PERCEIVED USEFULNESS AND EASE-OF-USE ITEMS IN B2C ELECTRONIC COMMERCE
Findings from an Analysis of Web-based Qualitative Data

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Abstract: The standard perceived usefulness and ease-of-use items of technology acceptance model were developed for organizational contexts, but they are also used in studies of consumer acceptance of electronic commerce. However, the terms used in the items are to some extent ambiguous. It is difficult to evaluate improvement in productivity, performance or effectiveness in purchasing products online. In this paper, items from a few recent electronic commerce studies applying technology acceptance model are summarised. Web-based qualitative data is analysed and the emerged features of electronic commerce that are important to consumers are compared with the measurement items from prior research. Finally, a combination of items based on the comparison is proposed. Consumers perceive the 24/7 accessibility of Web shopping site as useful, but this feature has not been measured in the prior studies reviewed here.

Key words: item, perceived usefulness, perceived ease-of-use, electronic commerce, consumer research

1. INTRODUCTION

How is a consumer's shopping performance improved by electronic commerce? Alternatively, how is a consumer's productivity increased when purchasing a book online or how is effectiveness enhanced when making an

online travel reservation? Imagine a situation where searching for the product from online shopping sites would be time consuming but the actual purchasing process would be fast and the product would be cheaper online but, on the other hand, the delivery would bring the total cost higher than if the product had been bought from a traditional shop. Comparing improvement in shopping performance, productivity or effectiveness between effort and outcome would be difficult.

In online shopping surveys based on the technology acceptance model (TAM) consumers have been asked questions such as the examples presented above (e.g. Gefen, 2003; Gentry and Calantone, 2002; Liu et al., 2003). The occasional electronic commerce studies applying TAM have modified construct items to measure e.g. savings in time or money, ease-of-navigation, simplicity of placing an order etc.(Aladwani, 2002; Heijden, 2003; Heijden et al., 2003; Stylianou et al., 2003; Wang et al., 2003).

However, the variation of construct items seems to be as wide as the range of authors. A unified combination of items that does not compromise the spirit of TAM and uses familiar concepts for consumers has not been developed for business-to-consumer electronic commerce research. Understandable concepts are vital in rigorous research: construct validity is in danger if it does not measure up to the intended notion, which is the case when the subjects do not comprehend questions.

The objective of this paper is to propose constructs that could be used in measuring consumers' perceptions of usefulness and ease-of-use in business to consumer (b2c) electronic commerce. A comparison of items used in prior research and features of electronic commerce that consumers find important will be made to accomplish this. The data set of this paper is qualitative and consists of 1900 answers to open-ended questions from a Web survey implemented in February 2002.

The paper is organised as follows: First, the constructs used are reviewed by synthesising published consumer TAM studies in an electronic commerce context. After that, a qualitative data set is analysed to find electronic commerce features related to usefulness and ease-of-use from the consumer perspective. Finally, similarities and differences between the features that emerged from the data and items used in previous studies are discussed.

2.   THEORY

The perceived usefulness and ease-of-use of a system are central concepts in the technology acceptance model. Perceived usefulness (PU) has been defined as a user's subjective perception of the ability of a computer to increase job performance when completing a task. Perceived ease-of-use

(PEOU) is a person's subjective perception of the effortlessness of a computer system, which affects the perceived usefulness and has therefore an indirect effect on a user's technology acceptance. (Davis, 1989; Davis et al., 1989; Venkatesh and Davis, 2000)

Table 1. Most common perceived usefulness items used in b2c electronic commerce studies.

Perceived usefulness item	Aladwani 2002	Devaraj, Fan and Kohli 2002	Gefen 2003	Gentry and Calantone 2002	Heijden et al. 2003	Liu et al. 2003	Stylianou et al. 2003	Wang et al. 2003
Using the system improves my performance in my job.			x			x	x	x
Using the system in my job increases my productivity.			x	x				
Using the system enhances my effectiveness in my job.	x	x	x			x		
I find the system useful in my job.	x	x	x	x	x	x		x
The website enables me to search and buy CDs/books faster.	x		x			x		
The website makes it easier to search for and purchase CDs/books.			x		x	x		x
Perceived ease-of-use item								
My interaction with the system is clear and understandable.		x	x		x	x		x
Interacting with the system does not require a lot of my mental effort.			x			x		
I find the system easy to use.		x	x	x	x			x
I find it easy to get the system to do what I want it to do.		x	x		x	x		
It is easy to become skilful at using the website.			x	x				x
Learning to operate the website is easy.			x	x	x	x		x
The website is flexible to interact with.			x			x	x	

The standard items of perceived usefulness and ease-of-use constructs have been used in several b2c electronic commerce studies; the most common items are presented in Table 1. However, since the questions have originally been developed for organisational context, the items used in consumer studies have been modified. The word "job" has been replaced with searching or buying, gathering information, navigating, etc. The word "system" has evolved into Web site, e-commerce, shop-bot, etc.

But how exactly does a Web site improve purchasing performance or e-commerce increase productivity? The Cambridge online dictionary defines performance as "how well a person, machine, etc. does a piece of work or an activity". Productivity refers to "the rate at which a company or country makes goods, usually judged in connection with the number of people and the amount of materials necessary to produce the goods". Effective is "successful or achieving the results that you want" and the derivative effectiveness is "how successfully the wanted results are achieved".

Performance, productivity and effectiveness are work-related concepts, however, they may be ambiguous to consumers since consumers and managers have different frames of references (El-Shinnawy and Markus, 1992). These terms are not clear and understandable to consumers, which may influence the validity of the instrument. The concepts should be adapted into a consumer context by using familiar terms, such as "getting the job done" or "saving money". An effort to translate items into consumer settings has been made in some electronic commerce studies applying TAM. Examples of these items are presented in Table 2. The items measure various actions: placing a purchasing order, cancelling an order and navigation. Control, quality of decision-making, saving money and time, interest of information, adding value, quality of navigation, increase of consumption, accomplishing more navigation as well as advantages and disadvantages are measured too.

Table 2. Additional non-standard items of PU and PEOU in b2c electronic commerce studies.

Study	Const	Item
Aladwani 2002	PU	Using this site would improve my ability to place a purchasing order.
		Using this site would enable me to cancel an order quickly and without hassles.
	PEOU	It is easy for me to place a purchasing order at this Web site.
		I find it easy to cancel a purchasing order at this Web site.
Devaraj et al. 2002	PU	Shopping online gives me greater control.
		Shopping online improves the quality of decision-making.
	PEOU	Overall, I believe that shopping online is easier.
Gentry and Calantone 2002	PU	Using shop-bots would save me money when buying books.
		Using shop-bots would save me time when buying books.
Heijden et al. 2003	PU	The online purchasing process on this website is fast.
Heijden 2003	PU	The information on the site is interesting to me.
		I find this a site that adds value.
	PEOU	It is easy to navigate around the site.
		I can quickly find the information that I need.

Study	Const	Item
Liu et al. 2003	PU	I think it is a user-friendly site.
		Using the e-commerce site with the standard user interface SUI improves the quality of the navigation I'm able to do.
		Using the e-commerce site with the SUI gives me greater control over my navigation.
		The e-commerce site with the SUI supports critical aspects of my navigation.
		Using the e-commerce site with the SUI increases my consumption.
		Using the e-commerce site with the SUI allows me to accomplish more navigation than would otherwise be possible.
	PEOU	I find the e-commerce site with the SUI cumbersome to use.
		Interacting with the e-commerce site with the SUI is often frustrating.
		It is easy for me to remember how to perform navigation using the e-commerce site with the SUI.
		I find it takes a lot of effort to become skilful at using the e-commerce site with the SUI
Stylianou et al. 2003	PU	E-commerce will be of benefit to me personally.
		The advantages of e-commerce to me will outweigh the disadvantages.
		Overall, using e-commerce will be advantageous to me.
	PEOU	I have the skills, capability and knowledge necessary to use e-commerce applications.

Moreover, there are various factors related to the usefulness in the literature. Ability to present rich information, accessibility, speed as well as inexpensive and easy purchases have often been mentioned as the main benefits of b2c electronic commerce (Leinbach and Brunn, 2001). Convenience has been defined as the speed of a process, ease of finding desired products, time savings, instant delivery, hassle-free shopping (Shim et al., 2001). The layout of a Web shopping site, organization features, ease of navigation and use are also convenience items (Lohse and Spiller, 1998). Burke (2002) discovered in his study that customers expected improvement in convenience so they that would be able to use one-click ordering, to browse their purchasing history and to be able to return defected items to a local retail store where they would also be delivered.

The ease of the purchasing process is a combination of perceived ease-of-use of a reliable system and the ability to get the desired product/price combination from the system. For example, Zeithaml, Parasuraman and Malhotra (2002) describe an e-SERVQUAL instrument for measuring e-service quality, which includes measures for efficiency and reliability. Efficiency-construct contains items concerning "the ability of the customers to get to the Web site, find their desired product and information associated with it,

and check out with minimal effort". Reliability refers to the technical functioning of the site.

Park and Kim (2003) have measured for example user interface, product and service information quality, information satisfaction and relational benefit. User interface quality refers to the customer perception of convenience and user friendliness of a Web shopping site. Information quality measures relevancy, timeliness, sufficiency, understandability, consistency and playfulness of product or service information. Information satisfaction is defined as "emotional response to the experience provided by the overall information service" and relational benefit is associated with the benefits a customer gains from using the site.

To summarize, the terms used in standard perceived usefulness and ease-of-use constructs are not appropriate for electronic commerce consumer research. There are numerous candidates for adapted PU and PEOU items, and the following data analysis could assist in selecting the most suitable items for future b2c electronic commerce studies applying TAM.

3.   THE RESEARCH BACKGROUND

The data used in this analysis is part of a Web survey conducted in February 2002, which has been reported in other papers (Järveläinen, 2003a; 2003b; 2003c). The overall research question of the study was: why do people who use the Internet for product information seeking not make their purchases online?

As the research question concerned online information seekers, the target population included both customers who had some online shopping experience and those who had none. A Web survey was therefore chosen as the data collection method. This setting omits the people who have not adopted Internet technology yet, since they do not have either means or motive for online shopping and consequently it would not be meaningful to include them in the target group.

The sample used in this study was based on the customers of a large passenger cruise company that sells products online. The company under study is one of the largest Finnish passenger cruise companies operating in the Baltic Sea, owned by a large European ferry operator. Its substantial market share (between Finland and Sweden approximately 50% and between Finland and Estonia roughly 20%) and its long reputable history make it a trustworthy company.

The customers have four purchasing channel choices: travel agency, company-owned ticketing agency, telephone and the company's interactive online booking system (since the products are in this case cruises the more

appropriate word "booking" will be used hereafter). The online booking system is in real-time and the payment methods include a secure Internet banking payment solution, credit card or bill, the same as in the bookings made through the traditional channels.

In comparison with postal mail or telephone surveys, a Web survey is a more rapid and a cheaper way to collect a great amount of data. In addition, the data coding is easy and reliable as with any computer-supported data collection method. The disadvantages include for example a biased sample or biased results and counting the response rate. (Humphrey, 2000; Ilieva et al., 2002; Zhang, 1999)

Ensuring the validity of the respondents is not easy with Web surveys because of the anonymity of the respondents. To reach the target population and valid subjects, the Web survey was placed on the company's homepage and only visitors who had made a reservation with the company during the previous three months were requested to answer the questionnaire. The risk of a very biased sample was minimal since it was apparent that not every customer visiting the company's Web site had any online shopping experience because of low adoption rates of b2c electronic commerce globally, locally and among the customers of this company. An effort was made to eliminate multiple responses from the same respondent with 1) no-reward policy (O'Neil and Penrod, 2001), 2) a cookie that was saved in the respondent's computer under his own username (and so impeded answering more than once) and 3) a careful screening of responses to find exactly similar responses.

The data was collected between February 1st and 11th 2002. The total number of responses was 2,511, from which 2,479 were unique and valid. The respondents were compared demographically to the respondents of two previous Web surveys (from January 2000 and November 2001, 920 and 2,875 responses respectively), which collected data about the average visitor to the company's Web site and development suggestions for the Internet pages. In all three Web surveys, 58.5 per cent of the respondents were women; the majority of subjects were between 18 and 45 years of age. The majority of respondents lived in the greater Helsinki area and Western Finland where the departure ports are situated. In these respects, this survey's data seems to correspond with that of the other surveys.

Quite a high percentage, 92 per cent of the respondents, used the Internet daily or almost daily. In 2003 (Statistics Finland, 2003), 66 per cent of the Finnish people used the Internet and as a Web survey cannot reach the non-users, the high percentage is understandable. Over half of the respondents (51.5 per cent) had made the previous booking over the telephone and approximately one in four had visited a travel or ticketing agency. Merely 23.2 per cent of all respondents had made the previous booking online.

The mainly quantitative questionnaire also included a few open-ended questions. One of them was: "Why have you used or not used the online booking system? Are you going to use the online booking system in the future? Please explain why." Over 1,900 respondents answered this open-ended question. This qualitative data was too interesting to be ignored totally, since most of the answers were quite long and rich in information, as open-ended responses tend to be in online surveys (Gunter et al., 2002).

4.   ANALYSIS AND RESULTS

In order to capture the essence of the large qualitative data set, the data had to be organized systematically. (Romano Jr. et al., 2003) describe a methodology for analyzing Web based qualitative data. The data codes were derived from the data itself as in grounded theory (Glaser and Strauss, 1967), because of the explorative nature of this study. The data was coded with a qualitative data analysis software package called QSR NVivo 1.3 and in the first phase, 19 categories emerged. Each response was coded into one or several categories.

Due to the extensive size of the data set the dichotomous coding was clustered with principal components analysis. Dichotomous data may be analysed with factor analysis if the underlying inter-item correlations are moderate, below 0.6 or 0.7 (Kim and Mueller, 1978). The largest correlations were between Online booking easy and Online booking quick with coefficient being 0.367. Approximately half of correlation coefficients were not statistically significant and nearly half of coefficients were below 0.2. In that sense, the data set meets the requirements. The results of the principal components analysis with Varimax rotation and Kaiser normalisation are presented in Table 3. The interpretation of components and descriptions of categories appear in Table 4. Approximately 50 % of variation was extracted with the analysis and seven factors emerged.

Table 3. Principal components analysis results.

	1	2	3	4	5	6	7	Extract
Online booking easy	0.728							0.579
Independent use of online booking system	0.519							0.291
Online booking system accessible 24 hours	0.588							0.352
Online booking quick	0.626							0.418
Offline when necessary	0.466							0.238
Offline booking easier		0.599						0.443
Product not available online		0.733						0.561
Offline booking cheaper		0.670						0.495
Satisfied with the system or online channel			0.707					0.515
Has tested the online booking system			0.634					0.453
Received an incentive when used the system			0.563					0.363
Distrust of the online channel				0.779				0.623
Conversation preference				0.727				0.599
Satisfied with traditional channel					0.795			0.649
Other reason					0.714			0.601
User interface of the online booking system complex						0.764		0.639
Experienced problems with the system						0.778		0.650
(Product related) information easier to get traditionally							0.608	0.396
Online booking slow							0.776	0.613
Eigenvalues	2.002	1.444	1.375	1.304	1.255	1.077	1.022	
Variance extraction	10.536	7.598	7.236	6.863	6.603	5.668	5.378	49.883

Table 4. The factors and data categories.

Higher category /factor	Lower category	Description
Trusts only the customer service	Conversation preference	Wants to communicate with a person or merely prefers offline booking.

Higher category /factor	Lower category	Description
	Distrust of the online channel	Distrusts the online channel itself or the security or his/her own skills with the online booking system (cannot be sure that he or she is able to get the intended booking e.g. correct booking).
Online booking useful	Ability to browse independently	Can check timetables, prices or availability independently at his or her own pace, or does not want to disturb customer service persons.
	Online booking easy	Perceives online booking as easy.
	Online booking quick	Considers online booking quick or quicker than offline booking or dislikes queuing on the phone.
	Online booking system accessible 24h	Online booking system accessible whenever most appropriate for customer, after call centre or agencies have closed.
	Offline when necessary	Usually prefers online booking system, but books the special arrangements offline.
Cheap and complex bookings easier offline	Offline booking cheaper	Knows or suspects that the products are cheaper offline or wants to ensure the cheapest product available or information about discounts and therefore books offline (e.g. discount cruises including bus transportation from home town).
	Offline booking easier	Perceives the booking (process or product) as complex or offline booking as easier or clearer than online, and therefore prefers traditional booking.
	Product not available online	Has e.g. a discount or gift voucher or a special cabin requirement, or a special service requirement for transportation, baby cot or pet, or a table reservation, none of which can be booked online.
Problematic or complex user interface	Experienced problems with the system	The online booking system has not been available, or has received an error message or there has been some other system related problem.
	User interface of the system complex	E.g. clicking back and forth through the stages in the user interface.
Tested, got incentive and satisfied with online channel	Tested the system	Either has tested or will test the system, possibly out of curiosity.
	Received an incentive when used the system	Perceived online booking as cheaper or received an incentive when he or she used the system (during a marketing campaign).
	Satisfied with the system or the Web	Used to or satisfied with online channel or system, or merely preferred online booking.
Satisfied with traditional customer service	Satisfied with traditional channel	Used to or satisfied with trustworthy expertise or friendly customer service in traditional channels.
	Other reason	Books always with the same person or is a regular customer, or has no knowledge of the online booking system.

Higher category /factor	Lower category	Description
Getting information and booking online is slow and difficult	(Product related) information easier to get traditionally	Has specific questions about entertainment, destination or wants extra information and considers information more easily available from traditional channel.
	Online booking slow	Perceives online booking as slow or slower than offline booking, e.g. because of having to click back and forth through the stages in the user interface or because of slow connection speed. Prefers to get immediate answers to his or her questions or to book last-minute cruises through traditional channels.

5. DISCUSSION

The objective of this paper was to propose constructs that could be used in measuring consumers' perceptions of usefulness and ease-of-use in electronic commerce. The items used in prior research were synthesised and features of online shopping that consumers find important were explored. The similarities and differences, summarised in Table 5, will be discussed here.

Three of the standard PU items were equivalent to data categories that emerged from the qualitative data. Additionally three analogous PU items were found from Table 2. There was no equivalent item for "Online booking system accessible 24 hours" in the standard or additional items. This is quite surprising since accessibility is one of the most beneficial features of the Internet (Lohse and Spiller, 1998).

Factors "Trusts only the customer service", "Cheap and complex bookings easier offline", "Problematic or complex user interface", "Getting information and booking online is slow and difficult" contained categories that referred to perceived ease-of-use of the traditional channels or perceived difficulty-of-use of the online booking system. It would be fruitful to also measure the ease-of-use of other channels in channel choice studies, but in technology acceptance studies these should be modified to focus on an online channel instead.

The first three PEOU categories related to a standard item: *I find it easy to get the system to do what I want it to do.* This item is derived from self-efficacy, which refers to the belief that one has the capability to perform a particular task (Chau, 2001), or computer self-efficacy, which is a belief in sone's ability to put computer technologies to use (Venkatesh and Davis, 1996). Instruments for measuring computer self-efficacy (Wang et al., 2003) and Internet self-efficacy (Hsu and Chiu, 2003) could also be used here.

The standard ease-of-use items are also mostly applicable in b2c electronic commerce research. However, the usefulness items may be ambiguous for consumers, and the proposed items below could be used instead.

Table 5. The data categories and equivalent items related to PU and PEOU constructs.

Data category	Const.	Equivalent item from published study
Online booking easy	PU	The Web site makes it easier to search for and purchase CDs/books.
Online booking quick	PU	The Web site enables me to search and buy CDs/books faster.
Online booking system accessible 24 hours	PU	
Independent use of online booking system	PU	Shopping online gives me greater control.
Offline booking cheaper	PU	Using shop-bots would save me money when buying books.
Online booking slow	PU	Using shop-bots would save me time when buying books.
Satisfied with the system or the Web	PU	I find the system useful in my job / The advantages of e-commerce to me will outweigh the disadvantages / I find this a site that adds value.
Distrust of the online channel	PEOU	I find it easy to get the system to do what I want it to do. Or I have the skills capability and knowledge necessary to use e-commerce applications.
Offline booking easier	PEOU	It is easy for me to place a purchasing order on this Web site.
(Product related) information easier to get traditionally	PEOU	I can quickly find the information that I need.
Experienced problems with the system	PEOU	Interacting with the e-commerce site with the SUI is often frustrating.
User interface of the system complex	PEOU	I find the e-commerce site with the SUI cumbersome to use
Online booking easy	PU	The Web site makes it easier to search for and purchase CDs/books.

Perceived usefulness

1. The Web site makes it easier to search for and purchase products.
2. The Web site enables me to search and buy products faster.
3. The Web site is useful since I can use it at any time suitable for me.
4. The Web site gives me greater control.
5. The Web site would save me money when purchasing products.
6. The Web site would save me time when purchasing products.
7. I find the Web site useful in purchasing products.

Perceived ease-of-use

1. I find it easy to get the Web site to do what I want it to do.
2. It is easy for me to place a purchasing order on this Web site.
3. I can quickly find the information that I need on this Web site.
4. Interacting with the Web site is often frustrating.
5. I find the Web site cumbersome to use
6. My interaction with the Web site is clear and understandable.
7. Interacting with the Web site does not require a lot mental effort.
8. It is easy to become skilful at using the Web site.
9. Learning to operate the Web site is easy.
10. The Web site is flexible to interact with.

6.   LIMITATIONS AND FURTHER RESEARCH

There are some limitations to this study. The literature review was not exhaustive, but exemplifies some recent and representative TAM studies in a b2c electronic commerce context. Although the data coding was checked with randomly selected samples presented for coding to colleagues, the data set was too large to be checked thoroughly by two or more data coders. Therefore, some categories may have been overlooked although the author has carefully read the complete data set 4-5 times. The proposed items in the constructs presented above are merely suggestions. However, validation of the items is beyond the scope of this paper and remains to be carried out in future research projects.

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