Understanding the Beliefs and Intentions in Search and Purchase Functions in an E-commerce Website

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Abstract:

Many e-commerce websites provide multiple functions such as a product search function, an on-line purchase function, an order tracking function, and for downloadable software products, a product delivery function. It is important to assess how perceptions of a peripheral function affect perceptions of the core purchase function that locks in revenue. In this study, we examine how the search function of an e-commerce site affects its purchase function. Further, we categorize research on function-based analysis into three progressive stages, depending on whether behavioral intention and beliefs are considered for separate functions and whether these concepts are related across functions. Based on purchase decision process, goal-oriented and experiential behaviors and task-dependency process, we hypothesize that each search construct has a direct effect on its corresponding purchase construct. A survey supports the hypotheses. An excellent search function can increase purchase intention, and ultimately contribute to the revenue of e-commerce sites.

Keywords: Function-based analysis, E-commerce, Purchase, Search, Usefulness, Ease of Use, Task Dependency Process, Goal-Oriented and Experiential

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Introduction

> *One belief affects not only that belief, but also other beliefs and the status of other reasons . . . My claim is that reasons for action, intention, and other attitudes exhibit a similarly complex structure.*
>
> *Notable Book of the Year 1999--Scanlon*

There are few studies focusing on the function-level acceptance of multifunctional devices. For many years, the technology acceptance model (TAM) has been widely used to measure the acceptance of a single-function system such as email, personal computer, and spreadsheet systems (Davis, 1989). TAM has three main factors: perceived usefulness (PU), perceived ease of use (PEOU) and behavioral intention (BI). Generally, TAM studies have treated each software system as a holistic system, with each factor measured as a single factor for the entire system. The study by Gefen and Straub (2000) is important as it introduces a new approach of applying the model to analyze different functions of a system. BI is assessed separately for two different functions, intention to inquire and intention to purchase, while PU and PEOU remain as single factors. Recent studies by Lin and Chan (2003) and Pavlou and Fygenson (2006) treat search and purchase functions separately and apply TAM and the theory of planned behavior (TPB) respectively to examine each of the functions.

Function-based analyses will become more important as modern technologies are integrating many different functions into a single system. Depending on a system, some functions may be sequential or complementary. Sismeiro and Bucklin (2004), in analyzing clickstream data for a car website, concluded that analyzing different functions/ process is better than just focusing on purchase. The relationship of consumer perceptions across functions becomes more important when a function is a precursor to another function. In the area of e-commerce for consumers, search and purchase are major functions (Gefen and Straub, 2000; Moe, 2003; Montgomery et al., 2004; Pavlou and Fygenson, 2006; Sismeiro and Bucklin, 2004). It is important for vendors to understand not only the impact of searching intention on purchase intention, but also the effects of the beliefs between two functions.

Most of the well-known e-commerce websites such as Amazon.com, Macys.com have low visit-to-purchase conversion rates of 1 or 2 percent (Montgomery et al. 2004; Sismeiro and Bucklin 2004; Tedeschi 2000). According to Tedeschi (2000), easier-to-use e-commerce websites may help e-tailers attract more sales. Since ease of use is an important factor to consider for attracting more sales, this study takes the approach by assessing perceived ease of use (PEOU) of two major e-commerce functions: search and purchase. More importantly, this study investigates how perceptions of the search function can affect purchase intention at an e-commerce website, which may lead to higher purchase conversion rates.

Consumers may exhibit two types of behavior: 1) goal-oriented where consumers first have a purchase intention, and 2) experiential where they do not have initial purchase intention. To describe a session of user interaction with an e-commerce website as purely purchase or non-purchase oriented may be inaccurate. Even when a user starts with a purchase intention, the search intention could eventually affect the purchase intention (Montgomery et al., 2004). Consistent with this notion, this study focuses on the perspective where search activities influence purchase activities. Further, according to Moe (2003), only 7 percent are goal-oriented shoppers. Thus, the big majority are experiential shoppers where searching may affect immediate or future purchase.

In the following sections, the literature on how research has moved from acceptance of holistic systems to acceptance of separate functions in the ecommerce context is reviewed. The literature also shows the differences in predicting intentions in different studies, and provides a theoretical explanation for the differences. This is followed by the research model and methodology. The subsequent sections provide the findings, discussion, and conclusion.

Theoretical Background

Functional Application of Technology Acceptance Model (TAM)

The technology acceptance model (Davis, 1989) is one of the most common research models in studies of the determinants of technology acceptance. It is based on the social psychology theory of reasoned action (TRA) (Ajzen, 1988; Fishbein and Ajzen,

1975). The parsimonious model consists of three constructs: perceived usefulness (PU) and perceived ease of use (PEOU) as determinants of behavioral intention. A later version includes another factor, attitude, towards using. The literature does not show a clear predominance of either version (e.g. see the review by Legris et al., 2003). For the purpose of this study, we will focus on the simpler model.

The technology acceptance model has been used to study many systems. Traditionally, studies with TAM have treated each system as a holistic unit where each factor (i.e. PU, PEOU and BI) is measured as a single factor. These studies include traditional software systems such as email, text editor, personal computer, and spreadsheet systems -- systems with more focused functions. For example, the text editor is used for typing and arranging document with words and pictures. Even with new features such as web publishing and versioning for teamwork, the text editor is still very focused on document preparation. Similarly, an email system is mainly designed for sending and receiving email.

Nowadays, systems incorporate many more and possibly diverse functions. For example, calendar scheduling and workflow are included in email systems, and e-commerce websites have search and purchase functions. Most TAM studies of new systems continue to treat systems in a holistic manner. However, interest is increasing in studying e-commerce systems at a functional level. Our review of the TAM and the TPB studies examining search and purchase functions shows that these studies have progressed through three stages.

In the first stage, as in the study by Gefen and Straub (2000), behavioral intention was separated into search and purchase functions while PEOU and PU were measured holistically. In their literature review, they suggested that PEOU is an important factor if the task is intrinsic to the technology (e.g. searching for books), but not if it is extrinsic (e.g. buying books). The results confirmed their hypotheses that PU has the usual effects on both intentions, and PEOU has an effect only on intention to search (intrinsic task). In the second stage, Lin and Chan (2003) argued that different tasks such as search or purchase likely require different sets of software features with different PEOU and PU for each task. It is conceivable that a system may be very

good for searching, but not good for purchase. A division of functions at the intention construct alone may not be able to capture the whole picture. It is necessary to also consider the perception constructs (PEOU and PU) for separate tasks. In the third stage, the relationships of factors across functions were considered (Pavlou and Fygenson, 2006). Drawing upon different theories such as the theory of mere exposure (Zajonc, 1968 as cited by Pavlou and Fygenson, 2006), Pavlou and Fygenson (2006) hypothesized that search behavior would positively influence purchase behavior. With the theory of implementation intentions (Gollwitzer, 1993; Gollwitzer, 1999), they further posited that intention to purchase would positively influence intention to search. Their results support these hypotheses.

Though the data supported Pavlou and Fygenson's (2006) hypotheses, the links between intentions are paradoxical with previous studies (e.g. Ha and Stoel, 2004; Kim and Park, 2005; Lightner and Eastman, 2002; Seock, 2003; Shim et al., 2001). The most interesting part, perhaps, is the fact that Shim et al. (2001) and Pavlou and Fygenson (2006) applied the same theory, that is, the theory of implementation intentions, to predict the causal effects between the intentions in opposite directions. Shim et al (2001) predicted that intention to search would have an influence on intention to purchase -- a hypothesis that is opposite to Pavlou and Fygenson (2006). They also found support for the hypothesis. In the next section, we will explain theoretically the circumstances where Shim et al's (2001) or Pavlou and Fygenson's (2006) hypotheses may be applicable.

Goal-Oriented and Experiential Behavior

Marketing scholars have long examined external and internal motivations involved in the buying process. For instance, some consumers shop because they need to do it (i.e. external); others shop because they simply like to (i.e. internal). These behaviors are also known as goal-oriented and experiential behaviors respectively (Babin et al., 1994; Moe, 2003). Table 1 shows the difference between these behaviors. Researchers have replicated these behaviors in online settings (Novak et al., 2003; Moe, 2003; Wells et al., 2005; Wolfinbarger and Gilly, 2001).

Category	Goal-Oriented Behavior	Experiential Behavior
Motivation	Extrinsic	Intrinsic
Value	Utilitarian	Hedonic

Type of Search	Directed Search	Non-directed /ongoing/browsing
Choice	Goal-directed	Navigational
Driven by	Cognition	Affection
Purchase type	Planned purchase	Unplanned purchase
Decision	Rational	Impulsive / Compulsive
View purchase as	Buying	Shopping

Table 1. Differences between Goal-oriented and Experiential Behavior (adapted from Babin et al., 2004; Novak et al., 2003; and Wolfinbarger and Gilly, 2001).

The formation of intention -- to purchase and to search -- for these two groups is different. Goal-oriented shoppers have an intention to purchase a specific product before they intend to find it online or offline (i.e. a direct search followed by a quick purchase). Experiential shoppers do not have an initial purchase intention, but they have an intention to browse for fun or for knowledge and may develop a purchase intention later (Moe, 2003). In terms of the temporal order, for the first scenario, shoppers first develop an intention to purchase, then an intention to search (i.e. intention to purchase affects intention to search). For the second scenario, an intention to purchase has not been formed until intention to search takes place (i.e. intention to search affects intention to purchase). Shoppers may also exhibit both goal-oriented and experiential behaviors (Babin et al., 1994; Montgomery et al., (2004). They may have an intention to purchase first. During the searching phase, they may encounter new products and develop an intention to purchase (i.e. experiential activity). For instance, the website may show related products, and/or offers discount for additional purchase. To simplify the complex interaction process, it is easier to model a single effect from search factors to purchase factors. For example, Moe (2006) describes a two-stage choice model of product selection, where search (products viewed) affects purchase (products purchased).

By borrowing the concept of goal-oriented and experiential behaviors from the consumer behavior literature, we have shown that intention to search affects intention to purchase, and intention to purchase also affects intention to search, depending on the scenario. The next section discusses consumer purchase decision process which corresponds closer to the second scenario, where intention to search precedes intention to purchase.

E-commerce Functions in Consumer Purchase Decision Process

A consumer purchase decision process model describes how consumers make purchasing decisions. It was derived from a decision process proposed by John Dewey about a century ago (Dewey, 1910, p. 72 as cited by Engel et al., 1968, p. 349; Engel et al., 1973, p. 46). The process was proposed to analyze the steps a person used to achieve a decision. Dewey also called the strategy as "steps in problem solving." Currently, this decision process strategy has become a widely acknowledged model known by consumer behavior and marketing researchers as consumer decision process. The process is also the pillar of consumer behavior model discussed by various marketing and consumer behavior textbooks (Evans and Berman, 1994, pp. 251-257; Kotler and Armstrong, 1995, pp. 164-171; Schoell and Guiltinan, 1995, pp. 134-137; Stanton and Futrell, 1987, pp. 129-131; Wilkie, 1986, pp. 497-543).

This process model is applicable to online purchasing situations. For instance, researchers applied this model to examine website design (Liang and Lai, 2000), online shopping behavior (Li and Zhang, 2002), e-commerce agent (Cheek and Quayle, 1998), pre-purchase online information seeking (Detlor et al., 2003), and analysis of web-based sales (Zellweger, 1997). Some researchers even proposed that cybermarketers could effectively respond to consumer need only if they understand this process model (Butler and Peppard, 1998).

There are five stages in this process model: 1) problem recognition, 2) information search, 3) evaluation of alternatives, 4) purchase decision, and 5) post purchase evaluation. Some websites may have functions supporting all five stages; others may support only two or three stages. A function which provides a review of the latest products or which sends periodicals may trigger the first stage -- the problem recognition stage (e.g. Eisner et al., 2000; Lightner, 2004). Through this function, a consumer may read an article about 3G mobile and understand that the technology may help her not only to communicate verbally, but also to see her children when she is on leave overseas. This information may lead her to the second stage: to find more information about the models and specifications using a search function (e.g. Gefen and Straub, 2000; Pavlou and Fygenson, 2006). In the third stage, the consumer may

understand the key differences among several products, and evaluate these differences by relying on a recommendation agent function (e.g. Swaminathan, 2003; Wang and Benbasat, 2005). After making use of the agent, in the fourth stage, she may develop an intention to buy and use the shopping cart function to make the purchase decision (e.g. Tilson et al., 1998). In the fifth stage, the consumer may use an order tracking function, and may provide feedback on her purchase (e.g. Oliver, 1993).

Previous studies in e-commerce adoption focus on search and purchase functions (Detlor et al., 2003; Gefen and Straub, 2000; Pavlou and Fygenson, 2006). In fact, the most basic and common functions in e-commerce websites are search and purchase; these are the most necessary functions which make an e-commerce website operable and which an e-commerce website must have. This study, therefore, examines these functions. In the next section, we demonstrate how the beliefs of these two functions are related by introducing the concept of task-dependency among processes.

Task-Dependency between Search and Purchase Processes

Task dependency refers to an ordering relationship between the precedent and dependent task. A dependent cannot be performed unless the precedent is performed (Sunil et al. 1991). Four types of task dependencies are finish-to-start (FS), start-to-start (SS), finish-to-finish (FF), and start-to-finish (SF). FS means that the dependent could only start after the precedent has finished. SS is that the dependent could start after the precedent has started. FF is that the dependent could only finish after the precedent has finished, and ST is that the dependent could only finish after the precedent has started.

Extending the notion of search and purchase as separate behaviors, we view a search task as the precedent of a purchase task. Specifically, a purchase task could not start until a search task has started (i.e. a SS type). This view is also consistent with previous studies (Detlor et al., 2003; Haubl and Trifts, 2000; Moorthy et al., 1997; Lightner and Eastman, 2002; Palvou and Fygenso, 2006; Shim et al., 2001; Zellweger, 1997). An example of a SS type for two behaviors is “Pour foundation’ and “Level Concrete”, in the context of building construction (Biafore, 2006; Musser, 2006; Office Online, 2006). In an e-commerce setting, the consumer could only buy an item

after he starts browsing or searching it. Though it is possible to buy an item with a direct URL link (e.g. the link may be given by friends), this situation may not be common. For instance, the product in the link may not trigger the problem recognition stage (the need). Even if it triggers the need, we may still need to get more information (search or browse) about the product.

The beliefs in two behaviors also follow an ordering relationship. In the building construction case, the belief on whether the "level concrete" task would be successful depends upon the belief of the success of "pour foundation" task. For instance, perceived difficulty in "level concrete" task depends on the perception on whether "pour foundation" task has been difficult (e.g. enough material for the foundation, the foundation is not extremely too high or too low). The beliefs on purchase behavior are also dependent on the beliefs on search behavior. For example, perceived ease of use (belief) of purchase depends on perceived ease of use of search. That is to say, if the website search function is difficult to use, it will adversely affect the perception of ease of use for the purchase function. For the same reason, perceived usefulness of purchase depends on perceived usefulness of search.

Research Model and Methodology

In Pavlou and Fygenson (2006), intention to purchase is hypothesized as a predictor of intention to search. In our study, we view intention to search as the predictor of intention to purchase. As explained by goal-oriented and experiential behavior, both scenarios are valid. In Pavlou and Fygenson's study, they view that the consumers have an intention to purchase online before they use the Internet. As reviewed earlier, it is possible for consumers not to have a purchase intention first (i.e. experiential shopping), and develop it later from searching. Moreover, consistent with the consumer decision process model, in which purchase function depends heavily on information search function (Engel et al., 1968, p. 349; Evans and Berman, 1994, pp. 251-257; Kotler and Armstrong, 1995, pp. 164-171; Schoell and Guiltinan, 1995, pp. 134-137; Stanton and Futrell, 1987, pp. 129-131; Wilkie, 1986, pp. 497-543), we hypothesize

H1: Intention to search has an effect on intention to purchase.

As an online purchase function depends on a search function (i.e. start-to-start type dependency), the perception of the search function (i.e. the precedent) is also expected to influence the perception on the purchase function (i.e. the dependent). For an e-commerce context, it is also quite logical to consider that if the search function is not easy to use, the consumers could not find the product, and their perceived ease of use for purchase will be negatively influenced. Consistent with the task dependency process, we hypothesize that each search construct will have an effect on the corresponding purchase construct. Specifically, we hypothesize

H2: PEOU for search has an effect on PEOU for purchase.

H3: PU for search has an effect on PU for purchase.

Lastly, consistent with the usual TAM, we hypothesize the usual relationships within each function:

H4: PEOU for search has an effect on intention to search.

H5: PU for search has an effect on intention to search.

H6: PEOU for search has an effect on PU for search.

H7: PEOU for purchase has an effect on intention to purchase.

H8: PU for purchase has an effect on intention to purchase.

H9: PEOU for purchase has an effect on PU for purchase.

Previous studies also showed that the role of experience on the predictor variables is important (Davis, 1989; Mathieson, 1991; Hong et al. 2002; Venkatesh et al. 2003). These studies argued that experience has an effect on perceived ease of use. Venkatesh et al. (2003), for instance, hypothesized that experience has an effect on effort expectancy (i.e. perceived ease of use), but not on performance expectancy (i.e. perceived usefulness). Hong et al. (2002) also did not hypothesize any effect from experience to perceived usefulness, "due to the theoretical arguments by Davis (1989) and Mathieson (1991)." These studies view experience as an internal control factor that will only influence perceived ease of use. Consistent with these studies, we hypothesize that

H10: Experience has an effect on perceived ease of use for search.

H11: Experience has an effect on perceived ease of use for purchase.

The hypothesized cross-functional technology acceptance model is shown in figure 1.

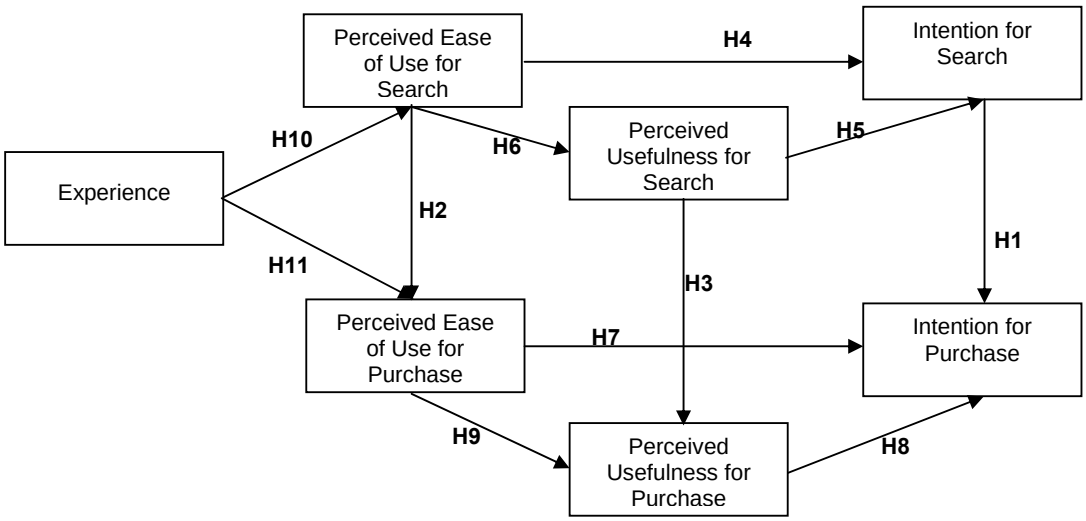

Figure 1. Cross-functional technology acceptance model

Survey

A survey was conducted to test the hypotheses. The subjects were undergraduate students in Singapore. At the time of the study, they were taking a module on developing e-commerce websites. They have knowledge on how e-commerce websites work (i.e. catalog and product searching, shopping cart mechanism, and checkout procedures). In particular, they have experience with a well-known website, which specializes in selling books. Moreover, they voluntarily participated in the study, and there was no incentive given for their participation. Surveys were administered to them online in a laboratory. They have to spend a minimum of 15 minutes in the laboratory. Finally, 135 responses are usable.

Construct Measurement

Subjects were asked for their perceptions and intended behavior for Amazon.com bookstore website. All instruments (shown in Appendix A) are adapted from Gefen and Straub (2000). In their survey items, PEOU and PU are adapted from the original TAM scales by Davis (1989), and Davis et al. (1989), and consist of six and five items respectively. These items are modified to specifically measure PEOU and PU for a function (i.e. purchase and search). Experience consists of two formative items: 1) whether the subjects have ever bought products online and 2) how much

experience the subjects have with the website. All items, except for experience, used a seven-point Likert scales ranging from strongly agree (1) to strongly disagree (7).

Data Analysis

The research model described in figure 1 is analyzed using SPSS and Partial Least Squares (PLS graph version 3). SPSS is used to analyze the descriptive statistics, and PLS is applied to assess the measurement model and the structural model simultaneously in one operation (Chin, 1998; Gefen et al., 2000). It is also used to analyze the average variance extracted. For testing path coefficients in PLS, t-values are assessed with a nonparametric test of significance known as bootstrapping.

Result

Table 2 reports the respondent characteristics. The average age of the participants is 22. Slightly more females participate in the survey (51.9%) Nearly half of the subjects have credit cards, and about forty percent of them have purchased products from the web. The mean for the experience on the website is 5.20. Table 3 reports the descriptive statistics for all constructs, and composite reliability (ρC) which is the measurement for internal consistency in PLS[2]. After dropping the first item in intention to search and the third item in intention to purchase, all constructs show high reliability ranging from 0.84 to 0.96. The values are given in column "ρC" in table 3. These numbers are higher than the acceptable 0.70 threshold for field research (Cronbach and Meehl, 1955; Nunnally and Bernstein, 1994).

Sample Characteristics (N=135)				
	Minimum	**Maximum**	**Mean**	**Std. Dev.**
Age	20	26	22.04	1.33
Have a credit card	0 (no) n=72(53.3%)	1(yes) N=63(46.7%)	0.47	0.50
Have bought before	0 (no) n=80(59.3%)	1(yes) n=55(40.7%)	0.40	0.49
Website experience	1	7	5.20	1.55
Gender	Male Female		N=65 N=70	48.1% 51.9%

Table 2. Sample characteristics of subjects

[2] Composite Reliability = $\rho_C = (\Sigma\lambda_i)^2 / [(\Sigma\lambda_i)^2 + \Sigma_i var(\varepsilon_i)]$, where λ_i is the component loading to an indicator and $var(\varepsilon_i)=1 - \lambda_i^2$

Descriptive Statistics (N=135)						
	#Item	Minimum	Maximum	Mean	Std. Dev.	ρC
PEOU (purchase)	6	1.00	7.00	3.27	1.02	0.934
PEOU (search)	6	1.00	7.00	3.00	1.12	0.957
PU (purchase)	4	1.00	7.00	3.40	1.06	0.919
PU (search)	4	1.00	7.00	3.23	1.11	0.941
Intention to search (IS)	3	1.00	7.00	2.87	1.20	0.936
Intention to purchase (IP)	2	1.00	7.00	3.74	1.22	0.843

Table 3. Descriptive statistics for research constructs

Measurement Model

The measurement items show convergent validity. Table 4 shows the loadings of the measures of the cross-functional technology acceptance model. All items have significant loadings at the 0.0001 level. All measures fulfilled the recommended levels of composite reliability (ρC) and average variance extracted. For instance, all items in the model are higher than recommended value of 0.50 (Fornell and Larcker, 1981). Not only all constructs for the model show high composite reliabilities, but also the average variances extracted are very high at 0.78 and above (see Table 4).

The items also show discriminant validity. Items in one construct are not highly correlated with other constructs. Discriminant validity is shown when the square root of the average variance extracted for each construct is higher than the correlations between it and all other constructs (Fornell and Larcker, 1981). Table 5 shows the average variance extracted (AVE). All constructs share more variance with their indicators than with other constructs. The results shown in Table 4 and Table 5 provide strong empirical support for the reliability and validity of the scales in the model.

Construct	Item	Loading	St. Error	T-Statistic
Intention to Search				
CR=0.936	is2	0.918	0.020	45.81
AVE=0.830	is3	0.915	0.020	45.08
	is4	0.901	0.030	30.51
Perceived Ease of Use for Search				
CR=0.957	pe1s	0.877	0.026	33.31
AVE=0.788	pe2s	0.851	0.042	20.36
	pe3s	0.915	0.016	58.31
	pe4s	0.902	0.020	45.00
	pe5s	0.869	0.035	24.61
	pe6s	0.910	0.028	33.05
Perceived Usefulness for Search				
CR=0.941	pu1s	0.877	0.032	27.86

AVE=0.799	pu4s	0.843	0.033	25.30
	pu2s	0.921	0.012	75.17
	pu3s	0.931	0.017	53.98
Perceived Ease of Use for Purchase				
CR=0.934	pe1p	0.806	0.038	21.10
AVE=0.703	pe2p	0.780	0.054	14.45
	pe3p	0.849	0.030	28.19
	pe4p	0.852	0.038	22.51
	pe5p	0.815	0.053	15.42
	pe6p	0.922	0.015	60.50
Intention to Purchase				
CR=0.843	ip1	0.880	0.029	30.46
AVE=0.728	ip2	0.826	0.050	16.54
Perceived Usefulness for Purchase				
CR=0.919	pu1p	0.856	0.030	27.94
AVE=0.740	pu2p	0.881	0.025	35.76
	pu3p	0.904	0.019	47.46
	pu4p	0.796	0.056	14.24

Note: CR=Composite Reliability AVE=Average Variance Extracted

Table 4. Psychometric properties of measures

Structural Model

Figure 2 shows the result of the multivariate test of structural model with the path coefficients, t-statistics, and amount of variance explained (R^2). All path coefficients in the model are highly significant ($p<0.001$) or significant ($p<0.05$). Hypotheses 1 to 3 for the effects of search function on purchase function are strongly supported ($p < 0.01$). The TAM hypotheses for search (H4-H6) and purchase (H7-H9) functions are also supported. Further, the effects of experience on both PEOUs (search and purchase) are supported. Specifically, experience explains about 6 percent of the variation in PEOU for search, and experience and PEOU (search) explain 73% of the variation in PEOU (purchase). PEOU (search) also explains 69% of the variation in PU (search). The explained variance in PU (purchase) by PEOU (search) and PEOU (purchase) is 73%, which indicates that the usefulness of purchase function depends strongly not only on PEOU for its function, but also on PEOU for search function. Lastly, PEOU (search) and PU (search) explain approximately 54% of the variation in intention to search while PEOU (purchase), PU (purchase), and intention to search explain approximately 37% of the variation in intention to purchase.

	BIs	PEOUs	PUs	PEOUp	BIp	PUp
BIs	**0.830**					
PEOUs	0.448	**0.788**				
PUs	0.529	0.693	**0.799**			

PEOUp	0.423	0.608	0.592	**0.703**		
BIp	0.262	0.240	0.241	0.312	**0.728**	
PUp	0.443	0.555	0.646	0.665	0.327	**0.740**
Note:						
BIs=Intention to Search			BIp=Intention to Purchase			
PEOUs=Perceived Ease of Use (search)			PUs = Perceived Usefulness (search)			
PEOUp=Perceived Ease of Use (purchase)			PUp = Perceived Usefulness (purchase)			

Table 5. Average variance extracted for the constructs in the model [3]

Discussion

The main purpose of this study is to examine the relationship among search and purchase constructs in a typical e-commerce website. A model is proposed on how constructs in the search function affect their corresponding constructs in the purchase function. These cross-functional relationships are in addition to the usual TAM relationships within each function. All hypotheses are supported by the survey data. The result also shows that the model can provide a richer understanding of an e-commerce website. For instance, it indicates that an e-commerce website which is flexible and easy to interact with for its search function will have ease of use for purchase function (i.e. PEOUs → PEOUp). Similarly, increasing the productivity and performance of search (i.e. PUs) also has an influence on how useful the site is for buying products (i.e. PUs → PUp).

[3] The bold typeface number on the leading diagonal are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs.

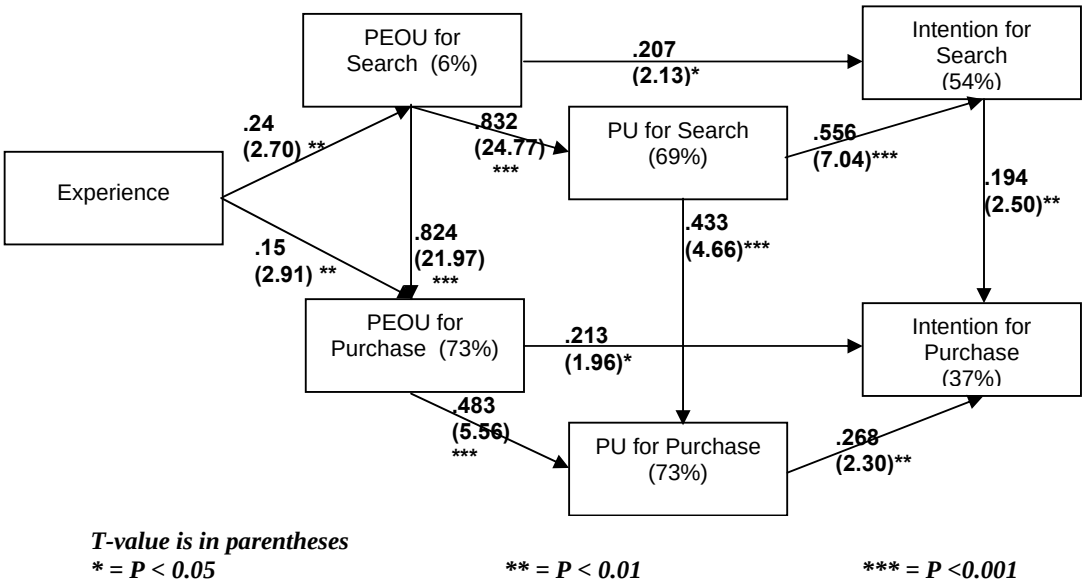

Figure 2. Structural model analysis

To evaluate the impact that the search process has on the purchase process, we exclude experience and compare the cross-functional model with a purchase-only TAM model. Using the formula for calculating effect size (f2) by Cohen (1988), we find that the purchase-only TAM has lower r-square compare to the cross-functional model by substantial effect sizes. Specifically, without including perceived usefulness for search, the variance (R-square) explained in perceived usefulness for purchase reduces to 0.66. The effect size (f2) is 0.26 which, according to Cohen (1988), is a medium effect (i.e. small > 0.02, medium > 0.15, and large > 0.35; please note small effects does not mean unimportant effects). Dropping intention to search from the model also reduces the R-square for intention to purchase to 0.34, and the effect size is 0.04. More importantly, one path from the single construct, that is perceived ease of use for search, captures more than 60 percent of the variance in perceived ease of use for purchase. These results show that the relationship between the two beliefs should be captured.

Before pointing out the implications of the research, the limitations are discussed. First, the subjects are students. The generalizability of the study to other environments may be limited. On the positive side, these subjects know e-commerce and many are experienced online consumers. Almost half of them have credit cards, and at least one-third of the subjects have purchased a product online (early independent t-test confirms there are no significant differences between subjects with

credit card and purchase experience and subjects without). Considering their familiarity with the e-commerce system, their buying power, and their online shopping histories, the findings may be applied to other individuals. Moreover, other researchers also identified that the most dominant group of e-shoppers are between the ages of 18 and 34 (Lim et al. 2006). Our sample, therefore, may mirror actual online customers. Second, the sample size in this study is relatively small (n=135). However, our sample size is adequate for the analysis. It is more than 10 times the number of free model parameters (i.e. at least 80 observations) (Bentler, 1995 and Hu et al., 1992 as cited by Marcoulides and Saunders, 2006). Third, the data collection was about one website; the result in this paper may not be generalized to other websites. Actual usage behavior was also not measured. However, this limitation is somewhat less critical as many previous studies have established the causal link between intention and behavior (e.g. Taylor and Todd, 1995; Morris and Venkatesh, 2000). For instance, Sheppard et al. (1988) showed a correlation of 0.53 between intention and behavior in their meta-analyses of the theory of reasoned action. For products where customization is important, it could be better to consider the customization function as well. The survey was conducted in Singapore, which is a modern Asian city, and generalization to other cultures may need to be careful, in light of study by Lim et al. (2004), where culture is found to have strong effects on e-commerce.

Implication and Conclusion

This study has several implications for research and practice. With regard to research, this study applies the theory of consumer decision process and task-dependency process to explain the interaction between search and purchase functions. It further integrates these theories with the technology acceptance model to develop a new cross-functional TAM model. We theoretically explain the situations for opposite causal directions between intention to search and intention to purchase. The study focused on the direction from intention to search toward intention to purchase. This is the common situation found in the clickstream study by Montgomery et al. (2004). The majority of visitors to a website do not already have an intention to purchase, as evidenced by the extremely low purchase rates (Montgomery et al. 2004; Tedeschi 2000). Additionally, examining the effect size of the new model with a purchase-only

model reveals that the relationships between search and purchase functions are strong and should be captured in the model.

Prior studies on the relationship between search and purchase have focused on the effect at the intention stage (Pavlou and Fygenson 2006). This study shows that the effects from search to purchase functions start much earlier, at the belief and cognitive stage, such as perceived ease of use and perceived usefulness. These early cross-functional effects have not been investigated before. The cross-functional analysis provides more details than a holistic measurement of each TAM construct.

This study also has several managerial implications. Many e-commerce websites do not have excellent or even good search capabilities (37signals, 2003). With the demonstrated multiple effects from search to purchase, managers should give more importance to having a good search capability as a means of increasing sales, and view the costs in developing a good search capability as an investment to increase purchase and revenue. Some specific suggestions for enhancing the search function are provided below. The results suggest that experience is an important predictor for PEOU for search and PEOU for purchase functions. When users are more familiar with the e-commerce websites, using search and purchase functions become easier for them. E-commerce developers should consider designing different interface features to suit users with different exposure to the websites. For search function, for instance, they could develop both basic search for users with less experience and advanced search for more experienced users. The results in this study also show that PEOU and PU for search function influence PEOU and PU for purchase function, and subsequently intention to purchase. These results tell e-tailers that cognitive beliefs in search function is important to the overall purchase function. For instance, an easy search function positively influences the ease of use of the purchase function, the usefulness of purchase function and subsequently intention to purchase. Perceived usefulness of the search function is also important. A good search system has to return effective results (i.e. useful) in which consumer would be able to use them for purchase function. In addition to a good search system, it will also be important for vendors to integrate search and purchase functions, where consumers can move easily between search and purchase functions (rather than a fixed sequence of search and

purchase steps). For example, consumers should be able to easily add products returned in a search to their shopping carts, search for products related to those in their shopping carts, or even get shipping information for products while they are searching.

As a methodological approach, the analysis of different functions can be applied to many new products and systems that offer distinct functions. This is particularly important since companies could examine how a new or existing function is affecting other functions. For example, what are the peripheral functions which may influence the critical intention to purchase? This important question affects revenue and profit. Do people buy a mobile phone because it has digital image capability? Does a tangential feature override the core feature, in terms of intention to use a product? When users show low acceptance for a particular function, developers may want to invest less on that particular function. This function-level approach could also be used with other models of technology use, e.g. trust-based models (Lim et al. 2006), or the theory of planned behavior (Ajzen 1991) where social influence could be considered (Lim et al. 2006).

Future research could consider other approaches in applying the TAM model. Individual TAM factors could be measured in multiple ways, e.g. function-based, as in this study, or even by time horizon (i.e. short-term / long-term distinction, as done by Chau (1996). Culture is also an important factor to consider for e-commerce (Lim et al. 2004). Future research could investigate whether people from different cultures use functions in e-commerce differently. The study also suggests further uses of the goal-oriented and experiential behavior to examine the causal effects between search and purchase intentions. For instance, if subjects have a purchase intention for a specific item (goal-oriented) before using the Internet, the proposition that purchase intention influences search intention may have a better result than a reverse proposition. The research methods of clickstream analysis (e.g. Moe 2003; Moe, 2006; Montgomery et al., 2004) and survey could be combined to provide finer analysis of shopper type and on-site behavior. Newer features such as customization, personalization and general promotions could also be investigated in the context of different shopper types and functions.

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Appendix A

Construct	Code	Question Wording
Perceived Ease of Use (p=purchase s=search)	PE1p	Amazon.com is easy-to-use for buying books
	PE1s	Amazon.com is easy-to-use for book searching
	PE2p	It is easy to become skillful at buying books using Amazon.com
	PE2s	It is easy to become skillful at book searching using Amazon.com
	PE3p	Learning to operate Amazon.com for buying books is easy
	PE3s	Learning to operate Amazon.com for book searching is easy
	PE4p	For buying books, Amazon.com is flexible to interact with
	PE4s	For book searching, Amazon.com is flexible to interact with
	PE5p	My interaction for buying books with Amazon.com is clear and understandable
	PE5s	My interaction for book searching with Amazon.com is clear and understandable
	PE6p	It is easy to interact with Amazon.com for buying books

	PE6s	It is easy to interact with Amazon.com for book searching
Perceived Usefulness	PU1p	Amazon.com improves my performance in buying books
	PU1s	Amazon.com improves my performance in book searching
	PU2p	Amazon.com is useful for buying books
	PU2s	Amazon.com is useful for book searching
	PU3p	Amazon.com makes it easier to purchase books
	PU3s	Amazon.com makes it easier to search for books
	PU4p	Amazon.com increases my productivity in purchasing books
	PU4s	Amazon.com increases my productivity in book searching
Intention to Purchase	IP1	I would use my credit card to purchase from Amazon.com
	IP2	I am very likely to buy books from Amazon.com
	IP3	I would not hesitate to provide information about my habits to Amazon.com
Intention to Search	IS1	I would use Amazon.com to retrieve information
	IS2	I would use Amazon.com to inquire what readers think of a book
	IS3	I would use Amazon.com to find out about the author of the book
	IS4	I would use Amazon.com to inquire about book ratings
Experience	EX1	How much experience do you have with the website?
	EX2	Have you ever bought products online?