are presented in Fig. 2.

IV. Discussion

This study empirically examined the indirect effect that a mental model has on a smartphone user's behavioral intention to use a smartphone application in terms of the user's behavioral beliefs. In addition, this study also examined the extent to which intrinsic motivation affects behavioral beliefs through cognitive functions related to the expansion of the mental model. The results indicate, through mediating variables (including perceived usefulness and user satisfaction), that a mental model of a user has a significant indirect effect on the user's intention to use a smartphone application. In addition, the results also show that intrinsic motivation has a significant effect on perceived usefulness and perceived ease of use. These results can be used not only to understand the influence that intrinsic motivation and mental model have upon behavioral beliefs but to predict behavioral intentions to use technology.

One of the interesting results in this study is that "ease of use" did not have a significant effect on "intrinsic motivation" (of users). On the other hand, "perceived usefulness" was found to have a significant impact on "motivation." These results indicate that smartphone users could not be motivated simply as a result of the applications being easy to use. In fact,

most smartphone applications today are simple and easy enough to use, without requiring much effort to learn how to use them. Under these circumstances, "perceived ease of use" cannot be a precursor to "motivation." Therefore, the findings of this study suggest that rather than just being easy to use, smartphone applications should be useful for users in some ways if they are to be attractive to users.

In addition, the results of this study also imply that once a user is motivated, then there is a greater probability of extending the user's mental model of a given application by increasing the amount of time spent on the application. A motivated user is both interested and ready to use an application. The more a user uses an application, the more the user learns about the application. The knowledge learned whilst using the application may then be added to the associated mental model of the user, which in turn not only leads to an expansion of this mental model but also helps the user further perceive the usefulness and ease of use of the application. Thus, these results indicate that the intrinsic motivation of a user appears to be a precursor to the two main behavioral beliefs of the TAM.

Perhaps the most important contribution of this study to the IS literature is the fact that TAM was validated as well as extended [24], [37], [38]. In brief, the findings of this study are consistent with the TAM. By showing the significant effects that users' behavioral beliefs have on their intention to use applications, this study could confirm that TAM is adequate within the context of smartphone applications. In addition, by finding the effect that a mental model of a smartphone user has on the user's intention to use an application, this study also added the notion of the mental model as a new antecedent to the behavioral beliefs of the TAM. Therefore, the TAM was extended with the variable of the mental model in this context.

The findings of this study also present a few practical implications for application developers. First, application developers can use these findings to justify their efforts to improve the user interfaces of their applications. A review of the relevant IS literature reveals that the user interface is a critical component for the formation of a mental model [7]. In addition, the findings of this study indicate that a user's mental model for a given smartphone application has a significant impact on the user's intention to use the application. Thus, improvements to the designs of user interfaces for smartphone applications can be a powerful differentiating strategy between competing applications as well as a strategic advantage for developers.

Another practical implication is that the individual items of the "mental model" and "motivation" attributes (see Table 3) in the survey can be used to check not only whether a user interface of an application complies with a user's mental model for that application, but also whether the application itself motivates the user. This study identified that user satisfaction and intention to use an application can be secured through a user's mental model and motivation. Hence, the systematic indicators to check for compliance with a user's mental model and motivation are helpful for practitioners to develop user-centered user interfaces of smartphone applications.

V. Conclusion

This study empirically examined not only the indirect effect of the mental model on behavioral, but also the effect of motivation on behavioral beliefs (through cognitive functions) in terms of the expansion of the mental model.

The results of this study indicate that when a user learns while using an application, the mental model for the application is further developed, which in turn not only leads to an expansion of the mental model but also helps the user perceive the usefulness and ease of use of the application. In addition, the findings also suggest that rather than just being easy to use, smartphone applications should be useful for users in some ways if they are also intended to be attractive. In sum, the results of this study can be used not only to understand the influence that a user's mental model for an application and intrinsic motivation have on the user's behavioral beliefs, but also to predict user IT adoption in the context of smartphone application.

Despite several interesting findings, this study is subject to the limitations of empirical research. For instance, the sample size was relatively small. In addition, about 67% of the participants were undergraduate students and 80% were in their twenties. This means that the survey might not have included a representative sample of smartphone users. Moreover, the range of diversity of the applications was relatively small. About 62% of the applications used were social networking and communication applications. These are areas of concern for external validity. Any follow-up studies should look to address these limitations.

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Appendix

Latent variables	Observable variables	Definitions & questions
Mental model	Def.	Mental model in the context of this study is defined as an explanation of a smartphone user's thought processes about how a smartphone application works. It is an internal representation of a smartphone application, the relationships between its various functions, and a user's reasoning about his or her own acts and their consequences. It was measured by comparing each part of a mental model that corresponds to each part of a given smartphone application.
	MM1	Way to use the smartphone application that I used most recently was predictable.
	MM2	Smartphone application that I used most recently worked as predicted.
	MM3	Smartphone application that I used most recently worked as I know.
Perceived usefulness	Def.	Perceived usefulness was defined as the degree of expected practical worth that smartphone users perceive when they use a specific smartphone application, and it was measured by how a given smartphone application enhances the achievement of a user's job performance.
	US1	Smartphone application that I used most recently helped me achieve my personal goals easily.
	US2	Smartphone application that I used most recently was the most efficient way to achieve my personal goals.
	US3	Smartphone application that I used most recently was beneficial for me in general.
Perceived ease of use	Def.	Perceived ease of use was defined in this study as the degrees of freedom of effort that smartphone users would perceive when they use a specific smartphone application, and it was measured by how easy a given smartphone application was to use.
	EU1	Way to use the smartphone application that I used most recently was simple.
	EU2	Way to use the smartphone application that I used most recently was easy to understand.
	EU3	Functions in the smartphone application that I used most recently were easy to use.
Intrinsic motivation	Def.	Motivation in this study was defined as the reasons prompting smartphone users to learn and use a specific smartphone application, and it was measured by asking the users how strongly they felt about having an interest in learning and using the given smartphone application.
	MT1	I am interested in learning the way to use the smartphone application that I used most recently.
	MT2	As much as possible, I want to learn how to use the smartphone application that I used most recently.
	MT3	As much as possible, I want to know how to use the smartphone application that I used most recently.
Mental model expansion	Def.	Mental model expansion refers to an enlargement of an initial mental model. It was measured by comparing the differences between a user's current and initial mental models about the ways in which to use a given smartphone application.
	ME1	Smartphone application that I used most recently expanded my knowledge of how to use smartphone applications.
	ME2	Smartphone application that I used most recently gave me a chance to learn the new ways to use smartphone applications.
	ME3	I found new ways to use smartphone applications after using the smartphone application that I used most recently.
User satisfaction	Def.	User satisfaction is defined as the opinions of smartphone users about a specific smartphone application, and it was measured in terms of their experiences with a smartphone application.
	SF1	Experience of the smartphone application that I used most recently was very satisfying.
	SF2	Smartphone application that I used most recently was a pleasant experience.
	SF3	Overall, I was satisfied with the smartphone application that I used most recently from every aspect.
Intention to use	Def.	Intention to use is defined as a mental state of smartphone users that represents a commitment to using a specific smartphone application in the future. It was measured based upon the desires of smartphone users to use a smartphone application and the attempts to achieve their goals with the given application.
	IN1	I intend to use the smartphone application again in the near future.
	IN2	I intend to use the smartphone application again at every opportunity.
	IN3	I intend to use the smartphone application again to do my personal tasks.

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