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Empirical Investigation into Impact of Electronic Commerce Systems Richness on User Behavior: The Case of a Complex Product [a]

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Abstract

There is no doubt that growth of electronic commerce (EC) on the Internet/Web is only going to accelerate even more. However, given that commerce in these environments are virtual in nature and that most consumers feel uncomfortable with this virtuality a more compelling issue is how can the EC environments be made more acceptable to consumers to approximate their real-world physical store purchases behavior. Drawing upon previous literature, this study uses the theme of "fit" between EC environment and the product type, develops four different prototype systems depicting different EC environments, and using laboratory-based experiments examines the influence of "fit" on four user outcomes. Significant support to the "fit" theory is obtained.

Introduction

Electronic commerce (EC) environments are virtual in nature. Most consumers are likely to feel uncomfortable with this virtuality. If they go to a physical store, they can touch and feel the product and talk to a "real person" right away for additional product information or consultation. But, in a virtual store such as an electronic commerce site, they cannot do that. This difficulty is exacerbated in a poorly designed EC environment. Thus, EC environments have deficiency of environmental richness that physical stores enjoy. This deficiency might cause a lack of motivation on the part of consumers to accept EC technology as a regular transaction mode, lack of user satisfaction, lack of decision confidence, and lack of purchase intention. Thus, we argue that EC environment should be rich enough to compensate for the deficiency to have favorable influence on user behavior. In this study, we investigate the impact of richness of EC environment on user attitude/behavior in the context of a complex product.

Electronic Commerce System Richness: Social Presence and Product Presence

Focusing on user-computer interaction in the EC environment, EC system environments can be characterized using two major dimensions: social presence (SP) and product presence (PP) (Jahng et al.,

2000). Social presence in EC environments deals with the interaction between buyers and consumers or among buyers and can be defined as the degree to which a buyer psychologically perceives the sellers to be physically present when interacting with them. On the other hand, product presence addresses the interaction between buyers and products and can be defined as the extent to which a buyer psychologically perceives the products to be physically present when interacting with them. From a technology perspective, SP ranges from e-mail, on-line chatting, audio conferencing, audio/video conferencing, etc., whereas PP can be realized in varying degrees from text only, static picture, animation, 3-D view, virtual reality, etc. SP and PP are basically continuums, but in this study we dichotomize each dimension for the sake of simplicity and illustration.

This view draws upon the notion of task-technology fit that has generated considerable attention in recent times (Goodhue and Thompson, 1995; Goodhue, 1998; Mathieson and Keill, 1998; Zigurs and Buckland, 1998). Focusing on the linkage between information systems and individual performance, Goodhue and Thompson (1995) propose a comprehensive model by incorporating insights from two complementary research stream: Utilization focus stream and Fit focus stream. The former suggests that user (favorable) beliefs of and attitudes toward technology characteristic lead to utilization and ultimately to better performance, whereas the latter argues that task-technology fit impacts performance. The authors propose a new comprehensive model where they argue that task, technology and individual characteristics influence the task-technology fit (TTF) which influences utilization, and that both fit and utilization lead to better performance. They conceptualize task-technology fit measure as a composite of eight major factors such as data quality, data compatibility, data locatability, production timeliness, systems reliability, etc. Instead of testing the entire model, they derive a reduced model to test three relationships (between task/technology characteristics and user evaluation of fit, between fit and utilization, and between fit and performance). The study's results show that task-technology fit is influenced by both task and systems characteristics and that this fit (and utilization) lead to better job performance of IS users in firms. However, the study finds that task-technology fit is only weakly related to utilization.

Extending on this prior work, Goodhue (1998) develops a more comprehensive instrument for TTF and compares its utility in being used to measure user evaluation of information systems vis-à-vis two other popular measures in IS literature – namely, user information satisfaction (Bailey and Pearson, 1983) and EUC satisfaction (Doll and Torkzadeh, 1988). This measure consists of 12 dimensions of task-technology fit - level of detail, data accuracy, compatibility, locatability, accessibility, meaning, assistance, ease of use, system reliability, currency, presentation, and confusion. Based on the task-technology fit theory, he asserts that the correspondence between information systems functionality and task requirements would lead to positive user evaluation and positive performance impacts. Results from a field study of 10 Companies show that TTF instrument demonstrates satisfactory reliability and discriminant validity for the 12 separate dimensions of the task-technology fit. This study claims that TTF is an attractive alternative (to UIS and EUCS) to evaluate IS effectiveness within the context of managerial decision making in organizations. This study acknowledges that given the rapid technology changes (e.g., explosive growth of the Internet/Web) and sourcing options (e.g., outsourcing) this instrument would need modification/ adaptation if it is to be used in other research.

Mathieson and Keill (1998) show, through a laboratory-based experimental study, that perceived ease of use (EOU), an important factor for voluntary use of an information system, is not just a function of the user-computer interface but that it is also a function of task/technology fit. This study implores that developers need to consider deeper task-technology fit issues that are not corrected by merely changing the user interface.

Within the context of the Internet and web, a recent study examines in detail technological impediments to business-to-consumer end of electronic commerce and propose "interface limitations" as one of the top six key impediments (Rose, Khoo and Straub, 1999). This study discusses limitations of the interface (in EC) within the context of inability to satisfy the five key senses of humans – (3D) sight, sense of touch, feel, hear, and taste. Notwithstanding recent developments in new sensory-capturing and sending devices, widespread commercial use may be constrained at the current time due to bandwidth and security/privacy issues among others.

To recap (and as would be more clear from the material presented in the next section), our conceptual framework (involving the SP and PP dimensions) captures the key theme emerging from the above discussion that the interface of the EC environment must be designed to have a "fit" with the product (which in our case in a product purchase decision-making task) to generate favorable user outcomes.

Product Classification in virtual environment

Products have been widely discussed in EC literature as an important contingent factor of EC systems design. Many product characterizations exist in the traditional marketing literature; but, they have basically been discussed in the context of physical world commerce and thus might not be appropriate in a virtual context like EC environments. Along the dimensions of EC characterization presented above, we use the following two dimensions to characterize products in EC environments: SP requirements and PP requirements. SP requirement is defined as the degree to which a product choice task requires a sense of presence of a seller, while PP requirement is defined as the extent to which a product choice task requires a sense of presence of the target product. We argue that the amount of SP requirement can be determined by the product complexity (a function of number of product attributes, variability of each product attribute, and interdependence of product attributes). We further propose that the degree of PP requirement is related to the ability of the EC environment to satisfy the senses and that it can be determined by the importance of *visualization* (the extent to which availability of visual attributes such as shape, style, and design) of products is critical to consumer product-choice decision making and *experientiality* (the extent to which availability of experiential attributes of products is critical to consumer decision making). In this study, we examine a product that requires high SP and high PP to investigate the impact of EC environmental richness on user attitude/behavior.

User attitude and behavior

The importance of well-defined outcome variables has been emphasized in information systems (IS) research for a long time (DeLone and McLean, 1992). User outcome is a multifaceted construct that can be defined in different ways depending on research purposes and contexts. Within the context of effective EC environments, outcomes in general exist from two perspectives: the provider (or seller) and the consumer. From a provider/ seller standpoint, outcomes may include enhanced sales, profits, and market share through electronic business transactions. From a consumer's standpoint, outcomes include various attitude and behavioral factors. Drawing upon previous literature in Marketing and IS, some of these outcomes include user attitude toward the products and EC environments, satisfaction with product-choice and EC systems, acceptability of EC environments as a transaction mode, confidence in product-choice, ease of obtaining/processing information, etc. (Davis, 1988; Doll and Torkzadeh, 1988; Goslar et al., 1986; Mehta, 1994). Given the consideration of research questions raised earlier and resource constraints, we chose the following four variables to be relevant user outcomes within the

context of successful EC environments: users' satisfaction with the EC environments, decision confidence, acceptance of an EC environment as a transaction mode, and purchase intention.

Fit Model

Based on the discussions presented above and illustrated in Figure 1, we propose and test the following proposition:

PROPOSITION: A congruence between system richness (in terms of SP and PP) and product characteristics (in terms of SP/PP requirement) leads to favorable user outcomes.

Figure 1: EC Technology/Product Fit Model
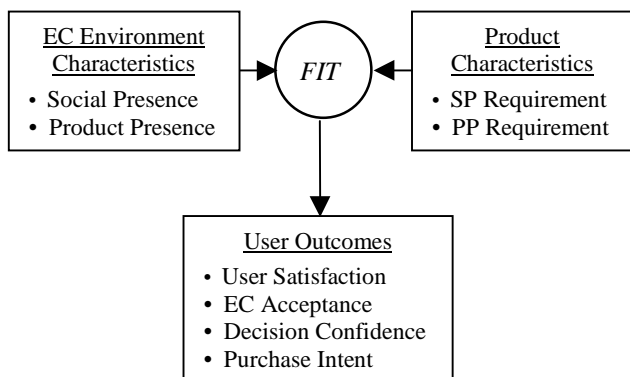
Research Methodology

In order to validate the fit model described above, we employed a controlled laboratory experiment using a complex product (digital camera) that requires high SP/PP. Digital camera was determined to fall into the category of "high complexity" in light of the fact that there are over 25 product attributes to consider many of which are not only interdependent but also take on multiple values. We developed four different prototypes (i.e., four combinations of high and low social and product presence) and one of these four prototypes was randomly assigned to each subject. Since this experiment compares four groups (one fit group and the other three misfit groups), a sample size of 64 per each group was determined to provide adequate statistical power (i.e., .80) for hypothesis testing (Cohen, 1969). Subjects for this experiment were recruited from an undergraduate introductory information systems course in the business school of a major Mid-western university. Their participation was voluntary.

EC environments were manipulated to have different amount of social presence and product presence. An EC environment with low PP was represented by a textual

description of product information on each attribute accompanied by a static picture of the digital camera. High PP was represented by interactive multimedia presentation of the product information accompanied by an ability/opportunity for the user to virtually try out the camera's various features. An EC environment with low SP was represented as one with e-mailing capability to obtain clarifications on the product from a (seller's) representative while high SP would provide real-time one-way video and two-way audio communication.

Social presence and product presence offered in the EC environment were assessed with a multi-item scale to validate the perception of participants in the experiments. Short et al.'s (1976) social presence measure was adapted to develop SP/PP measures of EC environments. User outcome measures such as user satisfaction (Doll and Torkzadeh, 1988), user decision confidence (Goslar et al., 1986), user acceptance (Davis, 1988), and purchase intention (Mehta, 1994) were developed by adapting previous scales. The propositions were tested using analysis of variance (ANOVA) technique to detect differences among the treatments.

Data Analysis and Research Results

As indicated in Table 1, a total of 408 subjects participated in the experiment. We collected more than 100 data points in each group.

Table 1: Distribution of Subjects by Group

Group type	Prototype ID	# of Subjects
Group 1	P1 – Low SP & Low PP	103
Group 2	P2 – Low SP & High PP	101
Group 3	P3 – High SP & Low PP	101
Group 4	P4 – High SP & High PP	103
Total		408

First, we measured social/product presences as perceived by subjects in each group. As shown in Table 2, results emerged as expected. For example, P4 (prototype used by group 4) has a significantly higher value of SP than P1 (prototype used by group 1) and P2 (prototype used by group 2), whereas P4 has a significantly higher value of PP than P1 and P3 (prototype used by group 3).

Table 2: Mean SP & PP Differences across Prototypes

	P1	P2	P3	P4	F-Test (Sig. Level)
SP: Social Presence	3.427	3.955	4.416	4.534	.0000
PP: Product Presence	4.102	4.768	4.594	5.017	.0000

We compared the four prototypes in terms of four user-outcome variables. As displayed in table 3, there are significant differences across the four EC environments for the same product. Group 4 using prototype 4 (the one that we manipulated to have the best *fit* with the product type examined in this study) has the highest values on each of the four outcome variables. We can also see the differences among the three *non-fit* groups. For example, group 1 using prototype 1 has lower values on these four user-outcome variables than group 2 or group 3.

Table 3: Mean User-Outcome Values across Prototypes

	P1	P2	P3	P4	F-Test (Sig. Level)
EC Satisfaction	3.75	4.11	4.17	4.25	0.000
Decision Confidence	5.07	5.19	5.12	5.36	0.033
EC Acceptance	3.71	4.55	4.62	5.03	0.000
Purchase Intention	4.20	5.37	5.32	5.61	0.000

Discussion and Conclusion

It can be noted from the above information that for a complex product that requires high degree of social/ product presence, we need a rich EC environment that provides high SP/PP. If the EC environment is not rich enough for a complex product, consumers' level of satisfaction, decision confidence, EC acceptance, and purchase intention are significantly, unfavorably influenced. The results show that the congruence between EC environments and products is critical to user outcomes. This line of thought is consistent with the previous theories such as task-technology fit theory (Goodhue and Thompson, 1995; Zigurs and Buckland, 1998), cognitive fit theory (Vessey and Galletta, 1991), media richness theory (Daft et al., 1986; Trevino et al., 1990), and social presence theory (Short et al., 1976). While a "rich" EC environment as depicted by High SP/PP is perhaps most desired it is possible that there are both internal constraints (resource availability) and external constraints (e.g., lack of high speed networks). The results indicate that providers of online commerce environments may have a choice – they can either opt for P2 (low SP/high PP) or P3 (high SP/low PP) each of which appears to be equally good on most of the user outcomes.

In this paper, we have just presented preliminary results of data analysis. We are currently in the process of detailed analysis of additional data collected through these experiments. Also note that this study only looked at a complex product that requires high amount of SP and PP. Obviously, no generalizations can be made based on a single study on just one (complex) product. It is necessary to not only replicate such studies on other, similar complex products but also examine the three other categories of product belonging to High SP/Low PP (e.g., retirement investment plan), Low SP/High PP (e.g., music CD), and Low SP/Low PP types (e.g., blank videotape).

[a] Authors names are alphabetically ordered. All have contributed equally.

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