Reexamining Technology Acceptance in Online Task Behaviours

By: Achita Muthitacharon, Prashant C. Palvia, Lloyd D. Brooks, Balaji C. Krishnan, Robert F. Otondo, and Donna Retzlaff-Robert

Muthitacharoen, A., Palvia, P., Brooks, L., Krishnan, B., Otondo, R., and Retzlaff-Robert, D. "Reexamining Technology Acceptance in Online Task Behaviors." Electronic Markets. Vol. 16, No. 1, 2006, pp. 4-15.

Made available courtesy of [publisher name]: The original publication is available at http://www.springerlink.com/

Reprinted with permission. No further reproduction is authorized without written permission from Springer-Verlag. This version of the document is not the version of record. Figures and/or pictures may be missing from this format of the document.

Abstract:
With rapid advances in information technology, information systems and software have become more versatile and multifunctional. However, users may have varying degrees of preferences to different functions and tasks that can be accomplished using a single technology. In order to investigate this phenomenon, this study adopts a previous study by Gefen and Straub (2000) as a reference point and uses Internet technology to investigate two tasks: information search and online purchasing. The current study provides a more comprehensive picture of applying task behaviours by decomposing each variable in the technology acceptance model (TAM) according to the two online tasks. The proposed model was tested with survey data from 435 respondents. Results demonstrate that TAM holds its explanatory utility very well when applied to task behaviours. Convergent and discriminant validities indicate that each task possesses its own characteristics and variables. A structural equation modelling test was performed and the results show that perceived ease of use and perceived usefulness have significant relationships with intention only within its task but not outside. As a result, our results outperform those reported in the baseline study of Gefen and Straub. It is therefore advisable for organizations in deploying technology to delineate user behaviour by tasks and explore the impact of the technology on individual tasks.
Keywords: information technology acceptance, technology acceptance model, task behaviours, online behaviours, e-commerce

Article:

INTRODUCTION

With rapid advances in information technology, information systems and software have become more versatile and multi-functional. However, users may have varying degrees of preferences to different functions and tasks that can be accomplished using a single technology. There are only a few studies that attempt to provide a theoretical justification of how and why a user makes a decision to use a technology only for one specific task and refuses to use it for others. In an organizational context, task accomplishment is the key to productivity and success while technology is the enabler. We, therefore, focus on tasks, particularly those that are volitional rather than mandated or assigned. Among several theories in IS research, we argue that integrating the technology acceptance model (Davis 1986; Davis et al. 1989) to task behaviours (Bandura 1986; Bandura and Wood 1989) can provide a more comprehensive understanding of user behaviours.

Applying TAM and task behaviours to user behaviour in electronic market is a focus of our study. It is mainly because the majority of Internet users use the Internet for browsing information and only 21% make online transactions (US Census Bureau 2002). Furthermore, sales generated from online retailers are only 1.3% of total retail sales in the US for the third quarter of 2002 (US Department of Commerce 2002). Gefen and Straub (2000) presented emerging evidence that ties task behaviours in electronic markets to variables in TAM (i.e., perceived usefulness and perceived ease of use). They applied TAM to task behaviours and examined intention variables with respect to online tasks. Despite several interesting findings, they reported that intention to

purchase was not significantly influenced by perceived ease of use. This finding contradicts the relationship proposed in TAM. They suggested that future research should decompose other variables in TAM and reexamine their relationships. We follow their advice and do just that. Our study builds on Gefen and Straub's work with a more comprehensive decomposition of TAM's variables. Its purpose is to reexamine whether TAM can hold its explanatory power to task behaviours in electronic markets.

THEORETICAL BACKGROUND

Technology acceptance model

In the late 1980s, the technology acceptance model (TAM) was developed and introduced to the IS discipline (Davis 1986; Davis et al. 1989). It was built upon the theory of reasoned action (Fishbein and Ajzen 1975), an intention theory that has been widely accepted for the past four decades. TAM has received wide attention from IS researchers for at least three reasons. First, it has a strong foundation in psychological theory (Chau 1996; Taylor and Todd 1995). Second, it is parsimonious and can be used as a guideline to develop a successful information system (Venkatesh 2000). Third, a past stream of research supports the robustness of the model across time, setting, populations and technologies (Venkatesh 2000).

TAM hypothesizes that actual system use is determined by users' behavioural intention to use (BI), which in turn is influenced by users' attitudes toward using (A). Attitude toward using is directly affected by two salient beliefs about the system: perceived usefulness and perceived ease of use. Perceived usefulness (U) is defined as 'the prospective user's subjective probability that using a specific application system will increase job performance'. Perceived ease of use (EOU) refers to 'the degree to which the prospective user expects the target system to be free of effort'. An additional relationship from U to BI in TAM is based on the assumption that intention to use could be based on an expected improvement in job performance regardless of attitude (Davis 1986, Davis et al. 1989). TAM and the relationships of its antecedents are shown in Figure 1.

Several attempts have been made to enhance the explanatory and predictive utility of TAM. Taylor and Todd (1995) integrated the Theory of Planned Behaviour (TPB) (Ajzen 1985) to TAM and proposed a decomposed version of TPB. Later, Venkatesh and Davis (2000) proposed an extended model of TAM, which incorporates social influence processes and cognitive instrumental processes. Several researchers (e.g., Agarwal and Prasad 1997; Koufaris 2002, Taylor and Todd 1995) integrated variables from the Innovation Diffusion Theory (Rogers 1983) to TAM or other intention models. Recently, TAM was combined with four core determinants of IT usage (Venkatesh et al. 2003). Despite reported improvement in the explanatory power of these new models, IS researchers have maintained their interest in TAM due to its parsimony and replicability.

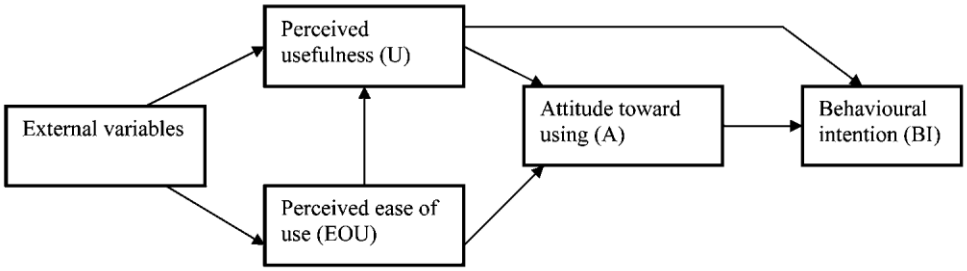

Figure 1. Technology acceptance model

While TAM has been used extensively in IS research, some of its variables have occasionally been omitted from the model. For example, Attitude toward Using has shown only a partial mediating impact between beliefs and intention and many studies have reported a weak link to U (Davis et al. 1989; Venkatesh and Davis 2000). It was also claimed that excluding the attitudinal variable could perhaps help better understand the influence of U and EOU on intention (Venkatesh 2000). While a group of IS researchers support the idea of excluding attitude from TAM, others provide supportive evidence and demonstrated benefits of preserving attitudinal variables (e.g., Chau and Hu 2001; Jackson et al. 1997). It is beyond the scope of this study to discuss the controversy of excluding the attitudinal variable from TAM. For more information regarding preserving and

omitting the attitudinal variable, please refer to the discussion in the following references (Chau and Hu 2001; Davis et al. 1989; Jackson et al. 1997; Venkatesh 2000; Venkatesh and Davis 2000).

Goal behaviours, task behaviours and technology acceptance

Intention theories have gained popularity across several disciplines in the past three decades. Literature suggests that there are more than 200 IS studies that adopt intention models. In the case of TAM alone, there are at least 96 studies published between 1989 and 2002. Such popularity can be attributed to the robustness of intention models. The robustness of intention models is derived from their flexibility to explain various types of behaviours. Intention models have been applied beyond their originally defined constraints. For instance, although the theory of reasoned action (TRA) was initially designed to cope with voluntary behaviours (Fishbein 1980; Fishbein and Ajzen 1975), TRA was shown to hold its predictive utility even when applied to goal behaviours (Sheppard et al. 1988). Since TRA is the underlying model of TAM, the robustness has transferred to TAM. For a list of studies that adopts goal behaviours, see Sheppard et al. (1988).

While intention models seem to hold predictive and explanatory power in the context of goal behaviours, little effort has been applied to extending intention models to task behaviours. In IS research, Gefen and Straub (2000) proposed the concepts of tasks that are intrinsic and extrinsic to information technology (IT). Tasks that are intrinsic to IT are defined as 'tasks where IT provides the primary ends'. On the other hand, tasks that are extrinsic to IT are those 'in which IT is only the means to achieving the primary product or service, i.e., IT is not the central component of the process but is instrumental in achieving it.'

When users perform an intrinsic task, they are driven by intrinsic motivations. According to Davis et al. (1992: 112): 'intrinsic motivation refers to the performance of an activity for apparent reinforcement other than the process of performing the activity per se.' When users perform an extrinsic task, they are driven by extrinsic motivation where the technology is perceived to be instrumental in achieving value outcomes that are distinct from the activity itself.

The concept of goal behaviours is closely related to task concept in IS research. Goal behaviour and task behaviour share a common ground in terms of both being driven by an individual's motivations. Not only can behaviours be driven by motivations (Davis et al. 1992; Gefen and Straub 2000), an individual's goals can also be driven by motivations (see, e.g., Bagozzi and Dholakia 1999; Locke 1968). While intention theories have been widely applied to goal behaviours (e.g., Loken and Fishbein 1980), they have rarely appeared in the domain of task. Since intention models hold their predictive and explanatory power in the goal behaviour context, it is logical to extend their application to the domain of task behaviours. Such an application would provide a deeper understanding of how and why users select to use a technology for a specific task but refuse to use it for another.

TAM can be considered a motivation-oriented model (Davis et al. 1992) where its antecedents are driven by intrinsic and/or extrinsic motivations. Tasks and motivations have been studied together extensively across several research disciplines (e.g., Gill 1996; Mawhinney 1990; Teo et al. 1999). In fact, the concepts of task and motivation share a common ground with TAM since they are rooted back to the cognitive evaluation theory (Deci 1975; Deci and Ryan 1987). The strong tie between TAM and the task concept allows us to extend TAM to the task domain.

Gefen and Straub's (2000) study was among the first to provide empirical results and theoretical justification of how to apply TAM's variables to the task concept. In their study, online information acquisition and online purchasing were considered tasks that are intrinsic and extrinsic to IT respectively. Online information acquisition is intrinsic to IT, largely because IT (i.e., the Internet browser) functions as an integrated service that combines intelligent interface and database to provide product information. In contrast, online purchasing is extrinsic to IT, because IT serves only as an interface to another system that handles the primary purchase activities involved, i.e., payment and shipping. Figure 2 shows Gefen and Straub's proposed model that

investigates the role of perceived ease of use and perceived usefulness to two intention variables: the intention to inquire information and the intention to make online purchases.

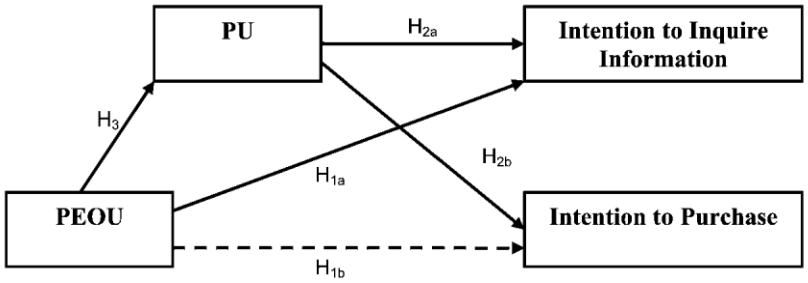

Figure 2. Gefen and Straub's proposed model Gefen and Straub 2000 p. 12

The present study adopts Gefen and Straub's work as the primary motivation and baseline, and builds on it. In their study, EOU and U were tested with two behavioural intentions: intention to purchase online and intention to seek product information. While the majority of relationships were supported by their data, intention to purchase online was not significantly influenced by EOU (H1b) (See Figure2). This insignificant relationship is surprising and contradicts previously reported relationships (e.g., Chen et al. 2002; Davis 1986; Taylor and Todd 1995). While providing some support for the lack of relationship, Gefen and Straub acknowledged the limitation of combining information search and purchasing tasks in both U and EOU (Gefen and Straub 2000: 20). Järveläinen and Puhakainen (2004) acknowledge that consumers who use the Internet extensively for information search may not necessarily make transactions online. This study, therefore, fully integrates the task concept in TAM by arguing that intention should not be the only variable that is decomposed according to tasks – other variables in TAM (i.e., EOU and U) should also be treated in the same manner.

MODEL AND RESEARCH HYPOTHESES DEVELOPMENT

Applying TAM to task behaviours

The current study applies TAM to the full scope of task behaviour by decomposing other variables in TAM based on the task being performed. By adopting this approach, TAM is applied to two online tasks shown in Figure 3. Information search task is presented on the left pane of the figure, while online purchasing task is depicted on the right. It is worth noting that there are two parallel sets of variables in the figure. Not only is the intention variable decomposed into online information search and online purchasing tasks, other variables (EOU and U) are also treated in a similar manner.

Relationships between these variables are adopted from those originally proposed by Davis et al. (1989). In addition to the original hypotheses, this study argues that users could perceive each task separately and develop different set of beliefs toward each task. In other words, we argue that there should be two separate sets of U and EOU and that Us and EOUs should have significant impact on intention only within the same task and not outside. A user who finds the Internet useful to perform information search may not find it useful for making purchases, and vice versa. The same approach could also be applied to EOU.

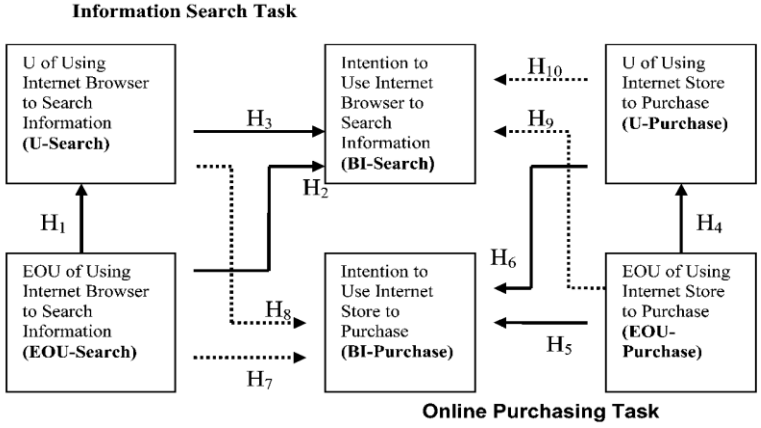

Figure 3. A comprehensive model of task behaviours in e-market

With the proposed improvement, this study proposes two set of hypotheses. The first set of hypotheses delineates relationships between TAM's variables within the same task, while the second set of hypotheses test the relationship of Us and EOUs outside their task.

Set I: Relationships of TAM's variables within their task.

H1: EOU-Search positively influences U-Search.
H2: EOU-Search positively influences Behavioural Intention to Search Information (BI-Search).
H3: U-Search positively influences Behavioural Intention to Search Information (BI-Search).
H4: EOU-Purchase positively influences U-Purchase.
H5: EOU-Purchase positively influences Behavioural Intention to Purchase Online (BI-Purchase).
H6: U-Purchase positively influences Behavioural Intention to Purchase Online (BI-Purchase).

Set II: Relationships of Us and EOUs outside their tasks.

H7: EOU-Search does not affect Behavioural Intention to Purchase Online (BI-Purchase).
H8: U-Search does not affect Behavioural Intention to Purchase Online (BI-Purchase).
H9: EOU-Purchase does not affect Behavioural Intention to Search Information (BI-Search).
H10: U-Purchase does not affect Behavioural Intention to Search Information (BI-Search).

According to the model, these variables target different Internet components. Internet browser is the target technology in the information search task, while Internet store is the target technology in online purchasing. While we acknowledge that an Internet store and its design could also play a pivotal role in a user's information search task, we argue that users, when performing information search, are not committed to use one particular website. During information search, the Internet browser is used to provide the primary result. The information search task does not obligate the user to any business rule that belongs to an Internet store. In contrast, in the online purchasing task, users have to conform to the business rules enforced by the Internet stores. Given the fundamentally different nature of the two behaviours/tasks, it is plausible that users would develop different beliefs towards them.

RESEARCH METHODOLOGY

Survey methodology was used for this research. A survey instrument was prepared to measure the various constructs of the research model. Questionnaire items were taken from previous studies and were adapted to fit to the context of this study. The primary sources of the items were instruments reported in the following studies (Taylor and Todd 1995; Venkatesh 2000; Venkatesh and Speier 2000). Items were modified to fit the context of task behaviours in an electronic market. For example, U and EOU were operationalized for the search and purchasing tasks separately. EOU-Search measures how easy it is to use the Internet browser for searching product information, while EOU-Purchase measures how easy it is to purchase a product from an Internet store. A similar approach was applied to perceived usefulness, and behavioural intention.

An online survey was developed for data collection and was made available on a website. An email list purchased from an international market research company was used to distribute an invitation to prospective participants. Although the email list contained a large number of addresses, we defined those living in the United States as the population frame. As an incentive, participants were eligible to win five $100 cash prizes. Additionally, to increase the sample size, student subjects from the authors' universities were also invited to participate.

One thousand email addresses from the list were used to send out invitations to US residences. Three hundred and fifty three (353) responded and 320 of these responses were usable. Of the 491 students contacted for the study, 138 responded and 115 participants completed the full survey. Of all the returned responses, 435 were complete and usable for analysis. Thus the final sample size is 435. In the sample, there were 263 males

(60.5%) and 172 females (39.5%). None of the participants were older than 49 years old. A majority of the subjects reported income levels in the range of $30,001 to $40,000.

DATA ANALYSIS

Responses from the two groups: general consumers and students were examined for systematic differences via MANOVA tests. To perform the test, additional information regarding their current information search and online purchasing behaviours were collected. The MANOVA analysis included the test of mean difference among the behavioural variables: product information search usage (B-Search) and online purchasing usage (B-Purchase). The results did not indicate any significant differences (See Appendix C). Therefore, the two sets of responses were combined. This step is appropriate for several reasons. Student profiles generally match those of the typical web users (US. Department of Commerce 2002). Furthermore, a growing number of IS studies employ students to represent online consumers (Gefen and Straub 2000; McKinney et al. 2002).

Structural equation modelling was used to evaluate the research model using LISREL VIII (Joreskog and Sorbom 1984). Bentler and Chou (1987) suggest a minimum ratio of 5:1 for the sample size to the number of parameters being estimated in the model. The sample size meets this criterion. The LISREL model consists of a structural model and a measurement model. The measurement model considers latent constructs as linear combinations of sets of observable indicators. The structural model describes the theoretical relationships among the latent constructs through a set of general linear equations (i.e., the path analysis model). Both models were analysed using maximum likelihood estimation.

Table 1. Measures of model fit and reported values for measurement and structural models

Fit measure	*Recommended values*	*Measurement model result*	*Structural model result*
Goodness of Fit (GFI)	⩾0.90	0.83	0.83
Norm Fit Index (NFI)	⩾0.90	0.88	0.88
Non-Norm Fit Index (NNFI)	⩾0.90	0.90	0.90
Comparative Fit Index (CFI)	⩾0.90	0.90	0.90
Root Mean Square Residual	⩽1.00	0.039	0.046
RMSEA	⩽0.10	0.093	0.094

Table 2. Assessment of the measurement model (discriminant validity and internal consistency reliability)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*ICR*
1 BI-Purchase	***0.84***						0.85
2 BI-Search	0.30	***0.78***					0.80
3 EOU-Purchase	0.53	0.38	***0.79***				0.81
4 EOU-Search	0.22	0.57	0.51	***0.73***			0.76
5 U-Purchase	0.67	0.32	0.58	0.28	***0.82***		0.83
6 U-Search	0.14	0.70	0.24	0.50	0.22	***0.87***	0.87

Notes: Diagonal elements are variances extracted for the individual constructs.
Off-diagonal elements are the correlations between the different constructs.
ICR=Internal Consistency Reliability.

RESULTS

The six latent variables of the proposed model were composed of 30 items. Using the correlation matrix as the input, the measurement model shows strong fitness between the data and the proposed model (χ^2=1,417.06, df = 215, p=0.00). The GFI, and NFI are 0.83, and 0.88, respectively. Since GFI and NFI may suffer from inconsistencies due to sampling characteristics (Bollen, 1989; Hair et al. 1998), we also examined the non-normed fit index (NNFI), the comparative fit index (CFI), and the root mean squared error of approximation (RMSEA). These results, displayed in Table 1, were acceptable. That is, CFI and NNFI met the acceptable standard of 0.90 (Hu and Bentler 1995; Segars and Grover 1993) and RMSEA is below 0.10 (Browne and Cudeck 1993). A full result of the measurement model can be found in Appendix B.

Composite and discriminant validities were examined and the results provided supportive evidence. Composite reliability or internal consistency reliability (ICR) is ‘the extent to which different assessment methods concur in their measurement of the same trait (i.e. construct)’ (Byrne 1998). Discriminant validity measures ‘the extent to which independent assessment method diverge in their measurement of different traits’. It is achieved when the square root of the shared variance across items measuring a construct is higher than correlations across

constructs. A high extracted variance occurs when the items truly represent the latent construct (Hair et al. 1998). The recommended value of extracted variance is 0.50 or higher (Byrne 1998; Hair et al. 1998). The recommended value of internal reliability ranges from 0.5 to 0.7 (Fornell and Larker 1981; Hair et al. 1998; Nunnally 1978). Table2 shows that the constructs are generally robust in terms of both reliability and extracted variance. In addition, it shows that all of the six constructs achieve acceptable level of discriminant validity, where correlations to other constructs are less than its own square root of the extracted variance.

Analysis of the structural model generated a Chi-Square value of 1,429.31 (df = 219, p = 0.00). Other goodness-of-fit indices for the proposed model were GFI=0.83, NFI=0.88, NNFI=0.88, and CFI=0.90 (see Table 1). All of the measures combined support the structural model and there is a strong fit between the data and the proposed model. Table 3 provides a summary of the hypotheses tested in the model.

Structural equation modelling supports all ten hypotheses. The relationship of Us, EOUs, and intention are found significant only inside its task and not outside. Structural analysis also reported high R^2 values for the behavioural intention variables: 0.49 and 0.58 respectively for BI-Purchase and BI-Search.

DISCUSSION

Interpretation of findings

The primary purpose of the study was to emphasize the role of task behaviours in technology adoption. Results demonstrate that TAM holds its explanatory power very well in this domain. The model explained approximately 50% (or more) of the variance in each of behavioural variables (49% and 58% for BI-Purchase and BI-Search respectively), which is more than those reported in many TAM studies and also in the baseline study (e.g., Gefen and Straub 2000; Suh and Han 2003; Taylor and Todd 1995). The high explained variance could be primarily attributed to the delineation of online behaviours into tasks that are intrinsic and extrinsic to IT. The discriminant and convergent validities indicate that there are two separate sets of EOU, U, and Behavioural Intentions, rendering strong empirical support to task behaviours. The findings confirm that there are at least two task behaviours in the online shopping environment and they should be analysed separately in organizational implementation of the technology.

Table 3. Summary of hypotheses testing

	Relationship					
Hypothesis	*From*	*To*	*Standardized correlations*	*t-values*	*Significant*	*Interpretation*
H_1	EOU-Search	U-Search	0.50	9.68	Y	Supported
H_2	EOU-Search	BI-Search	0.23	4.60	Y	Supported
H_3	U-Search	BI-Search	0.55	10.86	Y	Supported
H_4	EOU-Purchase	U-Purchase	0.58	11.04	Y	Supported
H_5	EOU-Purchase	BI-Purchase	0.24	4.44	Y	Supported
H_6	U-Purchase	BI-Purchase	0.55	10.16	Y	Supported
H_7	EOU-Search	BI-Purchase	***−0.04***	***−0.80***	***N***	Supported
H_8	U-Search	BI-Purchase	***−0.02***	***−0.36***	***N***	Supported
H_9	EOU-Purchase	BI-Search	***0.08***	***1.90***	***N***	Supported
H_{10}	U-Purchase	BI-Search	***0.09***	***1.97***	***N***	Supported

Our study can be further examined and evaluated by comparing to the baseline study of Gefen and Straub (2000). In order to ensure a fair comparison, it is important to maintain procedural equivalence and distributional equivalence (Cooper and Richardson 1986). Procedural equivalence is achieved when (1) the boundary conditions of both models are observed, and (2) the measurements used to measure the construct follow the same definition. On procedural equivalence, this study is comparable because both studies investigate similar variables (boundary condition) and use measurements developed from similar sources.

Distributional equivalence referring to the respondents in the two samples is more difficult to achieve. The difficulty stems from the use of different groups of respondents. Such equivalence calls for knowledge of population variances. Since the two studies were conducted at different times, by different research methods, and by different researchers, a high level of distributional equivalence may not exist. Nonetheless, parts of the samples of the two studies share similar characteristics. Gefen and Straub's study had 217 MBA students and many of the subjects in our study are MBA students, thus suggesting at least partial distributional equivalence.

With the decomposed version of EOU and U to task behaviours, EOUs showed significant relationships with intention variables. This finding contradicts Gefen and Straub's result. In their study, the relationship between EOU and intention to purchase was not supported. Our argument is that their insignificant relationship between EOU and intention to purchase is due to not decomposing EOUs by task. This limitation was acknowledged by Gefen and Straub. Furthermore, R^2 values of 0.49 and 0.58 were reported for BI-Search and BI-Purchase in our model. These values are much greater than those reported in their study (0.18 for Intended Inquiry and 0.20 for Intended Purchase). In other words, the decomposition of EOUs and Us by task behaviour improves the explanatory power of the model.

Another result that contradicts the baseline study is the relationship of Us to two intention variables. In the baseline study, there is one perceived usefulness variable (U) and it was used to capture the usefulness of two online tasks together. Their perceived usefulness was found to have significant relationship to both behavioural intention variables (See Figure 2). In this study, U was decomposed into two variables according to their tasks. Our results demonstrate that perceived usefulness for information search only has significant impact on behavioural intention to search information and not behavioural intention to make purchases online. A similar result was found for perceived usefulness of using the Internet store to making online purchases.

By decomposing beliefs variables according to tasks, our study allows a thorough investigation of the relative importance of U and EOU more clearly. Based on the results, it can be further said that U has impacts on intention variables far more than EOU. The correlations between Us and intention variables equals to 0.55 for both tasks, while EOUs have smaller correlations to their intention variables, ranging from 0.23 to 0.24. The total effect of Us and EOUs on their intention variables were also examined and it reveals similar results. This implies that online users are generally more goal- and utility-oriented. They are more concerned with the usefulness aspects of technology than the easy-to-use characteristics. This result is consistent with the findings of the baseline study as well as the general literature on TAM's findings.

Implications, limitations, and future research

A number of theoretical and practical implications can be drawn from this study. In terms of theoretical significance, the study demonstrates the important role of tasks in IS research. By applying TAM to specific tasks that the technology can assist with, the explanatory power of the model is enhanced. As the technology becomes more integrated and functionally versatile, combining multiple tasks may dilute the utility of TAM. Convergent and discriminant validities indicate that TAM's variables can be decomposed according technology tasks. There are at least two sets of Us and EOUs in the online shopping environment, one for information search and one for online purchasing. Each U and EOU has significant relationship with its associated variables within tasks. These findings provide insights into the under-utilization of certain aspects of complex and integrated technologies.

Based on the findings, we expect that future TAM research will encounter more issues related to task behaviours as the technology become more complex and multi-functional. At the same time, it will become more challenging for IS researchers to apply TAM to task behaviours while maintaining the parsimony of their models. Perhaps an interim solution is to have a separate and simple TAM-like model for each task. Future studies should seek to integrate these models in order to interconnect the task behaviours into an overall coherent model.

In term of practical application, our results demonstrate that a user views the Internet technology by task. The Internet is one of many technologies that provide multiple functionalities to users. With the rapid advancement in information technology, both hardware and software have become multi-dimensional and multifunctional. For example, a word processor that used to allow users to create documents can now be used to create web pages. A cell phone that was used only to communicate now can be used as camera and organizer. System designers and engineers should investigate each function separately in order to improve user's acceptances. They need to take user's motivation into account and analyse the task to be performed. Such practice would render higher acceptance from users and could eventually lead to higher return on investment on information technology.

When compared to EOUs, Us were found to have higher impact on intention variables. Consistent with previous findings, this reiterates that while developing a new website or product for online users, system designers and web developers should focus on the functionality aspect. Online users seem to be willing to learn how to use and navigate a website, given that the website provides adequate value. Alternatively, it appears that a minimum threshold for ease of use is expected beyond which it is the value of the technology that really matters to the target customers.

In terms of limitations, while the survey methodology produces a good snapshot and allows one to capture a large sample fairly quickly (Davis and Cosenza 1993), it suffers from the self-reported nature of the responses. Survey respondents could under-report or over-report their behaviours (Bauman and Dent 1982). Other limitations of the survey method are: lack of control, internal validity, and inadequate suitability for addressing IT issues in complex settings. Future studies could replicate this or similar studies in different settings and use different methodologies. Such studies should be able to reveal deep and qualitative aspects of technology adoption and task behaviours.

Many extensions to our research are possible. A few suggestions are listed below:

- In order to fully understand task behaviours, future studies may investigate relationships between tasks and variables across tasks, such as the one between two EOUs. While our result indicated that Us and EOUs have significant relationships with intention variables only within their tasks and not outside, we do not conclude that there is no relationship between the two online tasks. The relationship between the two tasks should be further examined. Several decision-making theories posit that an individual performs information search before making purchase decision (Engel et al. 1973; Lipshitz and Bar-Ilan 1996; Simon 1955, 1960). We predict that the two online tasks could have relationship via the relationships between beliefs variables. A high degree of EOU in information search phase may result in high EOU in the online purchasing task. Such relationships should be theoretically justified and empirically tested.

- Recently, a significant body of research has identified the role of consumer trust and perceived risk in electronic markets (e.g., Chen et al. 2002; Jarvenpaa and Todd 1996; Salam 1998; Schoder and Haenlein 2004; Suh and Han 2003; Tan and Ouyang 2004). The concept of trust is highly related to perceived risk since risk plays in important part in the constitution of trust (Lewis and Weigert 1985; Schlenker et al. 1973). We encourage future research to decompose these two variables and investigate their impacts on the two online tasks. These variables may also provide theoretical linkages between the tasks.

CONCLUSION

This study expands our knowledge of how users and consumers make decision to adopt information technology by reexamining the technology acceptance model to task behaviours in an online shopping environment. It decomposes online consumer activity into two distinct tasks: online information search and online purchasing. The composite model of the two task included six variables and ten hypotheses. The model was evaluated using structural equation modelling. The results provided strong support for the model and outperformed those reported in the baseline study. The results additionally indicate that using TAM to explain user behaviour could be far more complex than originally thought. As information technologies become more complex and more

integrated, users can accept only selected functionalities and resist using others. The evidence from this study suggests that researchers and information system developers should take the task concept into serious consideration. There are many examples of technology where the task concept can be applied. For instance, an MS Word user may find it useful to create a document but may not necessarily find it useful for creating web pages or mail merges. Mobile phone and PDA is another example of technologies that are being integrated. With rapid changes in information technology, one could expect further proliferation of tasks and functionalities. Therefore, each task behaviour may need to be examined in its own right.

References

Agarwal, R. and Prasad, J. (1997) 'The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies', Decision Sciences 28(3): 557–82.

Ajzen, I. (1985) 'From Intention to Action: A Theory of Planned Behaviour', in J. Kuhland and J. Bechmann (eds) (1995) Action Controls: From Cognition to Behaviours, New York: Springer Verlag, pp. 11–39.

Bagozzi, R. P. and Dholakia, U. (1999) 'Goal Setting and Goal Striving in Consumer Behaviour', Journal of Marketing 63: 19–32.

Bandura, A. (1986) Social Foundation of Thought and Action: A Social Cognitive Theory, Engelwood Cliffs, NJ: Prentice-Hall.

Bandura, A. and Wood, R. (1989) 'Effect of Perceived Controllability and Performance Standards on Self-Regulation of Complex Decision Making', Journal of Personality and Social Psychology 56(3): 805–14.

Bauman, K. E. and Dent, C. W. (1982) 'Influence of an Objective Measure on Self-Reports of Behaviour', Journal of Applied Psychology 67(5): 623–8.

Bentler, P. M. and Chou, C. (1987) 'Practical Issues in Structural Modeling', Sociological Methods and Research 16: 78–117.

Bollen, K. A. (1989) Structural Equations with Latent Variables, New York: Wiley.

Browne, M. W. and Cudeck, R. (1993) 'Alternative Ways of Assessing Model Fit', in K. A. Bollen and J. S. Long (eds) Testing Structural Equation Models, Newbury Park, CA: Sage, pp. 445–55.

Byrne, B. M. (1998) Structural Equation Modeling with LISREL, PRELIS, and Simplis: Basic Concepts, Application, and Programming, Mahwah, NJ: Lawrence Erlbaum Associates.

Chau, P. Y. K. (1996) 'An Empirical Assessment of a Modified Technology Acceptance Model', Journal of Management Information Systems 13(2): 185–204.

Chau, P. Y. K. and Hu, P. J. (2001) 'Information Technology Acceptance by Individual Professionals: A Model Comparison Approach', Decision Sciences 32(4): 699–719.

Chen, L., Gillenson, M. L. and Sherrell, D. L. (2002) 'Enticing Online Customers: The Technology Acceptance Perspective', Information & Management 39(8): 705–19.

Cooper, W. H. and Richardson, J. J. (1986) 'Unfair Comparisons', Journal of Applied Psychology71(2): 179–84.

Davis, D. and Cosenza, R. M. (1993) Business Research for Decision Modeling, California: Wadsworth.

Davis, F. D. (1986) A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results, Cambridge, MA: MIT Sloan School of Management.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1989) 'User Acceptance of Computer Technology: A Comparison of Two Theoretical Models', Management Sciences 35(8): 982–1002.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1992) 'Extrinsic and Intrinsic Motivation to User Computers in Workplaces', Journal of Applied Social Psychology 22(14): 1111–32.

Deci, E. L. (1975) Intrinsic Motivation, New York: Plenum Press.

Deci, E. L. and Ryan, R. M. (1987) 'The Support of Autonomy and the Control of Behaviour', Journal of Personality and Social Psychology 53(6): 1024–37.

Engel, J. F., Kollat, D. T. and Blackwell, R. D. (1973) Consumer Behaviour (2 edn), New York: Holt, Rinehart, and Winston.

Fishbein, M. (1980) 'A Theory of Reasoned Action: Some Applications and Implications', in H. Howe and M. Page (eds) Proceeding of Nebraska Symposium on Motivation, Lincoln, NE.

Fishbein, M. and Ajzen, I. (1975) Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research, Boston, MA: Addison-Wesley.

Fornell, C. and Larker, D. F. (1981) 'Evaluating Structural Equation Model with Unobservable Variables and Measurement Error', Journal of Marketing Research 18(1): 39–50.
Gefen, D. and Straub, D. W. (2000) 'The Relative Importance of Perceived Ease of Use in IS Adoption: A Study of E-Commerce Adoption', Journal of Association for Information Systems 1(8): 1–30.
Gill, T. G. (1996) 'Expert Systems Usage: Task Change and
Intrinsic Motivation', MIS Quarterly 20(3): 301–29.
Hair, J. F. Jr., Anderson, R. E., Tatham, R. and Black, W. C. (1998) Multivariate Data Analysis (5th edn), Upper Saddle River, NJ: Prentice Hall.
Hu, L. T. and Bentler, P. M. (1995) 'Evaluating Model Fit', in R. H. Hoyle (ed.) Structural Equation Modeling: Concepts, Issues, and Applications, Thousand Oaks, CA: Sage, pp. 76–99.
Jackson, C. M., Chow, S. and Leitch, R. A. (1997) 'Toward an Understanding of the Behavioural Intention to Use an Information System', Decision Sciences 28(2): 357–89.
Järveläinen, J. and Puhakainen, J. (2004) 'Distrust of One's Own Web Skills: A Reason for Offline Booking after Online Information Search', Electronic Markets 14(4): 333–43.
Jarvenpaa, S. L. and Todd, P. A. (1996) 'Consumer Reactions to Electronic Shopping on the World Wide Web', International Journal of Electronic Commerce 1(2): 59–88.
Joreskog, J. G. and Sorbom, D. (1984) LISREL VI: Analysis of Linear Structural Relationships by Maximum Likelihood, Instrumental Variables, and Least Square Methods, Scientific Software.
Koufaris, M. (2002) 'Applying the Technology Acceptance Model and Flow Theory to Online Consumer Behaviour', Information Systems Research 13(2): 205–23.
Lewis, J. D. and Weigert, A. (1985) 'Trust as Social Reality', Social Forces 63(4): 967–83.
Lipshitz, R. and Bar-Ilan, O. (1996) 'How Problems are Solved: Reconsidering the Phase Theorem', Organizational Behaviour and Human Decision Process 65(1): 48–60.
Locke, E. A. (1968) 'Toward a Theory of Task Motivation and Incentives', Organizational Behaviour and Human Performance 3: 157–89.
Loken, B. and Fishbein, M. (1980) 'An Analysis of the Effects of Occupational Variables on Childbearing Intentions', Journal of Applied Social Psychology 10: 202–23.
Mawhinney, T. C. (1990) 'Decreasing Intrinsic Motivation with Extrinsic Rewards: Easier Said Than Done', Journal of Organizational Behaviour Management 1(11): 175–91.
McKinney, V., Yoon, K. and Zahedi, F. (2002) 'The Measurement of Web-Customer Satisfaction: An Expectation and Disconfirmation Approach', Information Systems Research 13(3): 296–316.
Nunnally, J. C. (1978) Psychometric Theory (2nd edn), New York: McGraw-Hill.
Rogers, E. M. (1983) Diffusion of Innovations (3rd edn), New York: Free Press.
Salam, A. F. M. N. (1998) Three Essays on Electronic Commerce:
WWW Information Content, Internet Involvement, and
Perceived Risk (World Wide Web), Buffalo, New York: State University of New York at Buffalo.
Schlenker, B. R., Helm, B. and Tedeschi, J. T. (1973) 'The Effects of Personality and Situational Variables on Behavioural Trust', Journal of Personality and Social Psychology 25: 419–27.
Schoder, D. and Haenlein, M. (2004) 'The Relative Importance of Different Trust Constructs for Sellers in the Online World', Electronic Markets 14(1): 48–57.
Segars, A. H. and Grover, V. (1993) 'Re-Examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis', MIS Quarterly 17(4): 517–26.
Sheppard, B. H., Hartwick, J. and Warshaw, P. R. (1988) 'The Theory of Reasoned Actions: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research', Journal of Consumer Research 15(3): 325–43.
Simon, H. A. (1955) 'A Behavioural Model of Rational Choice', Quarterly Journal of Economics 69: 99–118.
Simon, H. A. (1960) The New Science of Management Decision, New York, NY: Harper and Brothers.
Suh, B. and Han, I. (2003) 'The Impact of Customer Trust and Perception of Security Control on the Acceptance of Electronic Commerce', International Journal of Electronic Commerce 7(3): 135–61.
Tan, Z. and Ouyang, W. (2004) 'Diffusion and Impacts of the Internet and E-Commerce in China', Electronic Markets 14(1): 25–35.

Taylor, S. and Todd, P. A. (1995) 'Understanding Information Technology Usage: A Test of Competing Models', Information Systems Research 6(2): 144–76.
Teo, T. S. H., Lim, V. K. G. and Lai, R. Y. C. (1999) 'Intrinsic and Extrinsic Motivation in Internet Usage', Omega International Journal of Management Science 27(1): 25–37.
US Census Bureau (2002) 'Measuring the Electronic Economy', online at: http://www.census.gov/eos/www/ebusiness614.htm, accessed 30 August 2003.
US Department of Commerce (2002) 'A Nation Online: How Americans are Expanding Their Use of the Internet', online at: http://www.ntia.doc.gov/ntiahome/dn/html/ anationonline2.htm, accessed 30 August 2003.
Venkatesh, V. (2000) 'Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model', Information Systems Research 11(4): 342–65.
Venkatesh, V. and Davis, F. D. (2000) 'A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies', Management Science 46(2): 186–204.
Venkatesh, V. and Speier, C. (2000) 'Computer Technology Training in the Workplace: A Longitudinal Investigation of the Effect of Mood', Organizational Behaviour and Human Decision Processes 79(1): 1–28.
Venkatesh, V., Morris, M. G., Davis, G. and Davis, F. D. (2003) 'User Acceptance of Information Technology: Toward a Unified View', MIS Quarterly 27(3): 425–77.

APPENDIX A

Measurement instrument

Usefulness of Using Internet Browser to Search Information (U-Search)

1. Using my Internet browser increases my productivity in searching for product information.
2. Using my Internet browser enhances my effectiveness in searching for product information.
3. I find my Internet browser useful for searching for product information.
4. Using my Internet browser makes it easier to find product information.

Usefulness of Using Internet Store for Purchasing (U-Purchase)

1. Using my Internet store increases my productivity in purchasing product.
2. Using my Internet store enhances my effectiveness in purchasing product.
3. I find my Internet store useful for purchasing product.
4. Using my Internet store makes it easier to purchase product

Ease of Use of Using Internet Browser to Search Information (EOU-Search)

1. When searching for product information, my interaction with my Internet browser is clear and understandable.
2. I find my Internet browser easy to use for searching product information.
3. Interacting with my Internet browser to search product information does not require a great deal of my effort.
4. When searching for product information, I find it easy to get my Internet browser to do what I want it to do.

Ease of Use of Using Internet Store for Purchasing (EOU-Purchase)

1. My interaction with my Internet store is clear and understandable.
2. I find my Internet store easy to use for purchasing.
3. Interacting with my Internet store to make online purchases does not require a great deal of my effort.
4. When making online purchases, I find it easy to get my Internet store to do what I want it to do.

Behavioural intention to use internet browser for searching product information (bi-seek).

1. I intend to use my Internet browser for searching product information.
2. How likely are you to use your Internet browser for searching product information during the next month?

1	2	3	4	5	6	7
Extremely unlikely	Quite unlikely	Slightly unlikely	neither	Slightly likely	Quite likely	Extremely likely

3. How certain are your plans to use your Internet browser for searching for product information next month?

1	2	3	4	5	6	7
Extremely uncertain	Quite uncertain	Slightly uncertain	neither	Slightly certain	Quite certain	Extremely certain

Behavioural intention to use internet store for making online purchase (bi-shop).

1. I predict that I would make a purchase from my Internet store.
2. I intend to make a purchase from my Internet store.
3. How likely are you to make a purchase at your Internet store?

1	2	3	4	5	6	7
Extremely unlikely	Quite unlikely	Slightly unlikely	neither	Slightly likely	Quite likely	Extremely likely

4. How certain are your plans to make a purchase at your Internet store?

1	2	3	4	5	6	7
Extremely uncertain	Quite uncertain	Slightly uncertain	neither	Slightly certain	Quite certain	Extremely certain

APPENDIX B

parameter estimates from measurement model

Variables and their items	*Standardized loading*	*t-value*
Usefulness of Using Internet Browser to Search Information (U-Search)		
U-Search 1	0.93	25.65
U-Search 2	0.95	26.73
U-Search 3	0.91	24.74
U-Search 4	0.93	25.75
Usefulness of Using Internet Store for Purchasing (U-Purchase)		
U-Purchase 1	0.93	25.62
U-Purchase 2	0.95	26.31
U-Purchase 3	0.87	22.68
U-Purchase 4	0.87	22.58
Ease of Use of Using Internet Browser to Search Information (EOU-Search)		
EOU-Search 1	0.88	22.91
EOU-Search 2	0.87	22.31
EOU-Search 3	0.75	17.85
EOU-Search 4	0.90	23.50
Ease of Use of Using Internet Store for Purchasing (EOU-Purchase)		
EOU-Pchase1	0.87	22.50
EOU-Pchase2	0.90	23.76
EOU-Pchase3	0.89	23.40
EOU-Pchase4	0.89	23.48
Intention to Use Internet Browser for Searching Product Information (BI-Search)		
BI-Search1	0.92	24.66
BI-Search2	0.79	19.25
BI-Search3	0.94	25.41
Intention to Use Internet Store for Purchasing (BI-Purchase)		
BI-Purchase1	0.97	27.73
BI-Purchase2	0.96	27.34
BI- Purchase3	0.89	23.87
BI- Purchase4	0.85	21.81

APPENDIX C

Manova result

Effect		*Value*	*F*	*Hypothesis df*	*Error df*	*Sig*
Intercept	Pillai's Trace	0.946	1240.56	6.00	428.00	0.000
	Wilk's Lambda	0.054	1240.56	6.00	428.00	0.000
	Hotelling's Trace	17.391	1240.56	6.00	428.00	0.000
	Roy's Largest Root	17.391	1240.56	6.00	428.00	0.000
Group	Pillai's Trace	0.002	0.146	6.00	428.00	0.990
	Wilk's Lambda	0.998	0.146	6.00	428.00	0.990
	Hotelling's Trace	0.002	0.146	6.00	428.00	0.990
	Roy's Largest Root	0.002	0.146	6.00	428.00	0.990