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DIFFERENTIAL IMPACT OF WEB AND MOBILE INTERACTIVITY ON E-RETAILERS' PERFORMANCE

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Abstract

This study investigates the differential impact of machine and person interactivity in both Web and mobile e-commerce channels on e-retailers' operational and financial performance. Based on the data on 463 large e-retailers in U.S. and Canada, interesting findings that Web machine interactivity and mobile person interactivity have significantly positive impact on e-retailers' operational performance, while Web person interactivity and mobile machine interactivity do not. E-retailers' operational performance was found to have significantly positive impact on e-retailers' financial performance. Overall, this study provides in-depth insights into the differential role that machine and person interactivity in Web and mobile channels play in impacting e-retailers' performance. Implications for research and practice as well as suggestions for future research are discussed.

Keywords: Machine Interactivity, Person Interactivity, E-Commerce, Mobile Commerce.

1 INTRODUCTION

The Website interface is an integral component of online store for e-retailers as it is the conduit in which consumers interact with merchants during their pre-purchase, purchase, and post-purchase phases of shopping (Sicilia et al. 2005; Varadarajan & Yadav 2002). In the early days of e-commerce, retailers primarily focus on designing interface that can help consumers to search for information and complete transaction efficiently. Since then, Website tools such as search engines and recommendation agents that can facilitate consumers' searching, comparing, and purchasing products are now commonly available on most e-commerce Websites (Haubl & Trifts 2000; Yadav & Varadarajan 2005). With advancements in Web technologies and expectations from consumers who demand online shopping to be more social, there is an increasing trend in recent years for e-retailers to offer various options for online consumers to interact with customer service representatives and other consumers.

Just as location is widely regarded as a key factor for physical retail store success, the level of interactivity provided on a Website has been found to be an important contributor towards positive online user experience (Teo et al. 2003). The notion of interactivity has its roots in the field of communications and refers to the degree to which participants in a communication process have control over, and can exchange roles in their mutual discourse (Williams et al. 1988). In the context of marketing and e-commerce, interactivity is best understood in terms of the two dimensions of machine and person interactivity. Machine interactivity refers to the extent in which consumers can participate in modifying the form and content of a mediated environment in real time while person interactivity refers to the interactivity between people that occurs through a medium (Hoffman & Novak 1996).

As Web 2.0 applications such as Facebook and Twitter become pervasive, consumers demand e-retailers to provide more opportunities for them to engage in person-to-person conversations online (Riegner 2007). This nudges e-retailers to pay attention on improving the ability of their Website interface to allow higher level of person interactivity than before. And with the ubiquity of mobile devices, many retailers have also begun to offer a customized interface with design and functionalities catering to consumers who visit the e-store from mobile devices (Lee & Benbasat 2004). As multichannel retailing gains prominence, retailers are attempting to extend the interactivity features that they offer on the Web for mobile consumers to get a seamless shopping experience across retail channels (Kleijnen et al. 2007; Oh & Teo 2010).

Given these shifts in consumers' behaviors, how should e-retailers devote resources to provide machine and person interactivity on both Web and mobile interfaces? More importantly, which type of interactivity has a greater impact on e-retailers' operational metrics such as unique visitor number, conversion rate, and average ticket value? Although there is some academic research being done to examine the effects that different types of interactivity have on Web users (e.g., Suntornpithug & Khamalah 2010), we know very little about the differential effects of interactivity in both Web and mobile channels upon e-commerce operational and financial performance. Hence, this study attempts to provide some insights into the differential impact of Web and mobile interactivity on e-retailers' performance.

The research contributes theoretically by adding new knowledge on the effects of interactivity in the emerging domain of mobile interface. It also deepens our understanding of the relative impacts of machine and person interactivity in an e-commerce context. Results of the study can also inform e-retailers about the performance implications of different types of interactivity and offer them guidance on how to allocate resources to provide machine and person interactivity on both Web and mobile interfaces.

2 CONCEPTUAL DEVELOPMENT

2.1 Definition of Interactivity

Interactivity has always been considered as a key feature of interface design (Albert et al. 2004; Jiang & Benbasat 2007; McMillan 2005; Shneiderman 1997), and a critical advantage of computer-mediated communications (Ha & James 1998; Rafaeli & Sudweeks 1997). Due to its significance, over the past 30 years, interactivity has been widely discussed in multiple fields such as advertising, marketing, communication, information systems, and computer science (McMillan & Hwang 2002). Ha and James (1998) conceptualized interactivity as the extent to which the communicator and the audience respond to each other's communication need, and construed it as consisting of five dimensions: 1) playfulness, 2) choice, 3) connectedness, 4) information collection, and 5) reciprocal communication. While a universal definition of interactivity has yet to be attained, there is increasingly some agreement among scholars that interactivity can be divided into two broad types by whether the interactivity occurs with the medium (machine interactivity) or through the medium (person interactivity) (Gerbner & Barnouw 1989; Hoffman & Novak 1996; Liu & Shrum 2002; McMillan 2005).

2.2 Outcomes of Interactivity for E-commerce

Interactivity of Websites generate great opportunities for e-retailers to directly access market data and competitive intelligence, support and serve customers or channel partners in real time, and the ability to simultaneously interact with more customers than in physical stores, etc (Coviello et al. 2001; Evans & King 1999; Yadav & Varadarajan 2005). Online interactivity is becoming a valuable way of improving the communication quality of business Websites (Chen & Yen 2004), and retailers can capitalize on investment in improving Website interface design to increase the traffic and sales (Lohse & Spiller 1999).

Research has suggested that interactivity can help online merchants' efforts to build a good relationship with their customers (Ghose & Dou 1998). Interactivity on Website can offer benefits such as facilitated communications, customization of presented information, image manipulation, and entertainment for consumers (Fiore et al. 2005). It is designed to change knowledge and behavior of consumers (Haeckel 1998), and plays a crucial role in knowledge acquisition and development of cognitive skills in hypermedia computer-mediated environment (CME) (Sims 1997). Interactivity in CME when implemented properly can result in consumers' flow experience (Hoffman & Novak 1996), and the increase in interactivity will bring consumers enjoyable shopping experience (Jiang & Benbasat 2007).

Numerous studies have found that interactivity on commercial Website can affect consumers' attitude toward and perceptions of the Website and the products, as well as their intention to make purchase and return to the Website, etc. It was found that high level of interactivity on commercial Website has positive effect on consumers' perceived satisfaction, effectiveness, and efficiency toward the Website (Teo et al. 2003). High level of interactivity on a Website is significantly associated with perceived Website success by site users (Palmer 2003), and the greater the degree of interactivity, the more attractive the Website (Ghose & Dou 1998). Several aspects of Website interactivity, such as reciprocity, responsiveness, and nonverbal information, have significant effects on consumers' perceived interactivity, and result in more favorable attitude toward the Website (Johnson et al. 2006). Consumers who visit interactive Websites are more likely to have positive evaluations of the merchants (Hoffman & Novak 1996), and are more actively involved on the Websites than those who visit non-interactive sites (Johnson et al. 2006). The interactive nature of Websites has been suggested to enhance consumers' attitude toward the online retailer, desire to browse or return to the Web site, and online purchasing (Fiore et al. 2005). Increased interactivity in product presentations enhances consumers' perceived diagnosticity of products, and perceptions of the compatibility of online shopping with in-store shopping (Jiang & Benbasat 2007).

2.3 Impact of Machine Interactivity on E-retailers' Operational Performance

Machine interactivity refers to those interactions occurring between human and medium. The machine interactivity provided by e-retailers can benefit consumers in numerous aspects throughout their shopping process. One important benefit is the access to greater amounts of dynamic information to support queries for consumer decision making (Hoffman et al. 1995). The advanced search functions on Websites allow for deep, nonlinear searches initiated and controlled by consumers (Hoffman et al. 1995), and coupled with improved navigation features, can help consumers to easily reduce or eliminate unwanted or superfluous information and organize the information in such a way that facilitates the search process (Sicilia et al. 2005). Thus, consumers are able to efficiently find the products they want and easily learn about the properties of the products. Furthermore, the ability of the Web to amass, analyze, and control large quantities of specialized data can enable comparison shopping, reduce the uncertainty, and therefore make it more likely for consumers to make the purchase decision, and buy more from the merchant (Hoffman et al. 1995). The ability to provide a personalized, customized interaction for consumers allows e-retailers to differentiate product and service offerings (Palmer & Griffith 1998), and the availability of customization improves the quality and variety of products, enhances consumer satisfaction, and thereby increases the likelihood of consumers' return and frequency of visiting the Website (Palmer 2003).

It was suggested that Websites with multimedia rich interactive functions can influence online consumers' shopping motivations and entice them to modify or even transform their original shopping predispositions by providing them with attractive and enhanced interactive features and controls, thus generating a positive attitude towards products and services offered by the retailer (Islam 2009). Berthon et al. (1996) noted that interactivity based upon navigation, search engine and availability of visual tools on Website is critical in converting site visitors from interested contacts into interactive customers, and attracting them from being interested to making purchase, staying interactive and ultimately repeating purchase. Improving machine interactivity such as search and navigation capabilities of e-stores and especially product lists can generate significantly higher Website traffic and sales (Lohse & Spiller 1999). Therefore, it is reasonable to infer that those consumers who visit more interactive Websites regardless of whether it is through the Web or mobile channel should be more likely to make a purchase and buy more from the merchants. And due to the enjoyable shopping experience on the sites, they are more likely to repeatedly visit the website. Thus, we expect that:

Hypothesis 1 (H1): The level of machine interactivity on e-commerce Web channel is positively associated with the level of e-retailers' operational performance.

Hypothesis 2 (H2): The level of machine interactivity on e-commerce mobile channel is positively associated with the level of e-retailers' operational performance.

2.4 Impact of Person Interactivity on E-retailers' Operational Performance

Person interactivity refers to those interactions between humans through medium, and is treated as a higher level of interactivity compared to machine interactivity (Teo et al. 2003). It can be realized through functionalities and features such as click-to-call, live chat, email, and consumer reviews. Person-to-person interactivity in the form of blog can significantly influence users' attitude toward the Website (Thorson & Rodgers 2006). In addition, online consumer review system is considered as one of the most powerful channels to generate online word-of-mouth (Dellarocas 2003), and the presence of consumer reviews on Website has been shown to improve consumer perception of the usefulness and social presence of the Website (Kumar & Benbasat 2006). Reviews have the potential to attract consumer visits, increase the time spent on the site ("stickiness"), and create a sense of community among frequent shoppers (Mudambi & Schuff 2010). It can enhance consumer trust of the Website, and significantly affects consumers' intention to shop online (Awad & Ragowsky 2008).

Customer support component of interactivity has a significant positive impact on the likelihood of a Website being included in a list of high-quality Websites (Ghose & Dou 1998). It was suggested that e-commerce Websites should provide service telephone numbers on the sites to maximize consumer

satisfaction and thereby increase consumer retention (Fang & Salvendy 2003). More reciprocal communications between site visitors and e-retailers allows the Website to respond more to the particular needs of visitors (Ha & James 1998). The contact interactivity that occurs between e-retailers and consumers through Websites was found to be a critical antecedent of consumer loyalty in e-commerce, and can lead to consumers' willingness to pay more for the same product in competing Websites (Srinivasan et al. 2002). The ability to contact customer service representatives online is suggested to contribute to the delivery of superior service quality, which is a fairly strong predictor of customer loyalty and intention to repurchase (Zeithaml et al. 2002). Therefore, we hypothesize that:

Hypothesis 3 (H3): The level of person interactivity on e-commerce Web channel is positively associated with the level of e-retailers' operational performance.

Hypothesis 4 (H4): The level of person interactivity on e-commerce mobile channel is positively associated with the level of e-retailers' operational performance.

2.5 Relationship between E-retailers' Operational Performance and Financial Performance

Operational performance of e-retailers including metrics like visitor traffic, conversion rate and average ticket size can directly impact their financial performance such as online sales. It is commonly regarded that the volume of online sales necessarily has positive correlation with the amount of Website traffic. Attaining a large amount of traffic is an intermediate goal of most Websites regardless of their purposes, and achieving it is usually necessary in order to achieve other higher-level organizational goals (Alpar et al. 2001). For instance, visitors to an electronic shop do not automatically generate sales, but without them there will be no sales at all. The high traffic of Website also provides e-retailers with the potential to earn revenues by selling advertising space. Conversion rate refers to the percentage of visitors to an online store who actually buy a product from the store on that visit. The higher the conversion rate, the more likely generating great sale revenues. Sismeiro and Bucklin (2004) indicated that even small changes in conversion rate can result in considerable increases in sales revenues. Likewise, a large average ticket size (measure of the average value of a sale) is highly correlated with greater overall online sales. Hence, we hypothesize that:

Hypothesis 5 (H5): The level of e-retailers' operational performance (including monthly unique visits, conversion rate, and average ticket value) is positively associated with their online sales.

2.6 Control Variables

We controlled for the impact of Website reliability measured by Website response time, consistency, and availability, on e-retailers' operational performance because low reliability of Website will drive away visitors due to long response time, confuse consumers with inconsistent information, and decrease consumer satisfaction due to low site availability, all of which can decrease the likelihood of consumers to make purchase online, and to revisit the Website (Palmer 2003).

Furthermore, since financial performance can be influenced by whether the retailer is a consumer brand manufacturer, retain chain, catalog/call center, or web only, we controlled the effects of merchant type on financial performance.

Figure 1 shows the research model.

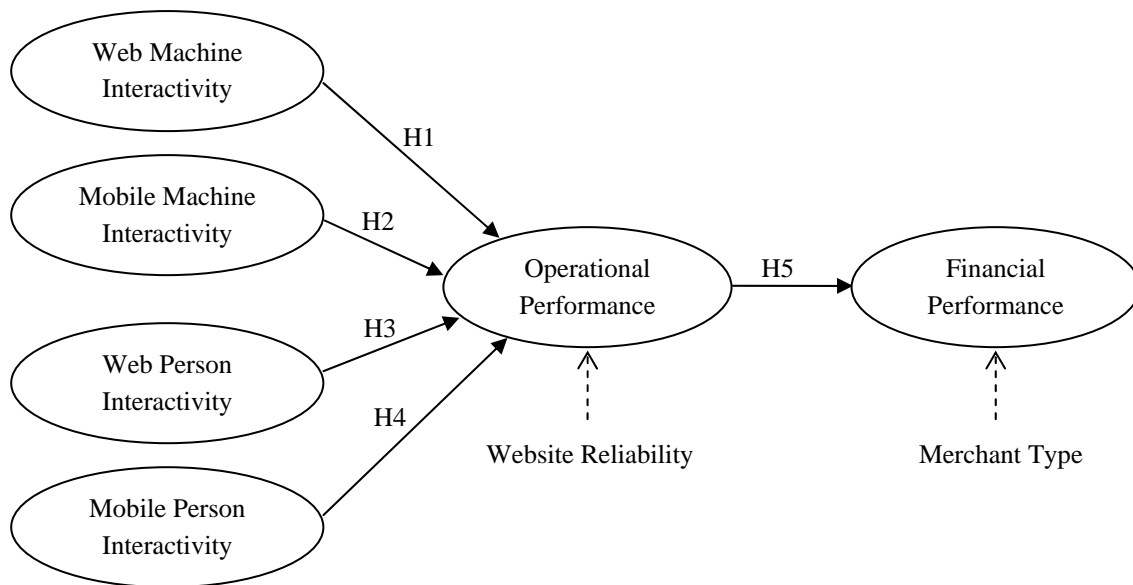


Figure 1. Research Model

3 RESEARCH METHOD

3.1 Operationalization of Constructs

In this study, Web interactivity refers to the interactivity generated by features that consumers access using a desktop/notebook computer while mobile interactivity refers to features that are accessed using mobile devices. Following the method of other researchers (Ghose & Dou 1998; Ha & James 1998; Teo et al. 2003), we used interactive functionalities and features to measure interactivity of Web and mobile interface. Specifically, Web machine interactivity was measured by interactive catalog, product customization, and site personalization, and mobile machine interactivity was assessed by keyword search, store locator, and zoom features accessible from mobile channel. Click to call/click to talk, live chat email, blogs, and customer reviews in the e-commerce Web channel measured Web person interactivity, while mobile person interactivity comprised of click to call, contact us form, and customer reviews provided in mobile channel.

As for performances of e-retailers, we used the commonly applied metrics including number of monthly unique visitors, conversion rate, average ticket value to measure operational performance, and the amount of online sales to measure financial performance.

3.2 Data Source

The data set used in this study was the *Internet Retailer Top 500 e-Retailers* database which surveyed and ranked the 500 largest e-retailers in U.S. and Canada based on their annual online sales of 2009. After eliminating companies with incomplete data, data on 463 e-retailers were used to test the research model. Among these e-retailers, the largest one is Amazon.com with 24.51 billion dollars of online sales in 2009. There are 53 brand manufacturers, 144 retail chain e-retailers, 81 catalog/call centers, and 185 web-only retailers. Table 1 shows the descriptive statistics of these e-retailers.

	Minimum	Maximum	Mean	Std. Deviation
Web Sales (USD)	10,028,204	24,510,000,000	257,604,091.430	1,316,902,275.711
Percent Growth (%)	-54.410	238.080	8.1368	23.753
Monthly Unique Visitors	23,424	62,518,000	1,794,001.370	5,008,068.347
Conversion Rate (%)	0.270	18.000	3.169	2.632
Average Ticket Value (USD)	8	1,800	192.480	216.782
Response Time (Seconds)	0.162	24.945	3.501	2.431
Site Availability (%)	13.660	99.970	99.358	4.086
Consistency (Likert type)	1	4	2.700	0.801

Table 1. Descriptive Statistics

4 DATA ANALYSIS AND RESULTS

Partial Least Squares (PLS) technique as implemented in SmartPLS 2.0 was used for the data analysis. PLS was found to be appropriate for the following reasons. First, PLS is able to handle errors of measurement in exogenous variables better than other methods such as multiple regression technique (Chin 1998; Chin et al. 2003). Second, given that there was little prior research or well-tested theories in the area of study, the flexibility of PLS to accommodate both exploratory and confirmatory analysis makes it a suitable method for the research context (Gefen et al. 2000). Third, some of the constructs in the model are formative and cannot be adequately modelled using covariance structure analysis due to the assumptions it imposes, PLS, being components based, can incorporate both formative and reflective indicators (Chin 1998).

4.1 Measurement Model Validation

According to Petter et al. (2007), principal components analysis rather than common factor analysis should be used to examine the item weights for measures to assess construct validity. In this study, SmartPLS with bootstrapping ($m = 400$, $n = 500$) was used to obtain indicator weights on their respective construct, and t-test values for path significance. As shown in Table 2, some indicators for their respective construct emerged as insignificant. Diamantopoulos and Winklhofer (2001) suggested that if any of the item weightings for formative measures are insignificant, it may be appropriate to remove insignificant indicators until all paths are significant. However, they also emphasized that when removing measures, it is critical to ensure that the construct is still measuring the entire domain and content validity is preserved. Bollen and Lennox (1991) also suggested even an insignificant indicator should be retained to ensure content validity. Thus, we reexamined the content of those insignificant items and concluded that they need to be retained to cover the conceptual domain and definition.

Construct reliability is established by absence of multicollinearity (Diamantopoulos & Winklhofer 2001; Petter et al. 2007). For formative constructs, excessive collinearity among indicators makes it difficult to separate the distinct influence of the individual indicator on the latent variable (Diamantopoulos & Winklhofer 2001). The magnitude of multicollinearity might be assessed statistically by the variance inflation factor (VIF), and the common cut-off threshold for VIF is below 10 (Diamantopoulos & Winklhofer 2001). However, a more rigorous rule proposed by Diamantopoulos and Siguaaw (2006) is $VIF < 3.3$.

Six ordinary least squares (OLS) regressions were run with the PLS construct scores as dependent variables and the indicators as independent variables for each construct to obtain VIF scores for the multicollinearity test. Construct score was calculated as the sum of the weighted scores of indicators forming the construct. In Table 2, VIF values ranged from 1.003 to 2.418, all below 3.3, showing that all tested formative latent variables met the requirements of multicollinearity and were thus considered appropriate.

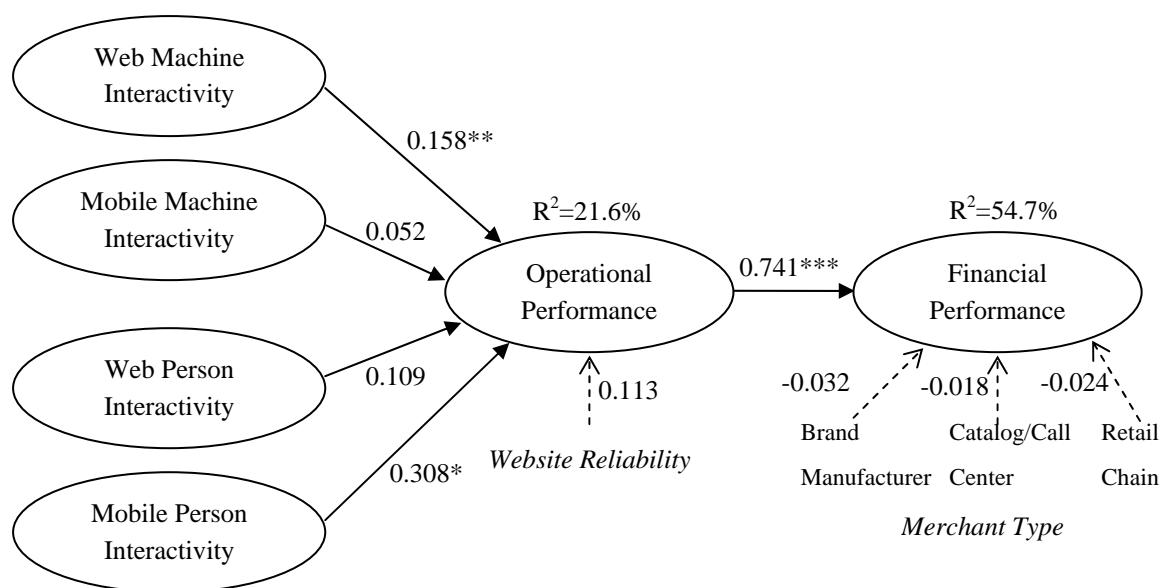
Constructs	Indicators	Weights	VIF
Web Machine Interactivity	Interactive Catalog	0.257	1.051
	Product Customization	0.297	1.037
	Site Personalization	0.835****	1.034
Mobile Machine Interactivity	Keyword Search	0.283	2.413
	Store Locator	0.237	1.524
	Zoom	0.610*	2.418
Web Person Interactivity	Click to Call / Click to Talk	0.803**	1.013
	Live Chat / E-Mail	-0.246	1.031
	Blogs	-0.087	1.065
	Customer Reviews	0.552*	1.080
Mobile Person Interactivity	Click to Call	0.075	2.365
	Contact Us Form	0.063	2.334
	Customer Reviews	0.919****	1.521
Operational Performance	Average Ticket	0.134**	1.052
	Conversion Rate	0.188*	1.050
	Monthly Unique Visitors	0.999****	1.010
Website Reliability	Consistency	0.658	1.398
	Response Time	-0.468	1.398
	Site Availability	0.205	1.003

Note: *significant at $p < 0.1$, **significant at $p < 0.05$, ***significant at $p < 0.01$, ****significant at $p < 0.001$.

Table 2. Item Weights and Multicollinearity Test

4.2 Testing of Structural Model

With sufficient evidence of good properties from the reliability and validity tests, the structural model was next assessed to evaluate its explanatory power and the significance of the hypothesized paths. Figure 2 shows the path analysis results of the structural model. 21.6% of the variance in operational performance and 54.7% of the variance in financial performance can be explained by the variables in the research model. Boot-strap re-sampling procedure was performed to assess the statistical significance of the path coefficients. As shown in Figure 2, Web machine interactivity and mobile person interactivity have significant positive effect on e-retailers' operational performance at $p < 0.005$, $p < 0.01$, respectively. E-retailers' operational performance has significant positive effect on financial performance at $p < 0.001$.



Note: *significant at $p < 0.01$, **significant at $p < 0.005$, ***significant at $p < 0.001$

Figure 2. Results of PLS Analysis

5 DISCUSSION AND IMPLICATIONS

5.1 Key Findings

In this study, we extend the interactivity concept in Web-based e-commerce environment to mobile commerce context, and empirically tested the effects of both Web and mobile interactivity on e-retailers’ operational and financial performances. Operational performance measured as number of monthly unique visitors, conversion rate and average ticket value has significantly positive effect on e-retailers’ financial performance in term of online sales after controlling for the effect of merchant type. The model can account for 54.7% of variance in financial performance, and the path coefficient of operational performance to financial performance is 0.741. This result demonstrates that it is quite necessary for e-retailers to attract more visitors to the site, improve conversion rate and average ticket value if they want to gain great sales revenues.

The four types of interactivity could explain 21.6% of variance in operational performance, controlling for the effect of website technical performance. Overall, person interactivity seems more important in improving e-retailers’ operational performance, based on the value of path coefficients between interactivity and operational performance (0.417 for person interactivity in both Web and mobile channels versus 0.210 for machine interactivity in both Web and mobile channels). One possible reason for this is that consumers are increasingly demanding more direct interactions with other consumers as well as the merchants since the machine interactivity features cannot fully meet consumers’ need for more personal assistance and support in their decision making process.

Interestingly, we found that machine interactivity in Web e-commerce channel has significantly positive effect on e-retailers’ operational performance, while the effect of machine interactivity in mobile channel on e-retailers’ operational performance is not significant. One possible explanation for this could be attributed to the difference in maturity of Web-based and mobile-based e-commerce. Given a choice of making an online purchase through computers or mobile devices, it is highly likely that consumers would choose computers to search, browse, compare, customize and purchase products rather than using mobile devices. This is because it is still rather difficult to perform information-intensive operations using a mobile input interface. Other plausible reasons for this may

lie in the nature of mobile devices' smaller screens, lower multimedia processing capabilities, limited bandwidth, and low reliability (Lee & Benbasat 2004). Consumers would prefer interactions with computers compared to mobile devices, and therefore machine interactivity in Web e-commerce channel has significant effect on e-retailers' operational performance.

Another interesting finding is that person interactivity in the mobile channel of e-commerce significantly impacts e-retailers' operational performance, while person interactivity in Web channel does not. The possible reason for this could be attributed to the nature of shopping and characteristics of mobile setting. In mobile platform, despite the inability of mobile devices to perform as well as computers in terms of Web speed and operability (Lee & Benbasat 2004), it is quite convenient for consumers to leverage the ubiquity of mobile devices to make direct contacts with customer service representatives through dialling the service number, and to post comments and browse others' reviews on specific products or services through mobile devices. Comparatively, person interactivity has less value to consumers in the Web environment and therefore mobile person interactivity takes precedence.

5.2 Managerial Implications

Our findings suggest interesting differential impacts of machine and person interactivity in Web and mobile platform on e-retailers' operational performance. Specifically, Web machine interactivity and mobile person interactivity both have significant positive effect on e-retailers' operational performance, whereas the effects of Web person interactivity and mobile machine interactivity are not significant. These findings provide insights as to how to trade off machine versus person interactivity provided to consumers in Web and mobile channels of e-commerce when faced with limited resources. On the Web platform, not only should e-retailers offer consumers the ability to search for and purchase products, they should also provide tailored advanced functionalities such as site personalization and product customization for consumers to generate more favourable consumer emotional responses to the site. It is quite importance for e-retailers to incorporate various Web applications into their Websites so as to allow consumers to accomplish their purchasing goal. The positive effect of mobile machine interactivity on e-retailers' operational performance also indicates that e-retailers need to provide commonly applied functionalities such as zooming pictures, keyword search in existing conditions of mobile device and technologies, for consumers who visit the Website through mobile devices.

Additionally, considering the popular trend of Web 2.0 applications such as discussion forum, social networking service, and microblog, it is necessary for e-retailers to provide person interactivity on sites so that consumers can turn to customer service representatives and other consumers for help and support during their purchasing process, or share and discuss their shopping experience with online friends and colleagues to gratify their social needs. Our findings indicate that when it comes to providing person interactivity on e-commerce Websites, e-retailers should pay more attention to the mobile channel over the Web channel. In mobile platform, e-retailers should leverage the advantage of mobile devices in terms of portability and ubiquity to provide easy person-to-person interactions such as click to call for consumers. Since most consumers like to refer to others' reviews on merchants, products and services in order to make a better purchase decision (Mudambi & Schuff 2010), the customer review component of person interactivity should be offered in e-retailers' sites to improve the stickiness and generate a sense of community among consumers. E-retailers should make special efforts to tailor customized interface to make it easy for mobile consumers to engage in person-to-person interactions.

5.3 Theoretical Implications

This study contributes to theory in several ways. First, this study enriches and broadens the academic literature on interactivity. To the best of our knowledge, prior research on interactivity in e-commerce and marketing fields has not applied the division of machine and person interactivity to mobile context. In this study we extend this interactivity classification on Web to mobile domain. Second,

this study empirically examined the effect of machine and person interactivity in Web and mobile platform on e-retailers' operational metrics such as number of monthly unique visitors, conversion rate and average ticket value, which helps us to gain a comprehensive understanding of the impact of different interactivity on e-retailers' operational performance. Our findings provide us with in-depth insights into the differential role machine and person interactivity in Web and mobile platform play in improving e-retailers' operational performance. Third, this study identified interface design features and functionalities that actually impact e-retailers' performance, and quantified how much of the performance is impacted, which provides empirical evidence for human-computer interface (HCI) researchers interested in the role of interactivity in e-commerce.

5.4 Limitations and Future Research

While this study has investigated the differential effect of machine and person interactivity in Web and mobile platform on e-retailers' performance, there are still some limitations which may restrict the potential implications of the study and need future work be conducted to advance the present study. First, measurement of four types of interactivity in this study are based on functionalities and features available from the Top 500 dataset as of 2009, it is by no means comprehensive. There are many new technical features that can enhance machine and person interactivity that are not captured in the present study. Future research should improve the domain coverage of different types of interactivity by including more items which manifest the corresponding dimension of interactivity. Second, data used to test the research model in our study are collected from U.S. and Canadian e-retailers. Relevance and applicability of our findings to e-retailers in other countries remains unknown, further studies need to be conducted in other countries. Third, future research can extend this study by incorporating other key factors. For instance, product type can be added as a potential moderator of different interactivity's impact on e-retailers' performance; the technical level of mobile applications can be integrated into our model to examine whether the impact of mobile interactivity on e-retailers' performance changes. Last but not least, as more mobile applications designed for iPhone and Android users emerge on e-commerce Websites, there are exciting research opportunities that exist to study how these customized applications can overcome existing limitations of browser-based access on mobile devices when it comes to enhancing machine and person interactivity.

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