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System design effects on online impulse buying

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Abstract

Purpose – Integrating the two-system (reflective vs. impulsive) model and the “stimulus-organism-response” framework, the purpose of this paper is to construct and empirically test a model that examines online impulse buying as a phenomenon triggered by system design factors.

Design/methodology/approach – A laboratory experimental design with a 2×2 full factorial design involving 151 undergraduate students was used to validate the effects of system design stimuli on online impulse buying. Interactivity and vividness, two design factors, were manipulated and a fictitious VCD movie store was created, with four storefronts representing each combination of treatments.

Findings – A compelling and sociable virtual experience as conceptualized with telepresence and social presence has a significant effect on buying impulses over and above traditional marketing/product stimuli. Such virtual experience can be created through the usage of interactive and vivid website features. Furthermore, cognition positively moderates the relationship between buying impulse and the actual purchasing behavior.

Practical implications – The findings provide valuable guidance in website design that can stimulate online impulse buying. The results also indicate the importance of providing cognitive intervention at the purchasing stage.

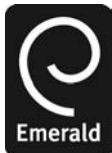
Originality/value – A significant extension of the “stimulus-organism-response” framework is to introduce presence as the system stimulus that captures the overall virtual experience and to specify the associated design features; i.e. interactivity and vividness. By incorporating the two-system model, this study offers a theoretical underpinning of the role of cognitive processing in impulse buying.

Keywords Impulse buying, Website design, Presence, M-R model, Consumer behaviour, Buying behaviour

Paper type Research paper

1. Introduction

Impulse buying is usually described as a sudden, compelling, hedonically complex purchasing behavior that lacks deliberate consideration of all available information and choice alternatives (e.g. Parboteeah *et al.*, 2009; Rook, 1987). All products may be purchased impulsively and all consumers engage in impulse buying on occasion (Piyush *et al.*, 2010). Online stores capitalize on this behavior by integrating multiple media and enabling consumers to buy around the clock, thereby exposing them to rich stimuli and subsequently providing ever-increasing opportunities for impulsive spending (LaRose, 2001). Impulse purchases represent almost 40 percent of all money spent on e-commerce sites, based on the observation of customers' shopping experiences by User Interface Engineering[1]. Other evidence of impulse buying can be found in the practitioners' efforts to promote online impulse buying, such as by cross-promotions at AOL Time Warner and recommendations at Amazon.com



Although impulse buying has relevance to current buying practices, research into the effects of system design on impulse buying remains limited. Most previous studies on online shopping approach the topic using traditional attitude-behavior models, such as the theory of planned behavior (Fishbein and Ajzen, 1975) and/or technology acceptance model (TAM) (Davis *et al.*, 1989). Such models view online shopping as a rational process and actual purchasing behavior driven by a well-formed intention. Although these studies shed some light on the impact of system design on rational buying, they fail to provide insight into the spontaneity and immediacy of the impulse buying that transpires, by definition, without prior intention (Rook and Fisher, 1995).

A few recent studies endeavored to investigate online impulse buying by identifying web site features that could supplement the traditional factors typically identified in marketing research (e.g. product, promotion, etc.). Possible external stimuli that promote online impulse buying (Madhavaram and Laverie, 2004) included media formats (Adelaar *et al.*, 2003) and task/mood-related cues (Parboteeah *et al.*, 2009). Various theories were proposed to explain online impulse buying, including the TAM (Koufaris, 2002) and the “stimulus-organism-response” (SOR) framework (Parboteeah *et al.*, 2009). While these studies provide important insight and suggest possible theoretical perspectives, there is a dearth of research aimed at understanding online impulse buying in general and the role of system design in particular. Confusion also remains regarding how to position cognitive processes in modeling online impulse buying; this calls for further discussion.

Based on the two-system (reflective vs impulsive) model (Strack and Deutsch, 2004) and the “SOR” framework (Mehrabian and Russell, 1974), in the present paper, we construct and empirically test a model that examines online impulse buying as a phenomenon triggered by system design factors. By incorporating the two-system model, this study offers a theoretical underpinning of the role of cognitive processing in impulse buying. Another significant extension of the “SOR” framework is to introduce presence as the system stimulus that captures the overall virtual experience and to specify the associated design features; i.e. interactivity and vividness.

This paper is structured as follows. We first define impulse buying and its related construct, and follow this with a discussion of the theoretical foundation for this research. Drawing upon the previous literature, we propose the research model and justify the hypotheses. This is followed by a description of the experiment and a discussion of the results. In conclusion, we summarize the study, discuss the theoretical and practical implications, and make suggestions for future research.

2. Theoretical background

2.1 *Impulse buying and buying impulse*

According to Rook (1987, p. 191), “impulse buying occurs when a consumer experiences a sudden, often powerful and persistent urge to buy something immediately. The impulse to buy is hedonically complex and may stimulate emotional conflict. Also, impulse buying is prone to occur with diminished regard for its consequences.” This definition implies that the impulsive urge to buy or the buying impulse is a defining characteristic of impulse buying, which refers to “the state of desires experienced upon encountering an object in the environment” (Beatty and Ferrell, 1998, p. 172). Impulse buying behavior occurs after experiencing an urge to buy and it tends to be spontaneous and lacking in much reflection. However, having a buying impulse does not necessarily mean acting upon it. Between the buying impulse and the actual purchase, various factors may intervene (Dholakia, 2000; Rook and Fisher, 1995) and, in fact, individuals use a myriad

of strategies to gain some control over this desire (Hock and Loewenstein, 1991). This distinction has also been empirically validated. For instance, Beatty and Ferrell (1998) empirically demonstrate the necessity to separate the buying impulse from the actual buying behavior, by showing the superior performance of their model when buying impulse was considered as the final dependent variable. Consistent with prior studies (Beatty and Ferrell, 1998; Rook, 1987), we also distinguish between buying impulse and impulse buying as the actual buying behavior acting upon the buying impulse. Moreover, existing findings (e.g. Beatty and Ferrell, 1998) also imply that the determinants for buying impulse may not necessarily predict impulse buying. In other words, not every buying impulse is enacted into actual buying behavior. Thus, it remains necessary to explore the contingencies in transforming impulse buying and buying impulse.

2.2 SOR paradigm and the Mehrabian-Russell model (M-R) model

Impulse buying is typically conceptualized as a reactionary behavior that involves a immediate response to stimuli presented within the retailing environment (Piron, 1991; Smith and Sivakumar, 2004). Both theoretical and empirical evidence has shown that the emotional or affective state is the main driver for the impulsive behavior (Strack and Deutsch, 2003). Thus, the SOR paradigm, widely applied in consumer behavior research (Jacoby, 2002; Jeong, 2009; Manganari *et al.*, 2011), offers a ready theoretical foundation. In particular, derived from this paradigm, the M-R model classifies two typical responses to stimuli – approach or avoidance – and proposes that three basic emotional states (acronym PAD) mediate the responses to the stimuli in retailing environments: pleasure-displeasure; arousal-non arousal; and dominance-submissiveness (Mehrabian and Russell, 1974). Pleasure refers to the degree to which a person feels happy or satisfied in a place; arousal concerns the degree of stimulation caused by an atmosphere; and dominance indicates the degree to which a person feels in control of a situation and feels to have influence over his/her surroundings and others. However, due to lack of empirical support, dominance has been removed from the model (Donovan *et al.*, 1994). Similarly, in application to the present study, the buying impulse and impulse buying are conceptualized as responses to the stimuli offered by an online environment, as mediated through emotional states.

The M-R model has been applied to explain impulse buying both offline (Youn and Faber, 2000) and online (Koufaris, 2002; Madhavaram and Laverie, 2004; Parboteeah *et al.*, 2009) (see Table I for a summary of studies using the M-R model). Compared to the studies in offline settings, research on online impulse buying tends to focus on specific web site features and to demonstrate their influences on online impulse buying. For instance, Parboteeah *et al.* (2009) investigated task and mood-related cues, where task-related cues included features like security, download delay, information fit-to-task, and navigation, while mood-related cues were indicated by background colors and associated graphics. Koufaris (2002) singled out value-added search mechanisms as a determinant for unplanned purchases and Adelaar *et al.* (2003) focussed on the different media formats. Although the findings of these previous studies provide insights about the impacts of specific features on online impulse buying, this research fails to shed light on the effect of the overall virtual experience brought about by the web site itself on online impulse buying (Li *et al.*, 2001). Unlike offline shopping, where consumers can have direct interaction with the actual products, online shopping is mediated through web sites. Thus, the experience with a web site as a whole, rather than a specific feature about the web site, might be more relevant and proximate with ultimate purchasing behavior.

						Online impulse buying
Authors	Stimuli/	Cognitive factors	Affective factors	Dependent variable	Method	
<i>Online setting (selected studies)</i>						399
Parboteeah <i>et al.</i> (2009)	Task vs mood-relevant cues	Perceived usefulness na	Perceived enjoyment	Urge to buy impulsively	Lab experiment	
Madhavaram and Laverie (2004)	Web features		Mood states	Impulse purchase	Exploratory survey	
Adelaar <i>et al.</i> (2003)	Media format		PAD	Impulse buying	Lab experiment	
Koufaris (2002)	Value-added search mechanisms	Perceived control; concentration (from the flow theory)	Shopping enjoyment	Intent to buy Unplanned purchases	Survey	
<i>Offline setting (selected studies)</i>						
Peck and Childers (2006)	Environmental salience of touch	Normative evaluation (moderator)		Actual Impulse purchasing	Field experiment	
Dholakia (2000)	Market stimuli Situational factors	Cognitive evaluation (moderator)	Mood states	Impulse and impulse enactment	Survey	
Youn and Faber (2000)	Atmospheric cues in retail settings, marketer-controlled cues, and marketing mix stimuli	na	Positive and negative feeling states	Impulse buying tendency	Survey	
Beatty and Ferrell (1998)			Positive and negative feeling states	Felt urge to buy impulsively and impulse buying	Survey	

Table I.
Studies on impulse buying based on the M-R model

Second, confusion remains regarding the role of cognitive processing in online impulse buying. While Parboteeah *et al.* (2009) modeled perceived usefulness as determinant of buying impulse with its impact mediated through enjoyment; Koufaris (2002) clearly argued against using TAM variables for predicting online impulse buying, as “TAM predicts intention to use a technology and subsequently the amount of usage. It does not differentiate between specific kinds of use or the results of such use, such as making unplanned purchases at a Web store” (p. 210). Furthermore, the buying impulse is characterized with high affective activation of the consumer, little intellectual control of the buying decision, and largely automatic behavior actuated by a special stimulus situation (Weinberg and Gottwald, 1982). In most prior consumer research on impulse buying in offline settings, cognitive processing has been mostly either modeled as direct factors to resist buying impulse (Vohs and Faber, 2007) or as moderators that intervene in the actual impulse buying (Dholakia, 2000; Rook and Fisher, 1995). Thus, how to model cognitive processing requires further exploration.

In the following sections, we would like to focus on the role of system design and virtual experience in triggering online impulse buying and to propose an alternative conceptualization of cognitive processing.

2.3 Cognitive processing in impulse buying and the two-system model

Although impulse buying is usually described as irrational, hedonic, and unreflective, it is not free from cognitive processing. The question is when cognitive processing likely happens during an impulse buy. We seek answers from the social psychological theories. Strack and Deutsch (2004) explain social behavior with a two-system model that specifies a joint function of reflective and impulsive systems. The reflective system generates behavioral decisions based on knowledge about facts and values, i.e. intention, whereas the impulsive system elicits behaviors through associative links and motivational orientations (in this case, buying impulse). Compared with the reflective system, the impulsive system is more rapid and has a lower threshold for processing incoming information. These advantages afford the impulsive system more primacy over the reflective system. In other words, the impulsive system is always engaged in processing (by itself or parallel to operations of the reflective system), but the reflective system may or may not be engaged. Hence, formation of an impulse requires no or little cognitive effort, but acting upon an impulse most likely involves reflective processes.

This model echoes the conceptualization of the buying impulse proposed by Weinberg and Gottwald (1982), wherein the buying impulse is characterized by high affective activation of the consumer, little intellectual control of the buying decision, and largely automatic behavior actuated by a special stimulus situation. Consistent with the two-system model, Dholakia (2000) further highlight the rapidity of formation of a buying impulse, which precludes deliberate processing of incoming information.

While the experience of a buying impulse involves little cognitive processing, the temporal delay between a buying impulse and an impulse buy may trigger the reflective system to evaluate the presence of possible constraints (Loewenstein, 1990) or normative influences (Rook and Fisher, 1995). This is also consistent with the idea held by social psychologists that thoughts regarding action occur spontaneously and primarily out of necessity, while action execution involves more than just reflexive responses to cues (Vallacher, 1993). Thus, cognitive processing has been modeled as moderating the relationship between the buying impulse and impulse buying (or enactment of a buying impulse) (Rook and Fisher, 1995). Dholakia (2000) further proposes that a consumer acting upon his/her buying impulse will be contingent upon the congruence between the buying impulse and cognitive evaluation.

In the present study, we follow the same line of thought to conceptualize impulse buying as the result of the interaction between buying impulse and cognitive processing. Since the focus of the current study is to illustrate the role of cognitive processing in online impulse buying, rather than to exhaust the possible cognitive evaluations (see Rook and Fisher, 1995; Dholakia, 2000 for more discussion), we only include one cognitive factor, i.e. value perception, which refers to the overall assessment of the utility of a product based on perceptions of what is received and what is given (Zeithaml, 1988). Value perception, as one of major outputs from the reflexive system, has been applied in consumer research to explain a wide variety of consumer behavior (e.g. Baker *et al.*, 2002).

2.4 Virtual experience as system stimuli: presence and design features

While the internet has become another important retailing channel with low cost and high convenience, it also falls short of customers' expectations to "experience" products (Madhavaram and Laverie, 2004). Since the shortened proximity between products and customers is important in fueling buying impulse (Dholakia, 2000; Hock and Loewenstein, 1991), it is desirable to reduce the distance between products

and customers due to computer-mediated interaction and to create a virtual experience that is compelling, vivid, involving, active, and psychologically affective (Li *et al.*, 2001; O'Cass and Carlson, 2010). Presence, by definition, represents this type of virtual experience, wherein "a person fails to perceive or acknowledge the existence of a medium in his or her communication environment and responds as if he or she would if the medium were not there" (Lombard and Ditton, 1997, p. 77). Two types of presence are proposed in prior research; i.e. telepresence and social presence. Telepresence or physical presence refers to the sense of being located somewhere, describing an immersive experience induced by a web site (Steuer, 1992). Social presence, on the other hand, is typically defined as the feeling of being together with the others (Ijsselstein *et al.*, 2000). In the context of online shopping, we adopt the perspective of social presence that focusses on "warmth," which indicates that the shopping web site conveys a feeling of human contact, sociability, and sensitivity (Hassanein and Head, 2005/2006; Rice and Case, 1983; Wang *et al.*, 2007). As an online customer experiences a strong sense of presence, his/her attention is more engaged in the virtual environment (Klein, 2003). The sense of presence reflects the extent to which the system design reduces the physical and social distance associated with computer mediation. Significant support exists for the value of this construct in studying online shopping experience in general (Hoffman and Novak, 1996; Novak *et al.*, 2000; Steuer, 1992).

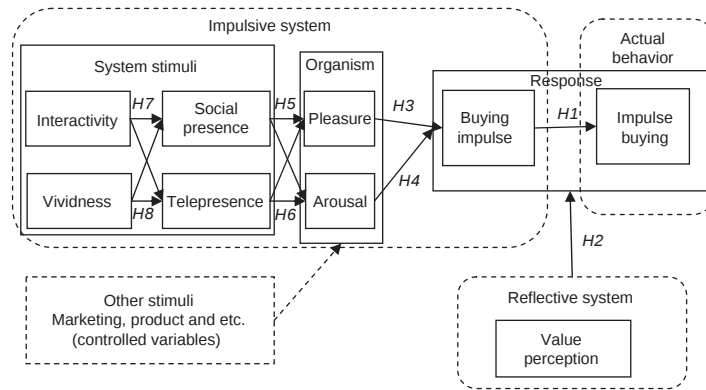
In the present study, presence that captures the overall virtual experience with an online shopping web site is proposed as the direct stimulus in the M-R model. To enhance the practical relevance, it is necessary to identify the design factors that may enhance the sense of presence. Lombard and Ditton (1997) provide comprehensive reviews of technological features shaping presence, most of which adhere to Steuer's (1992) conceptualization of technological features; i.e. interactivity and vividness. As the key advantage of new media (Rafaeli, 1989), interactivity describes the extent to which users can participate in modifying the form and content of a mediated environment in real time (Steuer, 1992). The literature indicates that user control (Hoffman and Novak, 1996) and information exchange (Bretz, 1984) are the two main components of interactivity. In the present research, interactivity is conceptualized as the susceptibility and responsiveness of computer-mediated stimuli to user control (Ariely, 2000; Klein, 2003; Sautter *et al.*, 2004; Steuer, 1992).

Vividness refers to the representational richness of mediated stimuli. Steuer (1992) conceptualizes vividness as a two-dimensional construct consisting of sensory width and sensory depth. Sensory width relates to the number of sensory dimensions simultaneously presented, and sensory depth describes the resolution within each of these perceptual channels. This conceptualization is developed for virtual reality systems where sensory stimulations are rich and diversified. However, for online shopping web sites, the simultaneous use of multiple sensory channels is limited. Furthermore, users tend to form a general impression rather than focus on specific facets of sensory stimulations (Anderson and Bower, 1980; Nisbett and Ross, 1980). Therefore, even though sensory depth and sensory width can be distinguished conceptually, in practice, this distinction is blurred for users. Consequently, we conceptualize vividness as a one-dimensional construct. Recent operationalization of vividness in the IS literature has also favored a one-dimensional approach (e.g. Khalifa and Shen, 2004).

3. Research model and hypothesis development

Figure 1 presents the proposed model for online impulse buying. There are three major differences from past applications of the M-R model and prior research on online

Figure 1.
Theoretical model for
online impulse buying



impulse buying. First, we examine both buying impulse and impulse buying. Second, drawing upon the two-system model and prior research on impulse buying, we provide a theoretical underpinning for the moderating role of cognitive processing (i.e. value perception) in the relationship between buying impulse and impulse buying. Third, going beyond the specific web site features, we conceptualize the overall virtual experience (i.e. telepresence and social presence) as the system stimuli and identify their associated system design features, which we believe has substantial practical implications. In the following, specific hypotheses from our model are developed and presented.

3.1 Buying impulse, value perception, and impulse buying

Consistent with prior studies that distinguish the buying impulse from actual impulse buying (Beatty and Ferrell, 1998; Rook and Gardner, 1993), this research also decomposes impulse buying into two stages; i.e. motivation and enactment (Weinberg and Gottwald, 1982). The buying impulse provides a motivational impetus for the subsequent buying behavior. "Once triggered, an impulse encourages immediate action, and the urge may be powerful and persistent" (Rook, 1987). Obviously, the strength of the buying impulse will determine the likelihood of engaging in impulse purchasing (Beatty and Ferrell, 1998):

H1. The buying impulse has a positive effect on impulse buying.

No matter how rapidly an impulse buy is conducted, the temporal delay between a buying impulse and the actual behavior allows for possible cognitive processing. This is also consistent with the two-system model, which suggests that behavior results from the interaction between the reflexive and impulsive systems (Strack and Deutsch, 2004). Value perception (i.e. the overall assessment of the utility of a product based on perceptions of what is received and what is given, Zeithaml, 1988), is one of main inputs from the reflexive system. For consumers, if the value perception is consistent with the buying impulse, the consumer may view the buying impulse as harmonious with his or her goals, resources, and situation, which will further reinforce the buying impulse. The consumer will then respond through an expression of his or her buying impulse. On the contrary, any dissonance between the value perception and the

buying impulse may reduce the chance of acting upon the buying impulse. Thus, we hypothesize that:

- H2.* The relationship between impulse buying and buying impulse is positively moderated by value perception.

3.2 Effect of the online organism on the buying impulse

As specified in the M-R model (Mehrabian and Russell, 1974), the affective reactions to the environment, i.e. pleasure and arousal, will determine an individual's response (in this study, the immediate response is the buying impulse). Specifically, pleasure serves as motivation for impulse buying, while arousal impacts impulse buying through mobilization (Rook and Gardner, 1993). An individual who feels pleasure with the shopping experience tends to use this momentary affective state as information in making a judgment (Schwarz, 1983) and is also motivated to process information that is consistent with this positive mood (Adaval, 2001). Thus, if other factors are equal, an individual in a pleasant state is more prone to experience a buying impulse. The effect of pleasure on the buying impulse has been examined in both online (Adelaar *et al.*, 2003; Parboteeah *et al.*, 2009) and offline settings (Beatty and Ferrell, 1998; Donovan *et al.*, 1994). Consistently, we hypothesize that:

- H3.* A greater feeling of pleasure will promote a stronger buying impulse in the online customer.

As predicted by the M-R model, the effect of arousal is bidirectional and contingent upon pleasure. In a pleasant environment, arousal is the cause for approach behavior; whereas in an unpleasant environment, arousal predicts avoidance behavior (Donovan *et al.*, 1994). Given a pleasant online shopping environment, consumers who are highly aroused allocate more attention and are more likely to continue exploring the web site and approach the products/services. The extended browsing may lead to buying impulse. On the contrary, in an unpleasant online shopping environment, highly aroused consumers are more aware of the unpleasant and therefore tend to discontinue the exploration or leave the web site. Thus, we hypothesize that:

- H4.* The effect of arousal on online buying impulse will be positive for consumers experiencing pleasure and negative for consumers not experiencing pleasure.

3.3 Effect of presence on the online organism

Prior studies using the M-R model have supported the notion that stimuli in a physical shopping environment influence consumers' arousal and pleasure (e.g. Donovan and Rossiter, 1982; Youn and Faber, 2000). Social factors, such as employees, are important characteristics of physical stores (Brady and Cronin, 2001). A friendly and sociable sales person has a positive influence on shoppers' arousal and pleasure (Baker *et al.*, 1992).

Compared with physical stores, online shopping web sites can be viewed as lacking human touch and sociability. Thus, adding social cues to a web site may make the human-computer interaction feel more "natural" and sociable (Hassanein and Head, 2005/2006). For instance, pictures and text content can convey a personal presence, in the same way that personal photographs and letters can (Gefen and Straub, 2003). Some social cues are likely to elicit responses to the computer as a social actor, such as

labeling the computer as “tutor” (Nass and Moon, 2000) or using voice for human-computer interaction (Steuer and Nass, 1993).

The resulting sense of social presence is confirmed to convey an impact similar to that of social factors in a physical store (Wang *et al.*, 2007). Consumers with strong sense of social presence will feel as if they are interacting with a social actor, such as a friendly and warm employee. Thus, these consumers are more likely to feel emotionally satisfied. Research on social presence also demonstrates that pleasure is the most prominent psychological impact of social presence (Hassanein and Head, 2005/2006; Lombard and Ditton, 1997). Reeves and Nass (1996) suggest that giving technology more social cues “turns up the social volume,” especially for some social cues that demand more activities from consumers. This also implies that consumers who interact with a web site that conveys a strong sense of social presence will be more likely to feel aroused (Wang *et al.*, 2007). Thus, we hypothesize that:

H5a. The sense of social presence with a web site has a positive effect on pleasure.

H5b. The sense of social presence with a web site has a positive effect on arousal.

Telepresence, on the other hand, is defined as the sense of being present in a remote environment (Steuer, 1992). In the context of online shopping, telepresence is mainly applied to describe the extent to which an online shopping web site can simulate direct experiences (Hopkins *et al.*, 2004; Klein, 2003). For instance, many web sites now use three-dimensional presentation to simulate a direct product experience (Li *et al.*, 2001). Advertising that is more interactive is introduced to online web sites to engage consumers (Lombard and Snyder-Duch, 2001). As the degree of the sense of telepresence increases, the computer-mediated experience will become much richer and more similar to an unmediated direct product experience (Klein, 2003). A strong sense of telepresence also implies that consumers will direct more attention to the online web site rather than the physical environment. Empirical evidence has shown that telepresence can induce positive affective feelings, such as arousal, affect, and enjoyment (Lombard and Ditton, 1997; Novak *et al.*, 2000). Accordingly, we hypothesize that:

H6a. The sense of telepresence with a web site has a positive effect on pleasure.

H6b. The sense of telepresence with a web site has a positive effect on arousal.

3.4 Effect of interactivity and vividness on presence

An interactive web site enables participants to examine the material and to determine the pace with which they want to proceed (Kettanurak *et al.*, 2001). Users with greater control over their actions tend to be more immersed in the mediated experience and therefore develop a stronger sense of presence (Witmer and Singer, 1998). The positive relationship between interactivity and telepresence has received wide empirical support in different contexts, such as, commercial web sites (Coyle and Thorson, 2001; Klein, 2003) and the online community (Khalifa and Shen, 2004). Interactivity is also believed to have a positive relationship with social presence (Williams and Rice, 1983). For example, Garramone *et al.* (1986) demonstrate that the degree of social presence felt with a bulletin board system is higher for the more interactive users. Fortin and

Dholakia (2005) also empirically demonstrate that internet ads that are more interactive evoke a greater sense of social presence. Accordingly, we hypothesize that:

- H7a.* Online stimuli that are more interactive will induce a stronger sense of telepresence in the online customer.
- H7b.* Online stimuli that are more interactive will induce a stronger sense of social presence in the online customer.

Vividness is often cited as an important determinant of presence (Lombard and Ditton, 1997). Prior research provides much evidence supporting the positive effect of vividness on telepresence (Lombard and Ditton, 1997; Steuer, 1992). Bhatt (2004) shows that the vividness of a web site enhances the user's engagement, an important indicator of telepresence. The positive relationship between vividness and social presence has been confirmed by studies on avatar use and anthropomorphic agents (e.g. Choi *et al.*, 2001). In a recent study, Khalifa and Shen (2004) empirically demonstrate the positive effect of vividness on both telepresence and social presence in virtual communities. Therefore, we hypothesize that:

- H8a.* Online stimuli that are more vivid will increase the sense of telepresence felt by the online customer.
- H8b.* Online stimuli that are more vivid will increase the sense of social presence felt by the online customer.

4. Research methodology

As indicated in Table I, laboratory experimental design is effective for studying the effects of system design stimuli on online impulse buying (Adelaar *et al.*, 2003; Parboteeah *et al.*, 2009). This design can better control the other non-system stimuli, such as product, marketing, and situational stimuli. Similarly, in the present study, the research model was validated by an experiment with a 2×2 full factorial design involving 151 undergraduate students. Interactivity (I) and vividness (V) were manipulated with two levels each, i.e. high (H) and low (L). A fictitious VCD movie store was created, with four storefronts representing each combination of treatments (i.e. HIHV, HILV, LIHV, and LILV). Before the main study, a pilot test was conducted with 34 undergraduate students; this was followed by a focus group discussion. The pilot results helped us to refine the experimental setting, including product selection, pricing, marketing stimuli, interface design, instrument design, and experimental procedure.

4.1 Participants

Undergraduate students were used in the empirical study since young people have constituted a large proportion of online shoppers (Dutta *et al.*, 2003). The study by Harris Interactive and Nickelodeon Online found that online users in USA between 18 and 24 years old spent 13 percent of their total expenditure online, indicating the youth are an active segment in online shopping. In Hong Kong, 75 percent of internet users are between 18 and 24 years old, 78 percent of them have an education at or above the college level. Therefore, the empirical study used undergraduate students as subjects. An e-mail invitation to participate in the experiment was sent to around

800 second-year undergraduate students. The final participants consisted of 34 students for the pilot test and 151 students for the main study, resulting in a response rate of 23 percent. There were 91.2 percent of participants between 20 and 25 years old and 82.4 percent of them had three to four years of internet experience. The demographic profile of the sample was consistent with that of the undergraduate students in the university.

The subjects were grouped based on gender. Each group was then randomly assigned to the four experimental groups representing each combination of treatments, to ensure equal representation of males and females. Individuals in each group were compared on a number of variables, including product involvement, attitudes toward online shopping, information processing styles, online shopping experience, and impulsivity. The results of a one-way analysis of variance, using manipulations as a grouping variable, indicated no significant difference for all variables, implying no individual differences across treatments.

4.2 Experimental setting: product, marketing, and situational stimuli

In creating this movie store, we managed to enhance the chances of observing the buying impulse and resulting buying by carefully choosing the product and marketing stimuli.

The choice of VCD movies as the only experimental products was made for the following reasons. First, use of a single type of product avoided the confounding effect of product types. Second, VCD movies are hedonic in nature and are more likely to stimulate a buying impulse (Rook, 1987). Third, VCD movies are very affordable, which reduces the budget concerns that might hinder the buying impulse. Finally, the standard market price of VCD movies reduces the potential uncertainty and ensures the same referent point for the subjects' value perception. To make the web site more realistic, we included 307 movies collected from popular movie web sites (such as imdb.com). Based on the general categorization used in real online stores, these movies were grouped into seven categories with over 40 movies in each category.

A 50 percent discount was used as a marketing stimulus to promote the buying impulse and impulse buying across the treatment groups. Use of a discount price is quite common in real online marketing. Finally, to alleviate the impact of situational factors, such as budget constraints, 100 HK dollars was given to each subject prior to their shopping experience as a reward for their participation. Participants were instructed that they did not have to spend money to buy VCD movies. The Amazon one-click transaction was adopted to shorten the delay between the buying impulse and impulse buying. Security and anonymity were assured prior to the experiment.

4.3 Manipulation and interface design

The system stimuli (i.e. interactivity and vividness) were set at two levels; i.e. high and low (see Table II). Based on the classification of interactivity level provided by Kristof and Satran (1995), the incremental method was used for the operationalization of interactivity (Burgoon *et al.*, 2000). With this design, the difference between two levels of interactivity could be attributed to the increasing levels of interactivity (Teo *et al.*, 2003). The same method was used for vividness and the manipulation was derived from the conceptualization in Steuer (1992), where vividness is defined in terms of sensory breadth and sensory depth. A higher level of vividness presents simultaneous sensory dimensions and higher resolution within each sensory channel. Prior studies have considered multi-media to be more vivid than pure text (Coyle and Thorson, 2001).

Variables	Level	Manipulation	Features
Interactivity (Schaffer and Hannafin, 1986; Burgoon <i>et al.</i> , 2000; Teo <i>et al.</i> , 2003)	High	Control over pace Control over sequence Control over variables Control over objects	Sequential browsing Choose specific movie Customize the database search Move posters or titles around the screen
	Low	Control over pace	Sequential browsing
Vividness (Kisielius and Sternthal, 1984; Keller and Block, 1997)	High	Multiple sensory channels with pictorial presentation	Text, images (movie posters) and multi-media (movie trailers)
	Low	Single sensory channel without pictorial presentation	Text only

Table II.
Manipulation and implementation

To avoid the confounding between the operationalization of interactivity and vividness, we did not include control over the media in the manipulation of interactivity. In addition, subjects could only passively watch the trailers, no matter their level of interactivity.

4.4 Measures

Consistent with prior studies (Beatty and Ferrell, 1998; Parboteeah *et al.*, 2009), we used a reflective scale consisting of four items, adapted from a study by Beatty and Ferrell (1998) that measured the buying impulse. We shortened the recall time by measuring it immediately after the subject clicked “Buy,” thereby capturing the felt urge at the moment and reducing the chance for rationalization.

Impulse buying is operationalized with a binary measure to indicate whether a buying impulse is enacted or not. It was given a value of 1 if the subject finished the transaction by clicking “confirm” in the transaction page; otherwise the value was 0. The measurement of actual behavior in this study enhances its real-world relevance. Using an objective measure can also reduce the common method variance. For further verification, an open question was added wherein the subject was asked to describe their shopping experience, as impulse buying episodes are memorable with reasonable accuracy (Rook and Gardner, 1993). Those who stated that their purchases had been well planned and goal-oriented were removed from the data analysis.

Perceived value was measured with five items developed by Adelaar *et al.* (2003). The measures for pleasure and arousal were adapted from the polar-scale developed by (Mehrabian and Russell, 1974) and well validated by numerous studies (e.g. Holbrook *et al.*, 1984; Rook and Gardner, 1993). For social presence, we adapted the measures developed by Short *et al.* (1976) and validated by several studies (e.g. Venkatesh and Johnson, 2002). The measurement of telepresence relied on the widely used “arrival” and “departure” instrument developed by Kim and Biocca (1997).

The manipulations of interactivity and vividness were confirmed to have the intended effects by the use of self-reported measures. For interactivity, the items regarding control levels were created. Three items measuring interactivity level, adapted from Liu (2003) and McMillan and Huang (2002), were also added. Vividness was measured with the “Visual Vividness Imagery Questionnaire” developed by Marks (1973); this is a widely used instrument with high reliability and validity (Campos *et al.*, 2002).

In addition to variables included in the research model, we also identified the following four control variables: involvement, information processing preferences, impulsivity, and attitude toward online shopping. Involvement refers to a person's perceived relevance of the object based on inherent needs, values, and interests (Zaichkowsky, 1985). Compared with a customer with low product involvement, a customer with high product involvement may be more active in information processing (Engel and Blackwell, 1982), and may exert a greater cognitive effort during comprehension of the product information (Celsi and Olson, 1988). Therefore, the degree of product involvement may confound the effects of system stimuli. To measure product involvement, we relied on the personal involvement inventory developed by Zaichkowsky (1985). Second, customers differ not only in their level of involvement, but also in their information processing preferences, i.e. the strategies for information acquisition and information utilization (Childers *et al.*, 1985). These differences are of special relevance in this study since the manipulation of vividness is based on different information presentation modes. Therefore, we used the Style of Processing scale to measure visual/verbal information processing ability and preference (Childers *et al.*, 1985). Third, buying impulsivity is an important personality factor that directly affects the generation of the buying impulse and its enactment. Consistent with prior studies, we adopted the items used by Rook and Gardner (1993) to measure impulsivity. Finally, the frequency of online shopping is used as indicator of past experience. The attitude toward online shopping was measured with four items adapted from Ajzen (2001), all of which may influence online shopping decisions.

4.5 Tasks and procedure

The experiment consisted of two stages, spanning two weeks. In the first stage, the subjects were told that their task was to evaluate an online movie store before it became operational. The subjects logged into the system with the ID/password assigned by the researchers. All functions related to transaction processing were disabled. The minimum time for browsing was ten minutes and there was no maximum time limit. At the end of browsing, we measured control variables, system design factors, and the organismic factors. Separating the measures at different time points reduces the common method bias. The first stage also serves as a learning process, allowing participants to become familiar with the online store and subsequently reducing the cognitive load in the shopping stage.

The second stage was arranged after one week. The subjects were told that they were going to revisit the same store web site after it had become operational and that any purchase they made through this web site was real and secured. It is necessary to note that, although the same interface was used across different stages, the sequence of movies was reshuffled to reduce the possibility of recall effects.

Each subject received 100 HK dollars before the start of the experiment. They were informed that they could use it for online shopping with this web site, but that purchases were totally voluntary. If they wanted to buy through this store, the only payment method was in cash upon the receipt of the order. After they entered the web site, a message was presented telling them that the online store was offering a 50 percent discount for all products as a special reward for their participation in assessing the web site. There was no time limit and they could quit any time by clicking "Exit" to leave the web site. If they wanted to make a purchase, they could click "Buy."

Immediately following an action (e.g. clicking "Exit" or "Buy"), a survey on the buying impulse was presented on the subsequent page. The question presented to

those choosing “Buy” was: “Please rate the extent to which you agree or disagree with the following statements, by dragging these slide bars”; while the question for those choosing “Exit” was: “Think about the VCD movie that attracted you most during the browsing and indicate the extent of agreement/disagreement with the following statements, by dragging these slide bars.” After finishing the survey, those who chose “Buy” were sent to the transaction page, which included a summary of product information, cost, payment, and the time for pickup. Two options were then provided; participants could either abandon the shopping cart or confirm the transaction. Either of these choices would lead to the exit survey, which included measures of value perception and an open question describing shopping experiences.

The subjects did not need to provide personal information for shipping or payment, which alleviated privacy concerns. In addition, the one-click transaction was used in this experiment for a further reduction in the cognitive consideration in the subjects’ behavior. Finally, the exit survey was presented, which consisted of the measure for value perception. To reduce the effects of social desirability bias, we emphasized to participants that there were no right or wrong answers to the questions and that it was important for them to shop as they pleased.

4.6 Data analysis

A manipulation check was used to confirm the effectiveness of the treatments. The method of multiple analyses of variance (MANOVA) was used, with averaged responses for manipulation check items and the dependent variables, to test the validity of the experimental design. Harman’s single-factor, a widely used method, was then used to check the common method variance (Podsakoff and Organ, 1986). According to this approach, common method variance is present if a single factor accounts for the majority of the covariance in the dependent and independent variables. The data were then analyzed in a holistic manner using the partial least squares (PLS) procedure, because it is able to model latent constructs under conditions of non-normality and small- to medium-sample sizes (Chin *et al.*, 2003). We conducted tests of significance for all paths using the bootstrap re-sampling procedure (Cottelman and Senn, 1992) and the standard approach for evaluation that requires path loadings from construct to measures to exceed 0.70. For checking internal consistency, we relied on composite reliability measures (ρ), as suggested by Chin (1998), and on the average variance extracted (AVE), as suggested by Fornell and Larcker (1987). We tested the discriminant validity by comparing the square root of the AVE for a particular construct to its correlations with the other constructs (Fornell and Larcker, 1987) and by examining cross-loadings of the constructs.

5. Empirical results and discussion

In total, 83 subjects (55 percent) purchased VCD movies from the web site. This implied that the experimental setting, including marketing stimuli, product choice, and transaction design, was effective in stimulating buying impulse and actual purchasing behavior while avoiding a ceiling effect.

5.1 Manipulation check

The results of MANOVA (see Table III) indicated no interaction between the treatments for interactivity and vividness, implying no confounding in the treatment. The manipulation for interactivity showed significant effects for all variables except for perceived vividness; while the manipulation for vividness showed significant

effects for all variables except for perceived interactivity. The results of MANOVA confirmed the validity of the experimental design.

5.2 Measurement model

As indicated in Table IV, the composite reliability scores (ρ) of all constructs were higher than the recommended value of 0.80, indicating internal consistency (Nunnally and Bernstein, 1994). The convergent validity was verified by examining the AVE. The AVE value indicates the amount of variance that a latent variable component captures from its indicators, relative to the amount due to measurement error. The AVE scores for all constructs were much higher than the generally recognized cutoff value of 0.50. In addition, all reflective items were significant at the 99 percent level, with high loadings (all above 0.70 and most above 0.80), demonstrating the convergent validity.

We tested the discriminant validity by comparing the square root of the AVE for a particular construct to its correlations with the other constructs (Fornell and Larcker, 1987) and by examining cross-loadings of the constructs. The square roots of the AVE scores were all higher than the correlations among the constructs (as indicated in Table V), demonstrating discriminant validity. All items also loaded higher on their respective constructs than on others (see Appendix), providing additional evidence for discriminant validity.

Common method variance was examined with Harman’s single factor, a widely used method used to check the common method variance (Podsakoff and Organ, 1986). The factor analysis, without any rotation, resulted in nine variables, with the first one accounting for only 30 percent of the variance. Thus, common method variance may not be a serious concern in this study.

5.3 Hypothesis testing and the structural model

Figure 2 presents the results of the PLS analysis of the structural model using the design stimuli as the independent variables. After accounting for the control variables, the structural model results indicated a good explanatory power for the buying impulse ($R^2 = 40.2$ percent) and impulse buying ($R^2 = 60.2$ percent), as well as for organismic variables (i.e. pleasure, $R^2 = 33.2$ percent; and arousal, $R^2 = 51.8$ percent) resulting from the system stimuli. Finally, interactivity and vividness proved to be effective in creating telepresence ($R^2 = 31.9$ percent) and social presence ($R^2 = 39.1$ percent). These results provided strong support for the research model.

5.4 Impulse buying and buying impulse (H1-H4)

Previous studies state that buying impulse precedes actual purchase behavior and serves as an imminent motivation. This proposition was also validated in the online

Table III.
Manipulation check

Dependent variable	Interactivity		Vividness		Interaction term	
	F-value	Significance	F-value	Significance	F-value	Significance
Perceived interactivity	2,499.03	0.000	0.036	0.850	0.009	0.923
Perceived vividness	0.018	0.894	1,380.03	0.000	0.438	0.509
Telepresence	23.772	0.000	82.44	0.000	0.037	0.847
Social presence	55.631	0.000	43.882	0.000	2.430	0.121
Pleasure	196.73	0.000	179.535	0.000	2.426	0.122
Arousal	11.789	0.000	59.478	0.000	0.471	0.494

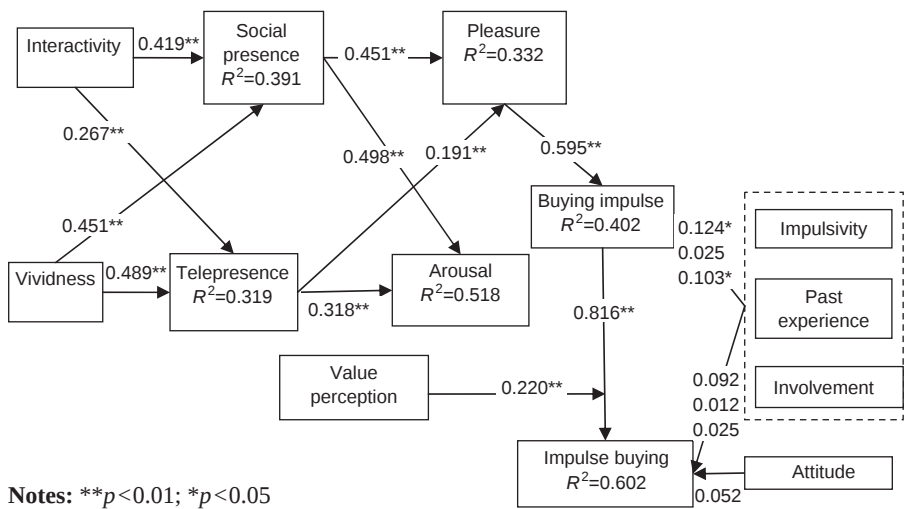
Construct	Items	Loadings	SE	<i>t</i> -statistics
Social presence $\rho = 0.998$; AVE = 0.990	Item1	0.99	0.00	1,149.26
	Item2	0.99	0.00	582.21
	Item3	0.98	0.00	1,030.90
	Item4	0.99	0.00	1,155.45
Telepresence $\rho = 0.885$; AVE = 0.658	Item2	0.80	0.05	14.82
	Item3	0.75	0.10	7.62
	Item4	0.83	0.05	17.59
	Item5	0.84	0.05	17.98
Pleasure $\rho = 0.964$; AVE = 0.900	Item1	0.96	0.02	55.03
	Item2	0.92	0.02	56.30
	Item3	0.97	0.02	62.86
Arousal $\rho = 0.969$; AVE = 0.853	Item1	0.92	0.02	52.30
	Item2	0.95	0.01	70.73
	Item3	0.94	0.01	66.67
Impulse $\rho = 0.994$; AVE = 0.976	Item1	0.98	0.00	320.30
	Item2	0.99	0.00	1,324.39
	Item3	0.98	0.00	364.18
	Item4	0.99	0.00	740.97
Value perception $\rho = 0.92$; AVE = 0.706	Item1	0.90	0.03	27.59
	Item2	0.92	0.04	25.73
	Item3	0.91	0.03	32.28
	Item4	0.76	0.10	8.13
	Item5	0.63	0.12	5.53
Attitude $\rho = 0.960$; AVE = 0.856	Item1	0.94	0.02	48.69
	Item2	0.93	0.02	53.51
	Item3	0.95	0.01	83.46
	Item4	0.87	0.05	16.08
Impulsivity $\rho = 0.887$; AVE = 0.523	Item2	0.65	0.15	4.78
	Item3	0.68	0.16	4.64
	Item4	0.69	0.15	4.97
	Item5	0.65	0.17	4.10
	Item6	0.66	0.19	3.95
	Item7	0.65	0.18	4.15
	Item8	0.55	0.21	3.05
Involvement $\rho = 0.931$; AVE = 0.819	Item1	0.86	0.14	6.28
	Item2	0.87	0.15	5.72
	Item3	0.87	0.16	5.90

Table IV.
Measurement model

	TP	P	SP	A	BI	VP	I	AT	IN
Telepresence (TP)	<i>0.811</i>								
Pleasure (P)	0.432	<i>0.947</i>							
Social presence (SP)	0.534	0.553	<i>0.995</i>						
Arousal (A)	0.584	0.515	0.668	<i>0.923</i>					
Buying impulse (BI)	0.551	0.617	0.642	0.665	<i>0.988</i>				
Value perception (VP)	0.140	0.085	0.329	0.264	0.120	<i>0.840</i>			
Impulsivity (I)	0.168	0.110	0.116	0.143	0.167	0.017	<i>0.723</i>		
Attitude (AT)	0.292	0.359	0.441	0.307	0.334	0.439	0.054	<i>0.925</i>	
Involvement (IN)	0.005	0.064	0.085	0.006	0.114	0.029	0.228	0.079	<i>0.91</i>

Table V.
Correlations between
latent constructs (diagonal
elements are square roots
of the AVE)

Figure 2.
Structural model
(total respondents)



context ($H1$: $\beta = 0.816$, $p < 0.01$). Buying impulse had a great impact on resulting buying behavior. Consistent with Rook and Fisher (1995) and Dholakia (2000), the significant moderating effect of value perception ($H2$: $\beta = 0.220$, $p < 0.01$) demonstrated that even the rapidity of one-click transaction did not preclude the likelihood that consumers were still thinking and evaluating. This result also implied that positive value perception would catalyze the enactment of a buying impulse by removing the dissonance between cognition and the buying impulse.

To gain additional insight, we tested the alternative model with a direct effect of value perception on impulse buying. However, this direct effect was not significant, nor was another cognitive factor (attitude) in predicting impulse buying. Together, these results provided further support for the argument that impulse buying results from the interaction between the impulsive and reflective system. The insignificant effect of cognitive factors also suggested that the resulting buying behavior was more impulsive than reflective.

Consistent with prior studies, pleasure ($H3$: $\beta = 0.595$, $p < 0.01$) was a significant determinant of the buying impulse, demonstrating that a pleasant emotional experience during online shopping had a strong implication for action tendency. To test the conditional effect of arousal on buying impulse ($H4$), we split the sample into two groups based on their ratings of pleasure. Since only 33 subjects rated the online store as unpleasant, we could not run the PLS analysis to compare the coefficients. Instead, we compared the regression coefficient between arousal and buying impulse for two groups. Table VI summarizes the regression results for both pleasant and unpleasant groups. We found a significant positive effect of arousal on buying impulse when the subject rated the shopping environment as pleasant. However, for the unpleasant rating, neither arousal nor pleasure was significant. Thus, $H4$ was partially supported by the pleasant condition.

We also compared the correlation between arousal and buying impulse for both pleasant (correlation = 0.618) and unpleasant (correlation = 0.392) groups, using the method introduced by Fisher (1921). The resulting z -test was significant ($p = 0.04$), indicating that the correlation between arousal and buying impulse in a pleasant condition was significantly stronger than in an unpleasant condition.

5.5 Virtual experience: system design and presence (H5-H8)

As indicated in Figure 2, the virtual experience, as conceptualized as social presence and telepresence, had significant effects on emotional states, validating *H5* and *H6*. A compelling, warm, and sociable virtual experience is important for stimulating positive emotional states. To gain additional insight about the relative importance of specific virtual experience in stimulating emotional states, the *z*-test of Meng *et al.* (1992) was used to compare the correlated correlation coefficients (see Table V). The relationship between social presence and pleasure was stronger ($p < 0.05$) than the relationship between telepresence and pleasure, whereas this difference was only marginally significant with regard to arousal ($p = 0.07$).

Among the design factors, interactivity had a significant effect on both telepresence (*H7a*: $\beta = 0.267$, $p < 0.01$) and social presence (*H7b*: $\beta = 0.419$, $p < 0.01$). Similarly, vividness was significant for telepresence (*H8a*: $\beta = 0.489$, $p < 0.01$) and social presence (*H8b*: $\beta = 0.451$, $p < 0.01$). Together, these design factors explained 39.1 percent of the variance of social presence and 31.9 percent of the variance of telepresence. These results were consistent with prior studies (Khalifa and Shen, 2004; Novak *et al.*, 2000).

6. General discussion and implications

Drawing upon the M-R model and two-system model, our research investigated online impulse buying as triggered by system design factors. The research model was validated by an experiment with a 2×2 full factorial design involving 151 undergraduate students. The results provide strong support for the research model. Our research makes an important contribution to both IS and marketing literature by demonstrating the important role played by system design factors in explaining experiential online shopping.

6.1 Theoretical implications

The theory underlying the present research differs from that of most prior studies, which only examine the determinants of the buying impulse, with the assumption that the buying impulse is a proxy for impulse buying (e.g. Parboteeah *et al.*, 2009). The current study empirically examines the linkage between buying impulse and impulse buying, thereby providing a more holistic understanding of online impulse buying. This research also acts on the suggestion by Parboteeah *et al.* (2009) to incorporate actual behavior in studies on online impulse buying.

The integration of impulse buying also enables us to explore the role of cognition in online impulse buying. Hence, the second contribution of this study is that it offers an alternative, perhaps more relevant, theoretical underpinning about cognition in online

Variable	Unpleasant group ($N = 33$)				Pleasant group ($N = 118$)			
	β	Significance	β	Significance	β	Significance	β	Significance
Impulsivity	0.37	0.04	0.32	0.08	0.18	1.34	0.06	0.41
Involvement	0.34	0.04	0.28	0.11	0.69	0.40	0.10	0.15
Past experience	0.18	0.27	0.14	0.43	0.90	0.13	0.01	0.84
Arousal			0.22	0.25			0.61	< 0.01
Pleasure			0.06	0.73			0.17	0.02
R^2		0.254		0.305		0.016		0.50
		($F = 3.3$; $p = 0.03$)		($F = 2.4$; $p = 0.17$)		($F = 0.6$; $p = 0.62$)		($F = 22.4$; $p < 0.01$)

Table VI.
Regression results on
buying impulse

impulse buying. Some prior studies, such as Parboteeah *et al.* (2009), propose the presence of cognition prior to the generation of a buying impulse. However, this argument is mainly based on theories and studies about reflective behavior rather than impulsive behavior (e.g. Sun and Zhang, 2005; Venkatesh, 2000). Our research draws upon the two-system model, which deals with both reflective and impulsive systems, and upon prior studies on impulse buying in physical settings, both of which support the presence of cognition after a buying impulse is triggered. The empirical results are also consistent with existing evidence in marketing literature (Dholakia, 2000; Rook and Fisher, 1995) and support the moderating effect of cognition between the buying impulse and impulse buying. Clearly, additional theoretical perspectives should be explored and further empirical investigation is needed, in order to elucidate the role of cognition in online impulse buying.

The use of the M-R model has been fruitful in explaining experiential shopping behavior both online and offline. While most previous studies based on the M-R model focus on specific stimuli such as different cues (Adelaar *et al.*, 2003; Parboteeah *et al.*, 2009), the present study proposes that the overall virtual experience with a shopping web site needs to be incorporated as an immediate stimulus in order to understand online shopping behavior. In our study, we extend the M-R model by integrating presence (telepresence and social presence), which allows us to capture the overall virtual experience brought about by a specific shopping web site, and we can empirically demonstrate its relevance and significance as stimuli for emotional states. In addition, since presence has been regarded as one of core design principles, our work also contributes to IS literature by providing a theoretical rationale for its impact on online impulse buying.

Finally, online impulse buying represents a typical IT-related behavior, which is characterized as experiential, hedonic, and affective laden. Other examples include online gaming, chatting, blogging, and downloading. Thus, our study also sheds light on these phenomena, which may extend beyond the explanatory power of traditional cognitive models. Specially, being impulsive might better be considered as an on-going state, rather than as being abnormal or exceptional. Future research needs to devote more attention to impulsive elements, as this will lead to a more balanced view toward human-computer interactions.

6.2 Practical implications

In addition to the theoretical implications, this study presents significant practical implications. With the wide adoption of online shopping, investment in online stores has grown rapidly. Online shopping now extends well beyond the initial stage that mainly focussed on information and utilitarian values. In particular, impulse buying has constituted a large portion for online sales, especially for holiday online shopping. Thus, firms are now starting to focus on online experiential shopping with the hope of enhancing the possibility of impulse buying. Our findings suggest that an effective web site can stimulate online impulse buying. The web site needs to provide an immersive and sociable virtual experience in order to enhance the chances for impulse buying. The selection and design of specific web site features can be guided by telepresence and social presence. Specifically, our study indicates that design features that increase the interactivity and vividness of the web site are also effective in delivering this type of virtual experience.

In addition to system design factors, the completion of an online impulse purchase is also contingent upon the cognitive processing involved in the shopping process. In

particular, the consonance between cognition and the buying impulse will further increase the extent of impulse buying. Although we did not manipulate cognitive processing in the present study, it could be influenced in practice by positive review/recommendation and/or the number of consumers who purchase the same product. In most online stores, this type of influence only appears at the selection or browsing stage. Our results also indicate the importance of providing this type of information at the purchasing stage, to reinforce the positive evaluation of the products in a shopping cart. In this way, the buying impulse is likely to be sustained and enacted. Online impulse buying is also expedited by a shortened purchasing procedure.

6.3 Limitations and future research

All studies have limitations that can potentially affect generalization of the findings. We now discuss those most central to the present study. First, this research has the traditional limitations associated with experimental design. In this experiment, marketing stimuli and product stimuli were controlled with a fixed value (constant discount price and single product) and individual characteristics (impulsivity, product involvement, prior experience with online shopping, and attitude) were controlled by inclusion in the research model. Although these strict controls enable us to single out the effect of system design factors, they also limit the generalizability of the results. Thus, it will be important and informative to examine the interaction among different stimuli that affect online impulse buying. The relative effectiveness of system design may vary for different marketing techniques and product categories. In addition, the focus on the main effects of system design does not exclude the possibility of interactions, such as interaction between interactivity and vividness. When integrated into a single web site, different design features may interfere with each other; this, in fact, may be more interesting than the main effects. However, our reasoning, at this point, is to establish a good base model from which important main effects could first be assessed (cf. Aiken and West, 1991; Beatty and Ferrell, 1998).

Second, use of a binary measure for impulse buying is sufficient for indicating whether the buying impulse is enacted or not, but it fails to capture the magnitude of the impulse buying. Future research could therefore replicate the model, using measures with more sophistication for impulse buying.

Third, in this research we focussed on presence to conceptualize virtual experience, as it is particularly relevant to inducing buying impulse and designed the study to reflect the different levels of presence. However, we are also aware of the alternative conceptualizations of virtual experiences that could be induced by an online shopping web site, such as 4E (Pine and Gilmore, 1999), by varying information content or product presentation (Jeong, 2009). It would be interesting to examine how the different resulting experiences, i.e. entertainment, educational, escapist, and esthetic, may influence buying impulse in different ways.

Finally, this study only examined one cognitive moderator, value perception, in online impulse buying. Therefore, future studies should apply the same approach to investigate the other possible cognitive factors, such as normative influences. These studies could also combine different shopping settings, such as the presence of other social actors, to reveal what kind of cognitive processing might happen within different shopping environments.

Overall, online impulse buying has become a popular phenomenon; however, research on this topic is still in its early stages. The present study integrates theories

from environmental psychology, social psychology, and information systems to further the understanding of the role of the system in online impulse buying. More research is necessary to address the limitations found in the present research and to replicate the model under different settings. However, our research provides a firm foundation for future studies on online impulsive behavior in general.

Note

1. <http://news.com.com/2100-1023-255411.html?legacy=cnet>

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Further reading

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Variable	Measurement	References
Vividness	Not very colorful – very colorful Very drab – very rich Very vague – very graphic Very abstract – very concrete Very confusing – very clear Not very descriptive – very descriptive Not very distinctive – very distinctive	Kelley <i>et al.</i> (1989); Jiang and Benbasat (2003)
Interactivity	I had control over the pace of browsing, such as, click to advance to browse the next movie or next page I had control over the browsing sequence, such as, jump to a specific movie I had control over variables, such as, use search functions I had control over objects, such as, move posters or movie titles around the screen I felt that I had a lot of control over my browsing this web site While I browsed this web site, I could choose freely what I wanted to see While browsing this web site, my actions decided the kind of experiences I got	Liu (2003); McMillan and Huang (2002)
Social presence	Extremely social – extremely unsocial Extremely personal – extremely impersonal Extremely sensitive – extremely insensitive Extremely warm – extremely cold	Short <i>et al.</i> (1976); Venkatesh and Johnson (2002)
Telepresence	During this web site browsing, I felt I was in the world the computer created (dropped) During this web site browsing, my body was in the room, but my mind was inside the world created by the computer (dropped) The computer-generated world seemed to me “somewhere I visited” rather than “something I saw” I felt I was more in the “computer world” than the “real world” around me when I was browsing the web site I forgot about my immediate surroundings when I was browsing the web site When I exited the web site, I felt like I came back to the “real world” after a journey	Coyle and Thorson (2001); Kim and Biocca (1997); Venkatesh and Johnson (2002)
Pleasure	Pleased – annoyed Satisfied – unsatisfied Interested – bored	Mehrabian and Russell (1974)

(continued)

Table AI.
Operationalization of
variables

Variable	Measurement	References
Arousal	Jittery – dull Wide-awake – sleepy Aroused – un-aroused	Mehrabian and Russell (1974)
Buying impulse	I experienced a sudden urge to buy this VCD movie I did not intend to buy this VCD movie before I saw it When I saw the VCD movie, I wanted to buy it although initially it was not in my plan The urge to buy this VCD movie was very strong	Beatty and Ferrell (1998)
Value perception	This product is a (very good value for the money to very poor value for the money) At the price shown the product is (very economical to very uneconomical) The product is considered to be a good buy (strongly agree to strongly disagree) The price shown for the product is (very acceptable to very unacceptable) This product appears to be a bargain (strongly agree to strongly disagree)	Adelaar <i>et al.</i> (2003)
Involvement	Unimportant – important Does not matters to me – matter to me Uninteresting – interesting	Zaichkowsky (1985)
Visual/verbal preferences	How do you process information? I enjoy doing work that requires the use of words I relive some special times in my life by mentally “picturing” just how everything looked I can never seem to find the right word when I need it I do a lot of reading When I am trying to learn something new, I would rather watch a demonstration than read how to do it I think I often use words in the wrong way I like to picture how I could fix up my apartment or a room as if I could buy anything I wanted I often make written notes to myself I like to daydream I generally prefer to use a diagram rather than a written set of instructions I find it helps to think in terms of mental pictures when doing many things After I meet someone for the first time, I can usually remember what they look like, but not much about them I like to think of synonyms for words When I have forgotten something I frequently try to form a mental “picture” to remember it	Childers <i>et al.</i> (1985)

Variable	Measurement	References
Buying impulsivity	I prefer to read instructions about how to do something rather than have someone show me	Rook and Gardner (1993)
	I prefer activities that do not require a lot of reading	
	My thinking often consists of mental "pictures" or images	
	I often buy things spontaneously (dropped)	
	"Just do it" describes the way I buy things	
	I often buy things without thinking	
	"I see it, I buy it" describes me	
	"Buy now, think about it later" describes me	
	Sometimes I feel like buying things on the spur-of-the-moment (spur: stimulus)	
	I buy things according to how I feel at the moment	
Attitude	I rarely plan most of my purchases	Ajzen and Madden (1986)
	Sometimes I am a bit reckless about what I buy (reckless: careless of results) (Dropped)	
	Bad – good	
	Foolish – wise	
	Negative – positive	
	Very negative – very positive	

Table AI.

Variables	1	2	3	4	5	6	7	8	9	10	11
Arousal1	0.873	0.060	0.075	0.017	0.055	0.059	0.244	0.053	0.040	0.124	0.028
Arousal2	0.844	0.092	0.078	0.029	0.064	−0.038	0.205	0.011	0.048	0.204	0.017
Arousal3	0.852	0.083	0.160	0.056	0.075	0.000	0.167	0.108	0.049	0.132	0.038
Interactivity1 ^a	0.186	0.303	0.006	−0.082	0.272	0.124	−0.126	−0.042	−0.106	0.006	−0.004
Interactivity2	0.260	0.838	0.113	−0.047	0.100	−0.094	0.040	0.004	0.002	0.052	0.029
Interactivity3	0.240	0.866	0.089	−0.074	0.039	−0.064	0.095	0.022	0.023	−0.012	0.046
Interactivity4	0.322	0.756	0.098	0.003	−0.062	−0.052	0.057	−0.005	−0.058	0.034	−0.036
Interactivity5	0.370	0.815	0.124	−0.038	0.070	−0.007	0.039	−0.049	−0.044	0.032	0.115
Interactivity6	0.457	0.725	0.077	−0.072	0.054	−0.041	0.066	−0.043	0.062	0.084	0.117
Interactivity7	0.323	0.614	0.056	0.006	0.102	0.002	0.183	−0.119	0.052	0.155	0.249
Social presence1	0.347	0.131	0.751	0.067	0.232	0.130	0.046	0.002	0.165	0.193	0.022
Social presence2	0.332	0.155	0.769	0.095	0.222	0.068	0.150	0.054	0.135	0.034	0.072
Social presence3	0.393	0.059	0.771	0.097	0.145	0.078	0.080	0.065	0.190	0.114	0.069
Social presence4	0.347	0.149	0.714	0.072	0.133	0.092	−0.007	0.057	0.192	0.263	−0.063
Impulsivity1 ^a	−0.024	−0.049	−0.134	0.624	0.117	0.097	−0.026	−0.132	−0.086	0.037	0.091
Impulsivity2	0.034	0.058	0.000	0.713	−0.067	−0.128	−0.035	0.085	0.002	−0.096	−0.109
Impulsivity3	−0.044	−0.004	0.045	0.761	−0.106	−0.103	0.122	0.082	−0.043	−0.238	0.014
Impulsivity4	−0.210	−0.022	0.171	0.736	0.014	−0.077	0.052	0.120	−0.006	0.167	0.214
Impulsivity5	−0.009	0.074	0.097	0.667	−0.156	−0.070	−0.090	0.193	0.105	−0.024	0.040

(continued)

Table AII.
Factor loadings and cross-loadings

Variables	1	2	3	4	5	6	7	8	9	10	11
Impulsivity6	−0.002	−0.198	−0.012	<i>0.705</i>	0.176	0.090	0.181	0.039	−0.018	−0.011	0.048
Impulsivity7	0.086	−0.051	0.040	<i>0.725</i>	0.087	−0.041	−0.018	0.109	−0.036	0.264	−0.085
Impulsivity8	0.076	0.072	−0.049	<i>0.629</i>	0.035	−0.130	−0.211	−0.086	−0.058	0.015	−0.078
Impulsivity9 ^a	0.167	−0.122	0.034	<i>0.530</i>	0.269	−0.105	0.075	0.025	−0.043	−0.130	0.046
Value perception1	0.117	0.066	0.118	0.004	<i>0.745</i>	0.086	0.126	0.145	0.298	0.172	0.038
Value perception2	0.045	0.119	0.079	0.064	<i>0.878</i>	0.036	0.070	0.115	0.153	0.059	0.052
Value perception3	0.104	−0.042	0.170	0.063	<i>0.771</i>	0.088	0.176	0.205	0.278	0.046	0.163
Value perception4	0.107	0.038	0.175	0.039	<i>0.825</i>	0.081	−0.010	0.066	0.015	−0.066	0.060
Value perception5	0.024	0.062	0.209	0.003	<i>0.696</i>	0.066	0.101	−0.015	−0.124	0.071	0.022
Attitude1	−0.083	−0.043	0.060	−0.051	0.057	<i>0.881</i>	0.053	0.065	−0.009	0.056	0.035
Attitude2	−0.025	−0.089	0.142	−0.096	0.049	<i>0.867</i>	0.106	0.118	−0.041	0.031	0.060
Attitude3	0.025	−0.072	−0.051	−0.122	0.085	<i>0.883</i>	−0.030	0.094	−0.005	−0.029	−0.017
Attitude4	0.045	0.020	−0.039	−0.046	0.065	<i>0.867</i>	0.082	0.139	0.007	−0.108	−0.094
Telepresence1 ^a	0.440	0.413	−0.049	0.117	0.047	0.073	<i>0.461</i>	0.055	0.188	0.168	0.055
Telepresence2 ^a	0.459	0.179	0.079	0.067	0.096	0.113	<i>0.548</i>	0.247	0.068	−0.058	0.142
Telepresence3	0.289	0.224	−0.006	0.004	0.046	0.154	<i>0.718</i>	−0.034	0.154	−0.002	−0.054
Telepresence4	0.185	−0.066	0.178	−0.021	0.188	−0.017	<i>0.795</i>	0.008	−0.005	0.075	−0.011
Telepresence5	0.455	0.145	0.052	−0.028	0.094	0.060	<i>0.655</i>	0.193	−0.048	−0.040	0.061
Telepresence6	0.411	0.089	0.068	0.100	0.052	0.064	<i>0.733</i>	0.026	−0.009	−0.004	0.087
Involvement1	0.214	−0.084	−0.011	0.151	0.140	0.084	0.085	<i>0.851</i>	−0.004	−0.117	−0.004
Involvement2	0.020	−0.005	0.011	0.150	0.159	0.171	0.015	<i>0.875</i>	0.044	0.097	−0.041
Involvement3	0.167	−0.017	0.065	0.139	0.119	0.259	0.098	<i>0.803</i>	0.098	0.067	−0.030
Impulse1	0.181	0.046	0.266	−0.022	0.176	−0.036	−0.056	0.131	<i>0.694</i>	0.049	0.001
Impulse2	0.192	−0.003	−0.014	−0.057	0.035	0.087	−0.060	−0.106	<i>0.787</i>	0.093	−0.062
Impulse3	0.042	−0.038	0.215	−0.056	0.107	0.006	0.037	−0.096	<i>0.719</i>	0.056	−0.027
Impulse4	0.062	−0.006	0.125	−0.055	0.197	−0.046	0.114	0.117	<i>0.837</i>	0.070	0.042
Pleasure1	0.470	0.163	0.337	0.079	0.121	−0.029	0.014	0.034	0.099	<i>0.625</i>	0.013
Pleasure2	0.432	0.143	0.426	−0.035	0.097	−0.123	0.015	0.018	0.111	<i>0.579</i>	0.044
Pleasure3	0.538	0.112	0.353	−0.054	0.074	−0.117	0.070	0.063	0.075	<i>0.579</i>	0.047
Vividness1	0.176	0.294	−0.035	−0.087	−0.110	−0.019	0.018	0.047	−0.038	0.201	<i>0.731</i>
Vividness2	0.227	0.178	0.078	−0.031	0.041	−0.030	0.050	0.110	−0.008	−0.103	<i>0.729</i>
Vividness3	0.155	0.215	−0.054	0.030	−0.004	−0.004	0.055	0.017	0.040	0.245	<i>0.756</i>
Vividness4	0.430	0.121	0.103	−0.049	0.162	0.031	−0.008	0.074	−0.065	0.009	<i>0.604</i>
Vividness5	0.388	0.081	−0.048	0.092	0.106	0.060	0.043	−0.133	−0.038	0.078	<i>0.636</i>
Vividness6	0.266	0.155	0.068	0.106	0.090	−0.038	0.047	−0.080	0.089	−0.011	<i>0.731</i>
Vividness7 ^a	0.610	0.125	0.133	−0.062	0.099	−0.171	0.150	0.121	0.029	−0.033	<i>0.511</i>

Table AII.

Note: ^aDropped in the data analysis due to high cross-loading or low loading

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