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EFFECTS OF MODALITY INTERACTIVITY AND USER AROUSAL IN ONLINE SHOPPING SITES

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ABSTRACT

Today's e-commerce websites provide a variety of modality-interactivity tools to allow consumers to access product by performing different actions on the site. This dissertation tries to reveal how these tools differ from the traditional online features, such as simple clicks and how these features change the way in which consumers process the product information online and evaluate the product. The way how interactivity influences consumers' information processing (Sundar, 2007) is very similar to what Kahneman (1973) hypothesized as the role of physiological arousal on individuals' cognitive functioning. Would arousal then function as an engine to magnify the effect of modality interactivity on consumers' cognitive processing? How would it affect modality interactivity's influence on consumers' attitudes and behavioral intentions toward product and the site? The arousal was treated as the other independent variable in this study.

A 3 (interactivity: low, medium, high) × 3 (arousal: control, low arousal, high arousal) between- subjects factorial experiment was conducted to understand how modality interactivity and arousal affects consumers on the perceptual, cognitive, attitudinal, and behavioral perspectives. The major findings of the study included the following aspects. 1) Modality-interactivity may affect an individual's allocation of cognitive resources for interactive versus non-interactive content on the same webpage. 2) While high-modality interactivity might expand the perceptual bandwidth in general, arousal would control the allocation of resources to interactive and non-interactive contents. 3) It identified a series of mediators for the influence of modality-interactivity on product purchase likelihood, such as engagement, and website attitudes. These findings imply that e-tailers need to be careful about where to employ interactivity

features on the site and how many interactivity tools they would like to have without violating consumers' expectation of the site's interactivity. E-tailers would also have to decide what kind of outcome they would like to achieve and strike a balance between encouraging more elaboration and generating more engagement with website content while employing interactivity tools and embedding music. 4) It also identified how hedonic and utilitarian shopping orientation would moderate the effects of interactivity and arousal.

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Chapter 1

Introduction

The Internet has fundamentally changed the way consumers shop for and purchase products, as well as how retailers and manufactures market their products (Strauss & Frost, 1999). Nowadays, consumers make either or both of their online and offline purchases based on product information obtained online, which makes the online retailing product page the critical point of influence. The maturation of the Internet technology and the growing online retailing competition have resulted in a proliferation of advanced website interface features which go beyond simply offering extensive product categories that are known to contribute to online marketing and retailing success (Fiore & Jin, 2003; Liu, Arnett, & Litecky, 2000; Lohse, Bellman, & Johnson, 2000; Lohse & Spiller, 1998). Hoque & Lohse (1999) argue that the promise of e-commerce and online shopping would depend on user interface and how individuals interact with websites. In fact, the interactivity of e-commerce websites has been claimed as a critical factor for studying online consumer behavior (Ballantine, 2005; Islam, 2009).

Early studies of online shopping have identified a series of factors behind e-tailer success or failure (Reibstein, 2000). Among the ten merchant attributes considered critical to online shopping experience, the importance of product representation has been ranked the highest (Reibstein, 2000). Unlike in brick and mortar stores, where consumers can directly see, feel, and touch the product, e-commerce websites usually provide only images, thus limiting consumer experience of the product. But, these sites have, over the years, worked hard to overcome this limitation by providing a number of advanced interface features. Aside from clicking and scrolling to show information, today's e-commerce websites provide a variety of interactive features that allow consumers to access the product by performing a series of actions on the product image. Consumers can spin the product to have a 360 degree view, zoom-in or out to have a global view or a detailed view of the product, pan-over to see different parts of the product, or mouse-over to change the color of the product.

According to Sundar (2007), these interactive features are modality-interactivity tools which serve to enhance the functionality of the website. Recent studies have shown that these interactive tools enable greater user interaction, thereby enhancing user engagement with website content (Sundar, Xu, Bellur, Jia, Oh, & Khoo, 2009). How do these features differ from traditional online features such as simple clicks? If consumers are provided with this alternative way of accessing product information, would they actually use it? How would these features change the way in which consumers process the product information online? Would they pay more attention to the product and think more? Or would they get more distracted by the features and subsequently ignore the detailed product specifications listed on the website? In addition, would more interactive features for the e-commerce website make consumers better engaged with product webpage and subsequently lead to more favorable attitudes towards the website and the product, which would ultimately change their purchase likelihood and even the actual purchase decision? The first aim of this study is to answer these questions by examining how modality- interactivity tools employed by e-commerce website would change consumers' responses on perceptual, cognitive, attitudinal, and behavioral levels.

As will be discussed later, there are several theoretical mechanisms by which interactivity can lead to better user engagement with content. One underlying mechanism is perceptual bandwidth, or the idea that using different modalities of interaction will serve to enhance users' mental mapping of information presented on the website. How does modality interactivity affect perceptual bandwidth? Sundar (2007) suggests that modality interactivity serves to enhance perceptual bandwidth by broadening individuals' mental representation of sensory inputs. The user has a wider experience of the mediated content, richer information processing, and finally better memory about the content consumed.

While it is intuitively appealing to think that a profusion of modality interactivity tools might actually compete for the same pool of cognitive resources, thus overloading the cognitive processing ability of users (Lang, 2000), Sundar (2007) suggests that interactivity could actually expand the cognitive capacity of users, thus allowing them to take in more information. This argument is very similar to Kahneman's (1973) hypothesized impact of physiological arousal on individuals' cognitive functioning. Kahneman suggested that an individual's total available processing capacity can be influenced by arousal. He considered arousal as the activation of processing capacity (Heo, 2004). Different levels of arousal may either enhance or inhibit an individual's information processing capacity (Kahneman, 1973). If the role played by interactivity in influencing information processing capacity is similar to that of arousal, then we may be able to test that empirically by observing the interaction of the two. If the effects of modality interactivity on information processing under conditions of low arousal is similar to that of high arousal without any interactivity, then we may conclude that interactivity operates in the same way as arousal. We might also find an additive effect. Arousal might function as an engine to magnify the effect of modality interactivity on perceptual bandwidth. In order to address such questions, this dissertation study added arousal as an additional independent variable, along with modality-interactivity.

In the current study, arousal was manipulated by the music played on e-commerce websites. Tempo, one of the structural features of music is considered the most successful determinant of arousal (Dubé, Chebat, & Morin, 1995). Existing studies have found that varying the tempo of music was successful in changing consumers' shopping experience in brick –and-mortar stores. Music tempo variations can significantly affect the pace of in-store traffic flow and dollar sales volume in supermarkets (Millaim, 1982), the perceived and actual shopping times in clothing stores (Yalch & Spangenberg, 2000), the desire to affiliate in buyer-seller interactions (Dubé, Chebat, & Morin, 1995), and purchases and length of stay in restaurants (Milliam, 1986). Interestingly, despite the ease of programming and a wide variety of highly customizable music, very few e-commerce websites (e.g. Tods.com) use background music to create the appropriate atmosphere for consumers to enhance their online shopping experience. Would arousal elicited by the tempo of music be still effective in influencing consumers' experience in online shopping? Would consumers get more engaged with e-commerce websites with highly arousing music? How would arousal affect consumers' product attitude, and purchase behavior? Therefore, the other aim of this study is to provide insights into the role of physiological arousal in influence consumers' experience in online purchases through perceptual, cognitive, attitudinal, and behavioral perspectives.

In sum, by exploring the main and interaction effects of modality interactivity and physiological arousal, the current study will be able to shed light on their individual influences on consumer online shopping experience and answer the following questions:

Would the music-induced arousal dampen or enhance the effectiveness of modality interactivity? How would arousal affect consumers' engagement with the website? How would the two interactively influence consumers' cognitive processing of product information, their attitude and behavioral intention towards both the product and the website? A series of individual difference factors, such as hedonic versus utilitarian shopping orientation (Kim & LaRose, 2004) and power-usage (Marathe, Sundar, NijeBijvank, Van Vugt, & Veldhuis, 2007), might also affect consumers' use of interactive tools on the website. These individual difference factors are also taken into consideration in this study, aside from the effects of interactivity and arousal.

In order to address these research questions, this dissertation will begin with concept explications of interactivity and arousal and discussions of theoretical underpinnings of their effects on information processing capacity and attitudes. It will then present a series of pretests for manipulating interactivity and arousal, followed by a detailed description of experimental design and methods used in the main study. Results of the study will be presented next, followed by a discussion of their implications for theory and practice.

Chapter 2

Literature Review

Before proposing the hypotheses, this chapter first will explicate the concept of interactivity in general and modality interactivity in particular, followed by a discussion of two competing theories for the influence of interactivity: cue-summation theory (Severin, 1967a, 1967b) and limited capacity theory (Lang, 2000). It will then explicate the concept of arousal in this context and present two opposing theories – the unidimensional model (Zillmann, 1971, 1983) and the optimal level model (Kahneman, 1973)—about the effects of arousal. Based on these two schools of theories, we will examine the underlying mechanisms for the potential moderating role of arousal on the effects of interactivity. The latter part of this chapter will identify a set of individual-difference variables, such as shopping orientation and power-usage, that might qualify the effects of interactivity and arousal.

Interactivity

With the emergence of various kinds of new communication technologies, the concept of "interactivity" has received considerable attention during the past twenty years (Sundar, 2004). Many communication scholars have attempted to conceptualize interactivity with various definitions and diversified models (Jensen, 2008; Kiousis, 2002; Kweon, Cho, & Kim, 2008; McMillan & Hwang, 2002; Sundar, Kalyanaraman, & Brown, 2003). Interactivity has been referred to as the ability for users to influence the form or content of the media (Jensen, 1997; Steuer, 1992), the synchronicity of communication (Häubl, & Trifts, 2000; Kiousis, 2002; Liu & Shrum, 2002), the responsiveness of the media towards user (Rafaeli, 1988), a two-way real-time information exchange (Rice &

Williams, 1984), the users' control over media (Jensen, 1998; Lieb, 1998; Newman, 1991) and even the information itself (Kalyanaraman, Ito, Malik, & Ferris, 2009). Some scholars choose just one factor as the locus of interactivity (Steuer, 1995; Rafaeli, 1988; Jensen, 1998); while others attempt to mix various factors to explicate interactivity as a construct with multiple dimensions. Sundar (2007) explicated interactivity as having three aspects: as a medium feature, as a source feature, and as a message feature. Stromer-Galley (2004) differentiated between "interactivity-as-product" and "interactivity-as-process" (p.391-393). This concept has also been distinguished into sensory, semantic, and behavioral dimensions (Sohn, 2009), or medium, human/medium, and human aspects (Chung & Yoo, 2009).

Several studies examine this concept focusing on the communication between individuals (Rafaeli, 1988; Rice & Williams, 19784); whereas others discuss it more in the context of interaction between individuals and computer/network/system (Jensen, 1999; Sundar et al, 2003). Stromer-Galley (2004) considers that the difference between these two phenomena is necessary to clarify the "murky conceptual waters of interactivity" (p.391). According to her, research on interactivity between people examines the process of interactivity, in other words, the interaction; whereas research on interactivity between individuals and computers or systems focuses on the product of interactivity.

There are also some disagreements about whether interactivity should be defined as the presence of technology options/interactivity or interaction potentials, or the subjective perception of the users (Bucy & Tao, 2007; Liu & Shrum, 2002; Tremayne, 2005; Leiner & Quiring, 2008). The eye-of-the-beholder approach (Leiner & Quiring, 2008; Song & Zinkhan, 2008) contends that conceptualizing interactivity by the presence or absence of features may not be appropriate for defining interactivity. Without valid manipulation checks, it is hard to know which features are perceived as more interactive and which are perceived as less interactive (Liu & Shrum, 2002). Also, unless people actually use the interactive features (Tremayne, 2005), the manipulation could not be considered as successful. Bucy and Tao (2007) criticize this perceptual approach by pointing out that it positions the mediator as the predictor. The perceptual approach situates perceived interactivity as the independent variable and media effects as the dependent variable. However, it fails to acknowledge that structural characteristics of information technology systems are required to evoke a sense of perceived interactivity in the first place (Sundar, 2004). The perceptual approach thus not only ignores the individual differences of users, but also the media attributes that precede user perceptions of interactivity. Therefore, they suggest that media stimuli should be used in the actual experiment to manipulate degree of interactivity ontologically. User perception is a result of it. In addition to the question of which factor comes first, the MAIN model proposed by Sundar (2008) argues that the interactivity tools on the interface can cue a number of cognitive heuristics that are favorable to user evaluations of the interfaces as well as its content. In other words, even if the users do not actually use those interactive tools, the heuristics triggered by the greater presence of interactivity features on the website may still positively impact users' perceptions and attitudes. Sundar and Bellur (in press) suggest that the interactivity features themselves could be richly suggestive and the perceived possibilities of interactivity may directly lead to evaluative responses. In other words, the perception arising from the mere presence of interactivity features itself would also affect users.

Modality Interactivity

The current study considers interactivity as the presence of technological features, particularly the various kinds of interface tools employed by e-commerce websites which allow consumers to interact with products online, such as flipping to demonstrate the product in 360 degrees, mousing over to get additional information, sliding to zoom-in or zoom-out, and dragging to rotate images. Based on the interactivity model proposed by Sundar (2007), these features belong to the category of “modality interactivity,” which is distinguished from “source interactivity” (the degree to which the website allows the user to serve as the source or gatekeeper of information) and “message interactivity” (the level of contingency between messages sent and received by user).

Modality interactivity focuses on the functional features of websites which allow users to interact with the interface or the system. These functions of these features are the action possibilities (Norman, 1999) that can be perceived by users. Therefore, modality interactivity can be understood not just as the existence of technological affordances, but also as the actual use of action possibilities (Sundar, 2007). It includes both the action potential and the realization of that potential. Each modality offers a unique method for consumers to access the content on website interfaces. The greater the number of modalities available on the website, the higher the website capacity to achieve information exchange between the user and the interface (Sundar, Kalyanaraman & Brown, 2003). This approach of treating interactivity as a cluster of functional features can be traced back to earlier studies done by Heeter (1989), Massey and Levy (1999), Ahern and Stromer-Galley (2000). In these studies, interactivity was typically opertaionalized in the form of interface tools, such as the presence of audio downloads, email links, and chat functions. All of these studies considered interactivity as a media feature, i.e., as a “product” (Stromer-Galley. 2004) rather than as a “process.”

The idea of treating interactivity as a medium feature does not limit the scope of the concept to only the modalities found in traditional media, like text, visual image, audio, and video. Each of these modalities is uniquely characterized by one type of traditional medium, such as text for print media, and video for television. Aside from these traditional interactivity features, modality interactivity also includes the wider variety of newer technological features afforded by online media (Sundar, 2007; Sundar, Xu, Bellur, Jia, Oh, & Khoo, 2010), such as drag, flip, mouse-over, slide, and cover-flow. They provide consumers with different ways of accessing information on a website. However, unlike traditional modalities for old media, the newer interactive modalities do not necessarily have one-to-one correspondence of one feature (e.g. video clip) with one basic sensory perception, such as audio, visual, touch, and smell. Some of them may involve several sensory perceptions at the same time and simultaneously provide varied ways for users to access website information. In addition, each modality may have different functionalities at the same time. For example, clicking to start an image slideshow and clicking a hyperlink to forward the product page to friends share the same modality of “click”, but serve two different functions on the website. New interactive media interfaces may feature a number of modalities within a single medium, which may actually give rise to the idea of “multimedia” (Sundar, 2000). In other words, modality rather than medium becomes the smallest unit of interactivity (Sundar, Xu, & Bellur, 2010). By providing a variety of modalities that integrate senses, new interface tools contribute to the idea of media convergence.

Sundar (2000) and Oviatt (2003) posit that the cumulation of technological features determines the capacity of interactivity afforded by media interfaces. New modality features on the websites can combine both traditional modalities and new modalities, such as integrating the slider and image change, or mouse-over and picture download. New modalities can provide not only novel combination of functionalities, but also greater possibilities to easily switch between various modality functions. For example, during the presidential election campaign, the *New York Times* created a debate analysis tool (http://elections.nytimes.com/2008/president/debates/first-presidential-debate.html). Users are able to click anywhere in the script to jump to a specific part of the video clip. At the same time, they can also drag the slider bar on top of the video to pick a particular topic to start the video. This flexibility to switch between modalities might lead to a higher level of interactivity.

Sundar et al.'s study (2010) on modality interactivity's effect for news websites showed that a cumulation of different modalities would provide users with a heightened sense of interactivity. Based on this assumption, the greater the number of modality features, the higher its level of interactivity. The current study follows this rationale to operationalize the levels of modality interactivity by varying the number of features across the three conditions. In summary, there was no interactivity feature in low condition, one feature of click to change image in medium interactivity condition, and three features of drag/click to rotate product, mouse over to zoom-in, and click to change color in high interactivity condition.

Modality Interactivity, Perceptual Bandwidth, & Cognitive Responses

Adding more modality features to the website interfaces would provide consumers with more ways of accessing the website content. It would enhance both the range and the mapping of information (Steuer, 1992). Reeves and Nass (2000) suggest that different interface modalities would lead to different perceptual representations. Interfaces with richer modalities would enhance the mental representation of the website content by involving more sensory perceptions. The sensory experience enabled by the modalities is called "perceptual bandwidth", with the interface possessing these different modalities as "perceptual interfaces" (Reeves & Nass, 2000). These perceptual interfaces may be modeled after everyday human action that happens in real life. For instance, the feature of dragging to have a 360-degree view of a product mimics the way that we rotate the product to examine the product from different angles in brick-and-mortar stores. The cover-flow feature mimics how we flip through pages in a photo album.

Sundar (2007) considers perceptual bandwidth as the key concept to understand how modality interactivity affects an individual's cognitive activity of processing website information. Perceptual bandwidth has been defined as the type and number of sensory channels involved during an interaction between media and its users (Sundar, Xu, & Bellur, 2010). However, there are different theories on how modality features would place demands on an individual's cognitive resources and affect their ability to process information. According to Reeves and Nass (2000), once a media interface involves more modalities, the volume knob of perceptual bandwidth will be turned up, leading to more sensory perceptions, increase the breadth and depth of mental representation of website content. In other words, website users would have richer experience with website content, which might lead to better information processing. They suggest that the changes in sensory experiences would lead to changes in attention and memory. The richer modality interface might thus lead to greater attention and better memory. This assumption is in line with the propositions of cue-summation theory.

Cue-summation theory. Garner (1970) posits that the nervous system is capable of simultaneously processing information from multiple sensory channels. Consistent with this statement, cue-summation theory proposed by Severin (1967a, 1967b; Hsia & Jester, 1968) with regard to information learning and retention in multimedia environment argues that information learning and cognitive activities will increase as the number of available stimuli increases. “Multiple-channel communications are superior to single-channel communication when relevant cues are summated across channels” (p.397). This theory also states that the information provided through different channels has to be relevant to each other; otherwise, the distraction would cause a decrease rather than an increase in information retention (Severin, 1967a).

Severin (1968) found that the combination of auditory signals with a visual presentation was more effective in producing recognition than a combination of visual cue and visual presentation, given that those cues were relevant in both situations. Combined audiovisual presentations were found significantly superior to either audio or visual presentation of information (Cushman, 1973). Brashears, Akers, and Smith (2005) found evidence to support this theory with regard to students’ information retention for electronic curriculum materials. They memorized more information when being exposed to text with audio or video component than simply text. A subsequent study (Brashears, Fraze, Lawver, & Baker, 2005) confirmed the validity of the theory by finding that students in the cue summation group reported significantly higher satisfaction than those in a single cue or a redundant cue group.

By extending this idea to more complex stimuli (such as news stories), Reese (1984) found that news learning was greater with redundant visual and script information. Drew and Grimes (1987) further confirmed Reese's finding by reporting that the higher the visual-verbal redundancy, the more audio information participants were able to recall. Similarly, Son, Reese, and Davie (1987) validated the theory by observing that additional visual-verbal cues lead to greater television news recall. The addition of summary oral recaps as audio cues improved audience understanding of the news.

In summary, this line of research proposes a linear relationship between number of modality features and the amount of cognitive activity. If various modality features can provide more cues relevant to each other, the richer media experience will broaden an individual's perceptual bandwidth to process information. In the current study, interactivity was manipulated by varying the number of modality interactive features embedded in the product image. Following this line of research, the website with more interactivity features would give consumers a richer experience with website content, broaden their perceptual bandwidth, and provide more relevant cues to assist them in processing product information than the ones with lesser number of interactivity features. Users would likely pay more attention to website content because of the novelty of the interactivity functions. Based on cue-summation theory, they should be able to memorize more when there are more interactivity features on the website. In studies testing the cue-summation theory, the memory aspect of cognitive activity is not specifically differentiated by recall or recognition. In fact, evidence supporting a linear relationship between number of modalities and both recall (Drew &Grimes, 1987; Son, Reese, & Davie, 1987) and recognition (Son & Davie, 1986) has been found. Therefore, this research proposes that high interactivity would broaden perceptual bandwidth and lead to better memory. Formally,

H1: Higher modality-interactivity will lead to greater attention to product information.

H2: Higher modality-interactivity would lead to better memory (for both recall and recognition).

Human information processing is more complex than attention and memory. Individuals might elaborate the information that they observe on the website and store it in an associative network, referred to as “schemata” (Wicks, 1992). In the context of online shopping, individuals might connect the newly encountered information to related preexisting knowledge or to other information encountered at the same time. The greater the number of such associations, the higher the elaboration (Anderson 1990). How would interactivity affect consumers’ cognitive elaboration of the product information on the website then? Tremayne and Dunwoody (2001) found in examining the effect of interactivity on cognitive processing that higher interactivity would lead to greater proportion of cognitive elaboration. When participants were asked to write down any thoughts that they had during website browsing after the experiment, the more easily and quickly they picked up the information that they had elaborated upon. Following cue-summation theory (Severin, 1967a, 1967b), higher level of interactivity would broaden the perceptual bandwidth and increase cognitive activity. Therefore, individuals should elaborate more on the newly encountered information revealed by website content with greater number of interactivity features.

H3. Higher modality-interactivity will lead to greater cognitive elaboration.

Limited capacity theory. In contrast to cue-summation theory, limited capacity theory (Lang, 2000) suggests that more and more modalities would compete for the same pool of limited cognitive resources and serve to affect how an individual attends to information. For example, highly interesting, emotional and moving images might draw more attention from an individual and affect memory for information. The limited capacity theory assumes that an individual’s ability to process information is limited. There might be two reasons why individuals cannot fully process information: 1) An individual may choose to allocate fewer resources to a situation than what the situation demands; 2) An individual does not have enough resources available, while the situation demands too many resources (Lang, 2000). In other words, the mismatch between required resources and the actually available resources results in incomplete processing.

Based on this theory, individuals are limited in the amount of information that can be processed in multiple channels at one time. If an individual allocates too much cognitive resources for one of the sub-processes of information processing, i.e., encoding, storage, or retrieval (Lang, 2000), he/she probably would not have sufficient resources for the other sub-processes. For example, if too many resources have been spent on encoding information, there will not be enough capacity for storing information. The original studies by Lang (1995, 2000) focused on individuals’ processing of television news. She found that the structural features of the medium, such as cuts, pacing, and edits would sometimes dominate the information processing by demanding the majority resource for encoding whereas leaving insufficient resource for storage.

The same rationale can be applied to processes of website information as well. If there are multiple interactive features on a website, individuals would likely start the automatic resource allocation because of the novelty of the interactivity function. The high interactivity condition would then demand more attention and lead to more orienting responses than either low or medium conditions. Since orienting responses are related to recognition memory, then consumers would recognize more product information than the other conditions. However, if consumers allocate too many resources to attention or encoding, they would have fewer available resources for information storage. Therefore, consumers would actually recall less about the product information after they leave the website. Thus,

H4a: Higher modality-interactivity will lead to better recognition memory.

H4b: Higher modality-interactivity will lead to worse recall memory.

Since the cognitive resources are limited, too much effort spent on orienting towards the novel interactivity features would inhibit the resources allocated to elaborating the website content. Individuals would lack cognitive capacity to associate the newly encountered information to either their related pre-existing knowledge or to other information encountered at the same time. Therefore, this study proposes that:

H5: Higher modality-interactivity will lead to lesser cognitive elaboration.

Modality Interactivity, Engagement, & Attitude

Adding more modality interactivity features on the website interfaces may not only affect consumers' cognitive responses, but also serve to change consumers' engagement with the website. However, the increase in engagement with website content is not necessarily accompanied with better memory or sophisticated elaboration (Sundar et al., 2010). The novel modality features employed by the website might stimulate users' curiosity and carry out more explorations over the site. For example, once consumers discover that by mousing-over product image, they are able to get an enlarged view of details, they might spend more time in exploring various parts of the product. Similarly, the spin feature which provides a 360-degree view of the product may preoccupy users as they keep dragging to rotate the product in order to view it from different angles. If consumers get engaged in exploring the website, they would be more immersed in the website and generate better attitude, as well as better behavioral intention towards both the product and the website. In examining the interactivity on business website, Ha and James (1998) suggested that the outcome of interactivity would be engagement in communication and establishment of better relationship between the company and consumer.

However, empirical studies on the effects of interactivity on engagement, attitude and behavioral intention have produced somewhat inconsistent findings. There are plenty of studies (especially in the marketing and consumer behavior area) demonstrating that interactivity does lead to better engagement and more favorable attitudes. For example, Sicilia, Ruiz, & Munuera (2005) found that consumers' flow state intensity were higher when they were exposed to the interactive website than when they exposed to the non-interactive website, which indicated a higher level of engagement with website for the interactive condition. They also found that attitude toward the site was more positive in the interactive condition than in the non-interactive conditions. These findings are consistent with Ghose and Dou (1998), who found in their study that interactivity was able to improve individuals' website evaluation. Fiore and Jin (2003) conducted a study to either allow customers to manipulate visual images of product on online shopping sites, or not provide such an interactivity feature on the site. In the interactivity condition, customers were able to mix and match apparel product images to determine how well they coordinated, whereas in the other condition, they were not able to do anything except normal website browsing. The study results provided empirical support for the effect of interactivity on enhancing approach responses towards the retailer. Customers showed better attitude towards the online store and were more willing to purchase from the site and willingness to return to the site. In examining the persuasive effect of interactive advertising, Sundar and Kim (2005) also found that the level of interactivity was positively associated with attitudes towards the advertisement and the advertised product. In general, research in the marketing and consumer behavior area (Daugherty, Li, & Biocca, 2005; Jiang & Benbasat, 2004; Li, Daugherty & Biocca, 2001) has suggested that employing interactive features on the website potentially improves consumers' attitudes towards brand and product, and thereby enhances purchase intention.

However, there are also some earlier studies suggesting a non-linear relationship between interactivity and engagement, attitude, and behavior outcomes. In examining the effect of interactivity present on a political candidate website, Sundar, Hesser, Kalynaraman and Brown (1998) found that for those who were less politically involved, higher interactivity did lead to better perceptions about both the political candidate and the website. However for those who were more politically involved, individuals in both high- and low-interactivity conditions showed less favorable attitude than those in the medium-interactivity condition. The study indicated that individuals with political expertise would possibly blame the website for having either too few or too many interactivity features, which interfered with their efficiency in processing the information on the website. In examining differences between interactive TV viewing and passive TV viewing, Vorderer, Knobloch, and Schramm (2001) did not find a positive linear effect for interactivity either. Individuals' cognitive ability was found to moderate the effect of interactivity, such that individuals of lower cognitive capacity actually enjoyed non-interactivity mode or low interactivity mode more, whereas those who with high cognitive capacity enjoyed high interactivity mode more. Sundar (2000) studied how different types and numbers of multimedia features on the website would influence individuals' attitude towards online news. Participants were randomly assigned to one of the following four conditions: text only, text + audio, text + pictures, text + pictures + audio, and text + pictures + audio + video. The results from this study found that merely increasing the number of multimedia features present on the website did not lead to better outcomes. In fact, individuals generated more negative evaluations towards both website and website content when the number of multimedia features was increased. Bucy (2004) also found that individuals felt less comfortable with the interactive TV news site compared to the non-interactive one. Even though they considered the interactive TV site more credible, informative, and relevant, they also felt frustrated with the increased amount of interactive tasks performed on the website. Too much product interactivity might be considered a burden to individuals' cognitive capacity and lead to less engagement with the product webpage. Bucy (2004) named the above mentioned non-linear relationship between interactivity and outcomes as "interactivity paradox", referring to the fact that more interactivity would not necessarily lead to better engagement or attitude.

The findings from the above line of research seem to suggest that more interactivity features would lead to more cognitive burden for website users or consumers. If cognitive overload happens, individuals may feel confused, disorientated, and frustrated with website browsing. This would prevent them from being immersed or engaged with the website content and subsequently cause less favorable attitudes. However, the multiple resource theory (Wicken, 1980) would argue against this rationale by indicating that information delivered via multiple channels should be easier to comprehend than that conveyed through a single channel. Oviatt, Coulston, and Lunsford (2004) also found that when the cognitive load increased because of the increase in task complexity, individuals would automatically switch to a multimodal path of information processing. By distributing the task through several modality channels, they were able to accommodate the changes in cognitive load. Therefore, the solution to the cognitive overload problem brought by the increased number of modalities is to use one modality to disambiguate information obtained from another modality, as suggested by Sundar et al. (2010). In other words, interactivity features could be designed such that they could themselves solve the overload problem (Sundar, et al., 2010). For example, the drag to rotate function might make it harder for consumers to observe details on the product because of the inherent motion involved in the process of operating that modality. This ambiguity would be solved by incorporating a feature that would mouse-over to stop the motion and zoom in on the product. Therefore, the problem with one modality feature would be solved by the other. Even if adding more modality features on the website would require more cognitive effort from users, a careful integration of these features could mutually disambiguate information, thereby producing greater engagement with website content.

The influence of interactivity on attitudinal and behavioral outcomes can also be explained through the MAIN model (Sundar, 2008). The MAIN model suggests that even without actual interaction, the interactivity tools themselves could cue a series of cognitive heuristics which might trigger favorable evaluation of the interface as well as its content. Based on the elaboration likelihood model (Petty & Cacioppo, 1986), if individuals are either of lower ability or of lower motivation, they would rely on such peripheral cues to make judgments. The realism heuristic (Sundar, 2008) would predict that individuals would be more likely to trust a website with visual modality than one without such a feature, because the former shows a higher resemblance to the real world. The interactivity tool of 360-degreeonline product view might trigger both the being-there heuristic and the novelty heuristic (Sundar, 2008). When the being-there heuristic is triggered, online shoppers might feel that they are experiencing the product just like they would in brick-and-mortar stores, leading to an intensification in their online shopping experience and favorable evaluations. The novelty heuristic might also lead to better evaluations, but for a different reason, namely an appreciation of the innovation represented by the 360-degree viewing tool. Based on the above discussion, incorporating multiple interactivity features on the website will get users more interested in and more engaged with website content. This engagement might subsequently lead to more positive attitudes towards the website, as well as more favorable attitudes towards the product. Based on the theory of planned behavior (Ajzen, 1991), attitude would predict behavioral intention and subsequent actual behavior. If a consumer feels good about the product, this favorable feeling would be able to predict purchase intention as well. Similarly, favorable attitude toward the website would lead to higher behavioral intention towards the website, such as recommending the site to others, returning to the site for more visits, and so on.

Existing studies in marketing and consumer behavior suggest that the general good feeling and satisfaction towards the product are negatively related to price sensitivity (Hallowell, 1996). Research has also shown that customers who actively participated in the sale and knew more about the product would be less price sensitive (Hsieh & Chang, 2004). If consumers get involved with the product interactivity features, they would have feelings of participation in the sale and get more tangible information about the product, they would then be less sensitive about the price. Based on these studies, this study proposes the following hypotheses relevant to the effects of modality-interactivity on an e-commerce website and the product featured in it.

H6: Higher modality-interactivity will lead to greater engagement with website content.

H7a: Higher modality-interactivity will lead to more favorable attitudes toward the website.

H7b: Higher modality-interactivity will lead to stronger behavioral intention toward the website.

H8a: Higher modality-interactivity will lead to more favorable attitudes towards the product.

H8b: Higher modality-interactivity will lead to stronger intention to purchase product.

H8c: Higher modality-interactivity will lead to lesser price sensitivity.

Based on the website browsing process, consumers would first get engaged with the website content, and then make evaluation towards the website and product. Engagement with website content might serve as the mediator for product and website attitude. Their evaluation of the website might further influence the judgment of the product, which indicates that website attitude might mediate the relationship between interactivity and product attitude. Therefore, the study also proposes two research questions:

RQ1: Will engagement mediate the relationship between modality-interactivity and product attitudes, and between interactivity and website attitudes?

RQ2: Will website attitudes mediate the relationship between modality-interactivity and product attitudes?

Music and Arousal

In brick-and-mortar stores, aside from presenting products through a variety of ways, retailers would also employ background music to create a pleasant shopping environment. Previous studies about music's effect on consumers' shopping experience have shown that it could successfully affect the pace of in-store traffic flow and dollar sales volume in supermarkets (Millaim, 1982). It might also influence consumers' perception of shopping time as well as the actual time spent in brick-and-mortar stores (Milliam, 1986; Yalch & Spangenberg, 2000), their desire to engage in buyer-seller interactions (Dubé, Chebat, & Morin, 1995), and actual purchases (Milliam, 1986).

The majority of the existing literature about consumers' shopping experience focuses on music's effects on individuals' attitude and behavior. However, Chebat,

Chebat, and Vaillant (2001) suggested that it was also important to explore how music cues would impact cognitive processes. They cited two models to explain the cognitive effects of music: the Associated Network Theory proposed by Bower (1981) and the theory developed by Hecker (1984). The associated network theory (Bower, 1981) suggests that an individual's emotional states would enhance the memory of and attention to the facts associated with the emotions. In other words, similar emotional context would be conducive for an individual to easily retrieve information encoded with the same emotional experience. This emotional retrieval process would facilitate memorization (Bower, 1981, as cited in Chebat et al., 2001).

In contrast, Hecker's (1984) theory suggested a distraction effect of music on cognitive processing. He proposed that music would divert an individual's attention toward music itself. If too much attention were paid to the music, an individual would not have enough resources to be allocated to paying attention to the events happening within the music context, or the information delivered with music. Having music would thus inhibit encoding of information. For example, individuals might ignore the message delivered by the advertisement when the advertisement is accompanied by the music, since the majority of cognitive resources would be allocated to paying attention to music itself.

The above mentioned distraction effect of music has also been found in the educational context examining learning effectiveness. For example, McFarland and Kennison (1987) found that individuals needed more effort to achieve successful learning task with the presence of music. In a later study, McFarland and Hanna (1990) confirmed this result by finding that music inhibited learning in a tactual-spatial task. Furnham and

Bradley (1997) also reported a detrimental effect of background music on immediate recall for both introverts and extraverts.

The underlying mechanism of music's effect can be explained through the various dimensions of emotional reactions. Based on Mehrabian and Russell's (1974) framework, there are three dimensions with regard to individuals' emotional reaction to the environment: pleasure (P), arousal (A), and dominance (D). The current study focuses on the arousal dimension which assesses how much the environment stimulates individuals. Existing studies have shown that by varying arousing levels, environmental cues, such as color (Bellizzi, Crowley, & Hasty, 1986) and music (Milliman, 1982; Yalch & Spangenberg, 2000; Dubé, Chebat, & Morin, 1995), may affect consumers' product browsing, purchase intention, and shopping time (Wakefield & Baker, 1998; Park, Iyer, & Smith, 1989; Baker, Grewal, & Levy, 1992; Kotler, 1973; Milliman, 1982) in brick-and-mortar retailing settings.

As discussed before, modality interactivity may affect consumers' mental representation of website content by essentially changing the information-processing ability of users. Physiological arousal, elicited by peripheral environment cues, can also affect consumers' information processing in a similar way by varying the resources available for information processing (Revelle & Loftus, 1992). Therefore, aside from the impact of interactivity, this study tries to ascertain how music-induced arousal influences consumers' cognitive processing during online shopping, as well as user engagement with website, attitudes towards product and website, and behavioral outcomes. Would music serve as a distraction in individuals' processing of online product information? What would happen if we vary the arousal level of music?

Duffy (1962) defined arousal as "a condition conceived to vary in a continuum from a low point in sleep to a high point in extreme effort or intense excitement" (p.5). It is the inverse of the probability of the subject falling asleep (Corcoran, 1963). Berlyne (1967) further suggested that arousal should be considered as a dimension rather than a phenomenon. Lindsley (1951) postulated that arousal should only account for the intensity rather than direction or quality. Therefore, arousal is seen as having no valence. Revelle and Loftus (1992) refer to arousal as a non-specific component of motivation. They propose that along the continuum dimension of arousal, a low level of arousal is actually a means to conserve physiological resources for more demanding activities whereas a high level of arousal is associated with a higher degree of metabolic response to the demand of tasks. Based on this explication, they suggest that variations in arousal serve the function of varying the resources available for information processing.

Effect of Arousal

The effect of arousal can be examined through two different categories of theories: the unidimensional model and the optimal level model. The representative theory of the unidimensional model is excitation transfer theory (Zillmann, 1971, 1983). The second category includes the assumption of arousal as activation of processing capacity (Kahneman, 1973), the Yerkes-Dodson law (Yerkes & Dodson, 1908, as cited by Broadhurst, 1957), and hypothesis about arousal reducing cue utilization (Easterbrook, 1959).

Excitation transfer theory. In general, relatively higher levels of arousal would facilitate the sustained detection of and rapid response to stimuli, as well as being conducive to long term retention (Hamilton, Fowler, & Porlier, 1989). A unitary model of arousal (Richwood & Price, 1988) that has been widely adopted and tested is the excitation transfer theory. It assumes that arousal created by different stimuli differ only in intensity but not in quality (Schwartz, 1972). Excitation transfer theory (Zilllmann, 1971, 1983) posits that the residual arousal from a stimulus will combine with arousal from a subsequent stimulus, thus intensifying human response to the second stimulus. The idea of excitation transfer can be traced back to early research done by Schachter and Wheeler (1962), showing that individuals' response towards humorous stimuli might be heightened by the state of their physiological arousal. This would happen if the stimulus for the initial physiological arousal state is ambiguous. In a later study, Cantor, Bryant, and Zillmann (1974) referred to the situation described by Schachter and Wheeler (1962) as "misattribution of arousal" (p.812). They suggested that the level of arousal or excitation determines the intensity of an individual's emotional state. The external arousing stimulus can increase the level of excitation. Once excitation occurs, it will take some time to completely decay. Even though the stimulus has been removed, the excitation caused by it will persist. This residual excitation will serve to amplify one's physiological response to other stimuli introduced at this point, which contributes to a cognitive appraisal of such stimuli as being more than ordinarily stimulating.

Three distinct phases have been identified to describe the complete excitation transfer process (Cantor, Zillmann, & Bryant, 1975). During the first stage, an individual is able to identify the stimulus source of the excitation. At the second stage, this individual is no longer aware of the source of excitation, although he/she is still physiologically aroused. At this point of time, the residual excitation might be transferred to a different stimulus. During the final stage, the physiological arousal is completely decayed.

The theory suggests that such transfer occurs under the following two situations: 1) when there is an appropriate time delay between the first and the second arousal stimulations so that individuals lose cognitive awareness of the source of first arousal and misattribute residual arousal from the first source to the second source; or 2) when the second source immediately follows the first source but with a cognitive closure between the two arousal stimuli, leading to a loss of awareness of arousal from the first source (Cantor, Zillmann, & Bryant, 1975).

Evidence to support this theory has been found in both traditional and new media interfaces. Excitation transfer effects have been found in exploring the effect of exposure to sexually violent media on rape myth acceptance (Emmers-Sommer, Pauley, Hanzal, & Triplett, 2006), in aggressive response over time for graphic video games (Boyan, 2008), and website download speed on subsequent browsing behavior (Sundar & Wagner, 2002).

In the current study, as will be described later, participants were first exposed to some background music while waiting for the product webpage to fully load on their computer screens. After the page was fully loaded, the music was still kept on until they finished browsing the page and left the website. If the excitation transfer theory is applied here, the background music played during page loading would be considered as the first source of arousal. This source of arousal serves as an energizer for the potential effect of subsequent interactivity stimulus. It would expand individuals' available cognitive processing capacity. With the expanded cognitive capacity, more cognitive resources would be available to detect and process the information on the website. Therefore, individuals should memorize more and elaborate more about the website content during browsing process when the arousal is high compared to when the arousal is low.

H9: Higher arousal (music with faster tempo) will lead to greater attention to product information.

H10: Higher arousal (music with faster tempo) will lead to better memory.

H11: Higher arousal (music with faster tempo) will lead to greater cognitive elaboration.

If consumers' perceptual bandwidth has been expanded by arousing music, their mental representation of sensory inputs would be broadened, which would lead to a wider experience of mediated content. More sensory perceptions of information on the website would be stimulated, which would lead to heightened level of engagement with website content. Once consumers get highly engaged with the website content, they would generate positive attitude towards the website and subsequently more behavioral intention towards the website. The favorable attitude towards the website would be transferred to their attitude towards the product, influence their purchase intention, and make them less sensitive about the price of the product.

H12: Higher arousal (music with faster tempo) will lead to greater engagement with website content.

H13a: Higher arousal (music with faster tempo) will lead to more favorable attitudes toward the website.

H13b: Higher arousal (music with faster tempo) will lead to stronger behavioral intention toward the website.

H14a: Higher arousal (music with faster tempo) will lead to more favorable attitudes towards product.

H14b: Higher arousal (music with faster tempo) will lead to higher intention to purchase product.

H14c: Higher arousal (music with faster tempo) will lead to lesser price sensitivity.

Optimal level theories. Unlike the excitation transfer theory, optimal level theories of arousal predict an inverted U shape relationship between arousal and performance outcome (Broadhurst, 1957). There is an optimal level for arousal to influence task performance (Kahneman, 1973). Task performed at levels of arousal below the optimum suffer from limitation of attention, whereas task performed at levels of arousal above the optimum are memory limited (Kahneman, 1973; Reinecke & Trepte, 2008).

Kahneman (1973) considers arousal as the activation of processing capacity. His divided attention model proposes that the total available processing capacities may be either increased or decreased by influence of arousal. Moderate levels of arousal are assumed to produce the greatest amount of available cognitive capacity (Friedenberg & Silverman, 2005). This assumption is consistent with the Yerkes-Dodson law (1908, as cited by Broadhurst, 1957). The Yerkes-Dodson law suggests that there is a non-linear relationship between the arousal and information processing. Information processing performance is relatively poor for either low or high level of arousal, since individuals will presumably get either too bored (under low arousal) or too anxious (when highly aroused). Cognitive performance reaches its optimum when arousal is at an intermediate level. Easterbrook's (1959) cue utilization theory posits that immediate memory relies more on peripheral cues whereas delayed memory relies more on central cues. However, high level of arousal might induce narrowed utilization of both types of cues and thus hinder both recall and recognition memory. With regard to the attention and detection of information, Revelle and Loftus (1992) indicated that there is evidence showing that increases of arousal from low to moderate are associated with improved performance, whereas the increases from moderate to high are associated with decrements in performance. High arousal has been found to lead to deficits for short term recall, although it actually facilitated longer term recall (Walker & Tarte, 1963). Eysenck (1975) also found that moderate level of arousal increased the speed of retrieval compared to either low or high levels of arousal. This indicates that the moderate level of arousal would facilitate recognition, whereas either high or low level of arousal would inhibit recognition.

If level of arousal is manipulated through either placing no music on the website, or a music with slow tempo (low arousal), or a music with fast tempo (high arousal). Based on Kahneman's (1973) and Reinecke and Trepte's (2008) studies, the condition with slow tempo music should be the optimal level of arousal for cognitive activities. Individuals in the control (no music) condition would suffer from lack of attention, whereas individuals in the fast-tempo music condition would be limited in memory. Since the memory questions were administered right after participants finished website browsing, they were only referred in the short-term context.

H15: Low arousal (music with slow tempo) will lead to greater attention to product information.

H16: Low arousal (music with faster tempo) will lead to better memory.

H17: Low arousal (music with faster tempo) will lead to greater cognitive elaboration.

With regard to the relationship between arousal and subsequent task performance and decision making, Mano (1992) and Sanbonmatsu and Kardes (1988) both found that high arousal level in individuals would lead to less approach behavior in subsequent tasks, such as spending less time on the task and employing simpler strategies to deal with tasks. One potential reason to explain this is that high arousing stimulus would restrict the amount of processing resources that can be allocated to subsequent tasks. Highly aroused individuals will tend to simplify future decisions and avoid more stimulating contexts (Menon & Kahn, 2002). The arousal caused by the external stimuli can be carried over to the next task and affect how much arousal would be desired (Mano, 1992). For example, if we enter a brick-and-mortar store with flashy lights and loud music, we would usually engage in less exploratory behavior, reduce unnecessary purchase, and shorten shopping time. The high arousal itself takes over too much attention and orienting responses, leaving fewer resources for accomplish the task right after it. In examining the effects of arousal and pleasure on online shopping experience, Menon and Kahn (2002) named the above mentioned influence as the “cross-category effects” of arousal. They found that if higher stimulation was provided by the initial Internet experience, then consumers subsequently tended to engage in less arousing activities, such as searching more categories, and consequently visited lesser number of sites. In the current study, if consumers get very highly aroused by the music first, they will not have enough cognitive resources remaining to be allocated to the subsequent browsing task on product page. They may try to avoid interacting with the elaborated website feature, become less engaged in reading the content. If they are less engaged with the website, it would be less likely that they will show any favorable attitude towards the website, which would subsequently reduce the likelihood to visit the website again in the future.

H18: Low arousal (music with faster tempo) will lead to greater engagement with website content.

H19a: Low arousal (music with faster tempo) will lead to more favorable attitudes toward the website.

H19b: Low arousal (music with faster tempo) will lead to stronger behavioral intention toward the website.

H20a: Low arousal (music with faster tempo) will lead to more favorable attitudes towards product.

H20b: Low arousal (music with faster tempo) will lead to stronger intention to purchase product.

H20c: Low arousal (music with faster tempo) will lead to lesser price sensitivity.

If the role played by interactivity in affecting information processing capacity is similar to that of arousal, then we might be able to empirically test that by examining the interaction effect of the two. If we were to discover an additive effect of modality interactivity and arousal, then arousal might function as an engine to magnify the effects of modality interactivity. Alternatively, we may find that the effects of modality interactivity occur only under low arousal conditions, but not under conditions of high arousal or no music .

To be more specific, when the cue-summation theory (Severin, 1967a, 1967b) holds true, we would be able to find that higher interactivity leads to more cognitive capacity for information processing. Arousal as an energizer, as predicted by the unidimensional model (Zillmann, 1971), would amplify one's physiological response to interactivity stimuli. Therefore, we should find a consistent increase in cognitive capacity, given the increases in both level of interactivity and level of arousal. However, if arousal can only expand one's processing capacity up to a certain point as suggested by the optimal level theories (Kahneman, 1973), we should find that one's cognitive capacity would increase up to a point and then drop, i.e. follow an inverted V-pattern with increases in both level of interactivity and level of arousal. When the limited capacity theory (Lang, 2000) holds true, even though arousal, as an energizer (as predicted by unidimensional models) would amplify one's cognitive capacity to interactivity stimuli in general, the allocation of cognitive resources to different stages of information processing would be different. Increases in level of interactivity would lead to increases of attention and recognition memory, but inhibit recall and cognitive elaboration. In contrast, when the limited capacity theory is combined with the optimal level model of arousal, moderate level of arousal with higher level of interactivity would lead to the greatest amount of available cognitive resources. However, even though more cognitive resources would be available under the condition of moderate level of arousal and high level of interactivity, too much orienting responses towards highly interactive website features would possibly improve encoding of website content, while inhibiting recall of website content.

Since the current study proposes a positive linear relationship between level of interactivity and a series of attitudinal and behavioral outcomes, such as engagement with website content, attitudes towards the website and product, behavioral intention towards the website, and purchase likelihood of the product, we should be able to find that higher levels of both interactivity and arousal would lead to best outcomes, given the assumption that arousal serves as the amplifier of one's response to stimuli. In contrast, if arousal would only expand one's processing capacity up to a point, we would find that high level of interactivity combined with moderate level of arousal would lead to the best outcomes.

In order to explore the interaction effect of interactivity and arousal, this study takes one step further to explore what would happen when these two factors are both present on the websites. Instead of proposing hypotheses for the interaction effect, the study raises a research question for that.

RQ3. What are the interaction effects of interactivity and arousal on consumers' perception, information processing, attitude, and behavior?

Influences of Individual Difference Factors

Given the e-commerce setting of the current investigation, individual difference variables, such as hedonic and utilitarian shopping orientation (Childers, Carr, Peck, & Carson, 2001) and power-usage (Marathe, Sundar, Bijvank, van Vugt, &Veldhuis, 2007) are likely to influence user interactions with the stimulus website. In this study, hedonic and utilitarian shopping orientations were treated as two separate moderators, whereas power-usage was considered a control variable.

Shopping orientation: Hedonic &utilitarian. Shopping orientation is associated with the general predisposition towards shopping, which can be conceptualized as dimensions of lifestyle based on interest and activities (Li, Kuo, & Russell, 1999). The hedonic and utilitarian shopping orientations are common to most typologies related to consumer shopping behavior. Both of them are known to exist across almost all consumption contexts (Babin, Darden, & Griffin, 1994). Hedonic shopping orientation, which might also be referred to as recreational or experiential orientation, focuses on the entertainment and enjoyment resulted from the fun and playfulness experienced during shopping process (Hirschman & Holbrook, 1982). Utilitarian shopping orientation, also called instrumental or convenience orientation, emphasizes the convenience of shopping experience (Babin, Darden, & Griffin, 1994). Hedonic shoppers are more intrinsically motivated towards shopping, looking for fun and sensory stimulation (Batra & Ahtola, 1991). Utilitarian shoppers are more concerned about whether they would be able to achieve their shopping goals in a timely and efficient manner, which would make their lives easier (Kim, 2002). These two orientation dimensions are not completely orthogonal to each other. Babin et al. (1994) have found in their study that these two orientations were not necessarily mutually exclusive. Their expected outcomes are usually correlated. However, in much of the existing literature, these two orientations have been treated as distinctive dimensions and examined separately (Anderson, 1971, 1972; Holbrook & Hirschman, 1982; Childers, Carr, Peck, & Carson, 2001) for their direct influence on perception of stores. Following this approach, the current study assumes that an individual might have both motivations at the same time. The two orientations might therefore influence their experience with online shopping through different mechanisms.

Research thus far on the relationship between shopping orientation and online behavior as focused on (1) discussing whether the general features of the Internet make the medium more suited for hedonic or utilitarian orientation (Childers et al., 2001), and (2) how to match each type of shopping orientation with certain website features (Kim &

LaRose, 2004). But, the two types of shopping orientations could very well coexist in the internet e-commerce environment. Certain interactivity features could satisfy both hedonic and utilitarian orientations at the same time. For example, the spin feature to rotate product image might satisfy hedonic shoppers with novelty and more fun in exploring product and involve more sensory stimulation. The same function might also satisfy utilitarian shoppers with a more direct and clear demonstration of the product's features and functions. This direct demonstration of product specification would reduce the time spent on reading through a long textual description. Individuals with different levels of hedonic and utilitarian shopping orientations might influence the way they use the interactivity features, and therefore react to different levels of interactivity and arousal while shopping online. Therefore, we pose the following research questions for study:

RQ4. How will hedonic shopping orientation moderate the effects of interactivity and arousal?

RQ5.How will utilitarian shopping orientation moderate the effects of interactivity and arousal?

Power-usage. Another individual-difference variable that might influence the effects of interactivity and arousal is power-usage (Marathe et al., 2007). Power-users are individuals who use the Internet, website, and other information technologies frequently and considers themselves experts of them (Marathe et al, 2007; Sundar & Marathe, 2006). Whether someone is a power-user or not might influence the extent to which s/he uses the technological features on the website and the degree of ease with which they use them. Since higher interactivity features might involve more unique and novel experience with the website, non-power users who are inept in technology use may experience frustration and disorientation with these features. In contrast, power users might feel more at ease with the interactivity features and interact more with these features. The difference in abilities to fully use the website features might affect the effectiveness of the interactivity manipulation. Therefore, in the current study, participants' power-usage was measured before their exposure to the experimental stimuli and entered in the analysis as a covariate.

In sum, this dissertation involves two manipulated independent variables (interactivity and arousal), two moderators (hedonic and utilitarian shopping orientations) and one control variable (power-usage).

Chapter 3

Methods

A 3 (interactivity: low, medium, high) $\times$ 3 (arousal: control, low arousal, high arousal) between- subjects factorial experiment was conducted to understand how modality interactivity and arousal individually and interactively influence consumers' perceptual bandwidth, engagement with product, information processing of website content and subsequent attitude and purchase intention towards the website and product. Stimulus websites with combinations of different levels of arousal and interactivity were developed for this study. Three pretests were conducted before the actual experiment to select the appropriate music excerpts for manipulating arousal, decide the product to be displayed on the website, and guide the development of interactive features on the website.

Pretest One: Selection of Arousal Stimuli

Level of arousal was manipulated through background music played on the website. A pretest was conducted to determine stimuli for high and low arousal conditions. The first aim of this pretest was to identify two pieces of music excerpts that varied in their levels of arousal. Aside from the level of arousal, this pretest would also compare the level of pleasure associated with each piece of music. Since marketers and e-tailers would be less likely to use music that elicit unpleasantness or negative emotions for consumers, the stimulus excepts should be able to elicit moderate level of pleasure for individuals. Therefore, in order to control the effect of pleasure caused by music, the two excerpts should not significantly differ in their levels of pleasure. Therefore, in this pretest, six initially selected music excerpts were evaluated for both their levels of arousal and levels of pleasure. Based on pretest results, two music excerpts that differed significantly in their levels of arousal but without any significant differences in level of pleasure were determined to manipulate levels of arousal in the actual experiment. A paper-and-pencil questionnaire with audio stimuli was used to explore the differences and similarities among music excerpts.

Participants. Twelve graduate students in communication studies participated in the pretest for selecting stimuli for arousal. Three of them were male. Their mean age was 27 years.

Stimuli. The existing studies (Dillman-Carpentier, & Potter, 2009; Dubé, Chebat, & Morin, 1995; Holbrook & Gardner, 1993) have found that tempo, as a structural characteristic, is the most successful determinant of music-induced arousal. Therefore, the current study manipulated different levels of arousal through adopting music excerpts with varied tempi. Tempo is measured in beats per minute (BPM). By modifying Dubé, Chebat, and Morin's (1995) categorization of music tempos, the current study defined the low level of arousal with a tempo of 98 BPM or slower, and the high level with a tempo of 120 BPM or faster. In addition, it featured a control group without any music.

Although Dillman-Carpentier and Potter (2009) have shown that music genre does not have an effect on listeners' physiological arousal, the study still carefully tried to avoid any potential confounds due to genre and therefore chose music excerpts that shared similar genre, such as classical music and new-age music. In selecting the music stimuli, the study also tried to control other parameters of the music excerpts by choosing optimal levels, as follows: flowing rhythm, medium or high pitch, and a medium volume. The initial music selection generated six music excerpts: William Tell Overture by

Rossini (138 BPM), Eine Kleine Nacktmusik by Mozart (128 BPM), Cello Suite No.1 by Bach (126 BPM), Ave Maria (instrumental version) by Bach (76 BPM), Through the Arbor by Kevin Kern (94 BPM), Sundial Dream by Kevin Kern (98 BPM). The first three excerpts were considered candidates for the high-arousal manipulation while the later three were considered candidates for the low-arousal manipulation. In general, neither offline nor online retailers would adopt any music that might lead to negative emotional responses from consumers. Therefore, a moderate level of pleasure was used as the criterion to select these six pieces of music. All of the music excerpts from initial selection were cut into 30 seconds in length.

Procedure. All twelve participants were asked to listen to all six excerpts from the above-mentioned pieces of music. They were asked to indicate the perceived level of pleasure and level of arousal after listening to each music excerpt on a paper-and-pencil questionnaire.

Measure. The non-verbal pictorial assessment technique of the Self-Assessment Manikin (SAM) scale, developed by Bradley and Lang (1984), was adopted to measure both the pleasure and the arousal associated with participants' affective reactions towards the music stimuli. This pretest used the 7-point SAM scale. This scale includes two parts. The first part represents the pleasure dimension and ranges from a smiling, happy figure to a frowning, unhappy figure. The second part shows the arousal dimension and ranges from an excited, wide-eyed figure to a relaxed, sleepy figure (Figure 1).

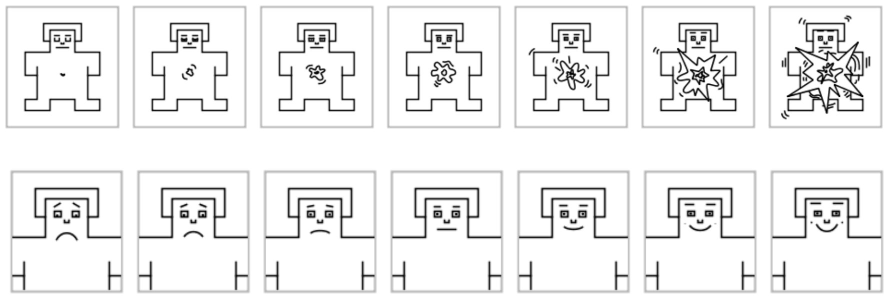


Figure 1. The 7-pointself-assessment manikin scale: arousal & pleasure

Results. An omnibus test was first conducted with music type as the independent variable, level of pleasure and level of arousal as respective dependent variables, and participant ID as the random factor. The result of the omnibus test showed that the six music excerpts did not significantly differ with regard to level of pleasure, F (5, 55) = 2.07, p =.08. All six music excerpts were found to induce moderately positive levels of pleasure. The means ranged from 4.50 to 5.42 on the 7-point scale. However, they differed significantly in the level of perceived arousal, F (5, 55) = 75.43, p<.01. Student's t was used to further examine the specific differences among music excerpts for both level of arousal and level of pleasure. The results of the pairwise comparison showed that among the three candidate excerpts for high arousal condition, William Tell Overture scored significantly higher (M = 5.92) than the other two pieces (M = 4.67 and 3.25). There was no difference among the three candidate excerpts for low arousal condition with regard to level of arousal, with Through the Arbor and Ave Maria both having the lowest scores of 1.92. Table 1 provides detailed information about pretest results. Based on these results, William Tell Overture was chosen for the high-arousal condition. The stimulus for the low arousal condition was a choice between Through the Arbor and Ave Maria. In order to minimize or even avoid the potential confounding effect of level of pleasure, the stimuli for high arousal and low arousal conditions should share the same or similar level of pleasure. This became the next criterion to decide which excerpt to choose for the low arousal condition. But, neither Through the Arbor nor Ave Maria differed significantly from William Tell Overture on the pleasure dimension. So, music genre was used to make the final decision. Ave Maria was composed in Baroque and Classical period, whereas William Tell Overture was composed in Romantic period. Both of them belong to the Common Practice period in the history of European art music. Through the Arbor is considered as New Age music which belongs to the Modern and Contemporary period. Ave Maria and William Tell Overture might share more in genre with regard to the time of completion. Based on this rationale, Ave Maria and William Tell Overture differed significantly in level of arousal, and were similar in level of pleasure and genre. They were eventually chosen as the arousal manipulations for the current study.

Table 1. Pretest results for music excerpts

Music ID	Name	Author	BPM	Pleasure	Arousal
1	Through the Arbor	Kevin Kern	94	5.25_{AB}	1.92_{D}
2	Eine Kleine Nacktmusik	Mozart	128	5.50_{A}	4.67_{A}
3	William Tell Overture	Rossini	138	5.17_{AB}	5.92_{B}
4	Ave Maria	Bach	76	4.60_{B}	1.92_{D}
5	Cello Suite No.1	Bach	126	4.50_{B}	3.25_{C}
6	Sundial Dream	Kevin Kern	98	5.42_{A}	2.08_{D}

Note: Means with no subscript in common differ at $p < .05$.

Pretest Two: **Selection of Product**

The purpose of the second pretest was to determine the product to be featured on the stimulus website with different manipulated levels of interactivity. The current study adopted two criteria for deciding the product to be displayed on the website.1) The product needs to have some likelihood to be bought online. 2) The product can afford a variety of modality interactivity features. In other words, it should be reasonable to embed various modality-interactivity features for the purpose of presenting the product. For example, book as a product would not be considered a good choice for the stimulus because it does not have the range of rich visual details that can be better illustrated with the use of modality-interactivity tools. Based on these two criteria, eight products that are commonly found in e-commerce websites were selected. They were digital camera, printer, camcorder, GPS, wireless router, laptop computer, desktop computer, and mp3 player. A pretest was then conducted to evaluate each product's likelihood of being purchased online in the past and in the future. Consumers' prior purchase experience with the product might influence their future purchase intention. This pretest therefore also included prior online and offline purchase experience as control variables that might influence people's future online purchase likelihood. An online questionnaire was used to measure participants' prior and future purchase likelihood towards these eight products.

Participants. Fifteen undergraduate students enrolled in a video production class participated in the pretest of product selection for extra credit. The mean age was 20.2 years. Eight of them were female, and the rest were male. Thirteen of them were Caucasian, with one Black and one Asian.

Procedure. Eight digital products that were widely sold online, such as digital camera, printer, camcorder, GPS, wireless router, laptop computer, desktop computer, and mp3 player were selected as candidates for the product to be shown on the stimulus websites. Participants were asked to fill out an online questionnaire indicating their previous online and offline purchasing experience, as well as their future online and offline purchase likelihood for each of these products.

Measures. Previous online and offline purchasing experiences with each of the eight products were measured by yes/no questions. The future online purchase likelihood was measured by a single item: “Please indicate the likelihood that you will purchase this product online in the future” on the 7-point scale ranging from “extremely unlikely” to “extremely likely”. The future offline purchase likelihood was measured by a single item: “Please indicate the likelihood that you will purchase this product offline in the future” on the same 7-point scale, ranging from “extremely unlikely” to “extremely likely”.

Results. An omnibus test was first conducted to explore the difference in online purchase likelihood among eight products, with participant ID as a random factor, product type as the independent variable, online purchase likelihood in the future as the dependent variable, and previous online and offline purchase experiences as the control variables. The result of this test showed that there was no significant difference among the eight products in general, F (7, 109) = 1.96, p =.07. In order to examine whether previous online purchase experience and offline purchase experience would predict future purchase intention, these two variables were respectively entered into two separate t-tests: one with previous online purchase experience as the predictor and the other with previous offline purchase experience as the predictor. Future online purchase likelihood was the dependent variable in both tests. The results of these two *t*-tests showed that previous online purchase experience positively predicted future online purchase likelihood, t (118) = 5.21, p < .01.Individualswho had purchased the product online before (M = 4.00, SD = 1.87) were more likely to purchase it again online than those who had never done so (M = 2.38, SD =1.44). In contrast, there was no significant relationship between previous offline purchase experience and future online purchase likelihood. In other words, whether individuals had purchased the product before offline would not influence their future online purchase likelihood.

A pairwise post-hoc test using Student's *t* was conducted to further compare the differences between products. The results of this test showed that some products differed from each other with regard to future online purchase likelihood (Table 2), such as mp3 player and wireless router, camera and desktop, mp3 player and GPS. However, there was no significant difference among the top four products that had higher online purchase likelihood than the rest: mp3 player (*M* = 4.07), camera (*M* = 3.85), laptop computer (*M* = 3.70), and printer (*M* = 3.28). Among these four products, mp3 player and camera had higher future online purchase likelihood and a respectable number of individuals who had purchased them before. Table 2 shows detailed information for all eight products. As a result, mp3 player and digital camera became the top two choices.

Table 2. Pretest results for products

Product ID	Name	Ever purchased online	Ever purchased offline	Likelihood of purchasing online in the future
1	mp3player	8	12	4.07_{A}
2	camera	6	13	3.85_{AB}
3	laptop	6	12	3.70_{ABC}
4	printer	4	13	3.28_{ABC}
5	gps	2	7	2.90_{BC}
6	camcorder	4	8	2.88_{BC}
7	wireless router	5	10	2.72_{C}
8	desktop	3	12	2.65_{C}

Note: For ever purchased online and offline columns, the numbers mean the total numbers of individuals, whereas the numbers in the column of likelihood of purchasing online in the future refer to the means for products. Means with no subscript in common differ at $p < .05$.

By taking a further step to examine the current product webpages of mp3 players and cameras on e-commerce website, the study found that the majority manufacturers and online retailers do not usually provide elaborated interactive product features for mp3 players. One potential reason might be that the interfaces of mp3 players are generally very lean in both functional and cosmetic features, for which galleries of interactive features are unnecessary. In contrast, most online retailers offer a variety of interactivity features for digital cameras. For the convenience of successfully manipulating different levels of interactivity, as well as achieving higher level of ecological validity, this study decided to use digital camera as the product to be shown on the websites.

Pretest Three: Manipulations of Interactive Features

Based on the results from the first two pretests, the study developed test versions of three websites with different levels of modality interactivity. The aim of the third pretest was to figure out whether the manipulation of different levels of interactivity would be successful. In order to fulfill this task, a between-subjects experiment with level of modality interactivity as the independent variable and perceived interactivity as the dependent variable was conducted.

Participants. Eighty-four undergraduate students from a large media-effects class took part in this pretest. The average age for these participants was 19.8. They were mostly female (61.0%). The majority of them were white (76.2%), with 26.5 % of freshmen, 33.7% sophomores, 22.9% juniors, and 16.9% seniors. They were randomly assigned to one of the three interactivity conditions. All of them signed the informed consent form prior to their participation in the experiment.

Website stimuli. Three e-commerce websites with a fictitious brand of Mack.com were constructed for this study. All of the websites shared the same page layout, theme color, navigational tools, and contents. They were constructed based on the website of B&H (www.bhphotovideo.com), a famous online retailer of photo, video, audio, and other digital devices.

Each stimulus website comprised four webpages. The first webpage was the homepage of the site. This webpage had three sections. The top section included the website logo, shopping cart status, search tool bar, and menu bar. The center section included seasonal promotions, deals, as well as product category lists with links to product collection pages. The bottom section showed information about customer services, company information, and other resources. Figure 2 provides an example of the homepage layout. By clicking the link embedded in the product category of camera on the first webpage, participants were directed to the second webpage. However, aside from the link embedded in the "point and shoot" subcategory, all the other links for different categories were deactivated. Participants were not able to perform any action on them.

The second webpage of the website was a production collection page. Similar to the homepage, it had three sections with the top and bottom sections the same as a homepage. The center section showed a list of point-and-shoot digital cameras with varied brands, prices, and technological specifications. There is only a minimal amount of information shown for each product on this page, such as brand, model, price, add-to-cart button, and add-to-wishlist button. On the left side of this page was a menu-style checklist for consumers to narrow down their choices (Figure 3), such as by brand, by resolution, by optical zoom, by LCD size, by memory card type, by color, and by price.

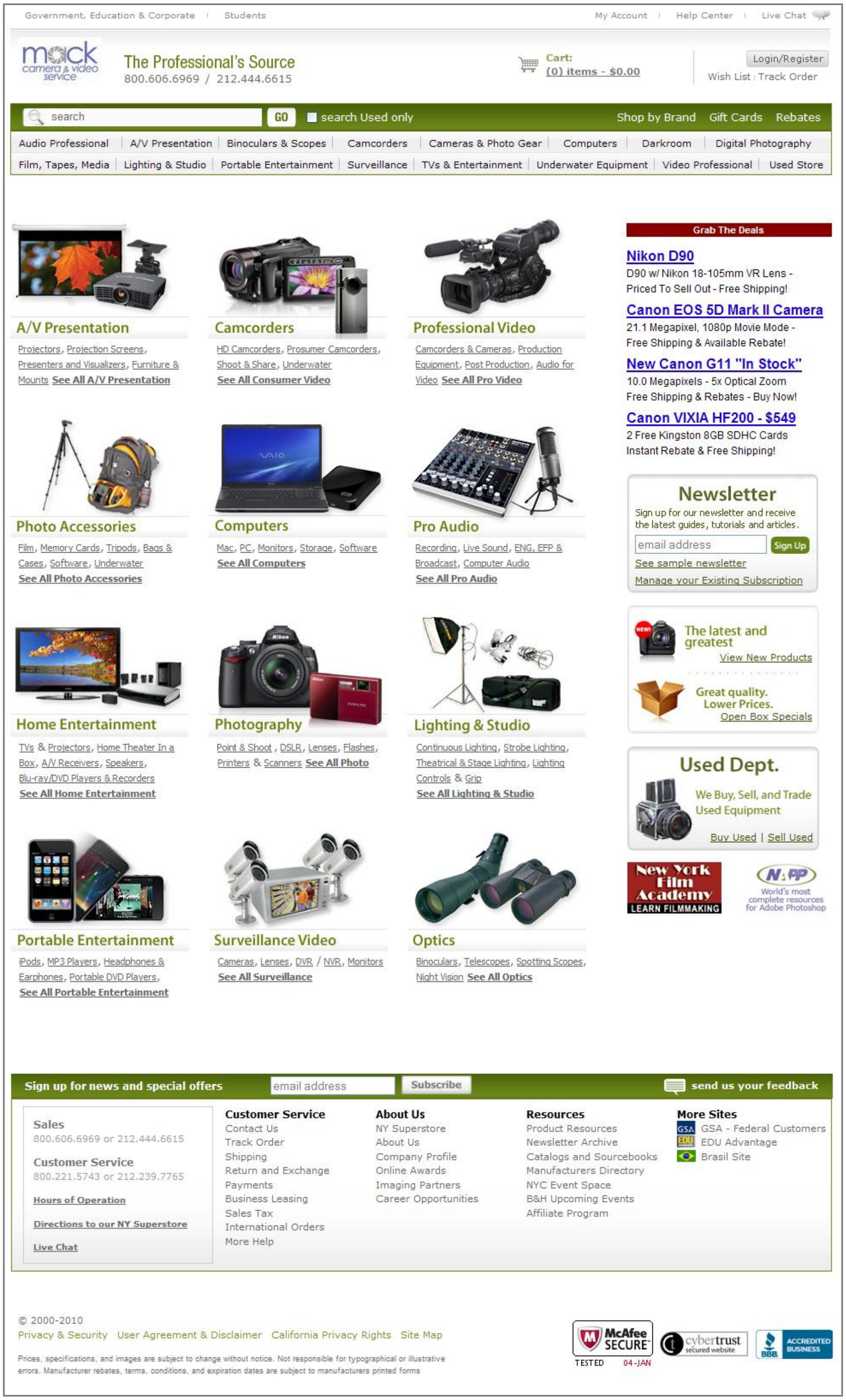


Figure 2. Homepage of website stimuli in Pretest Three

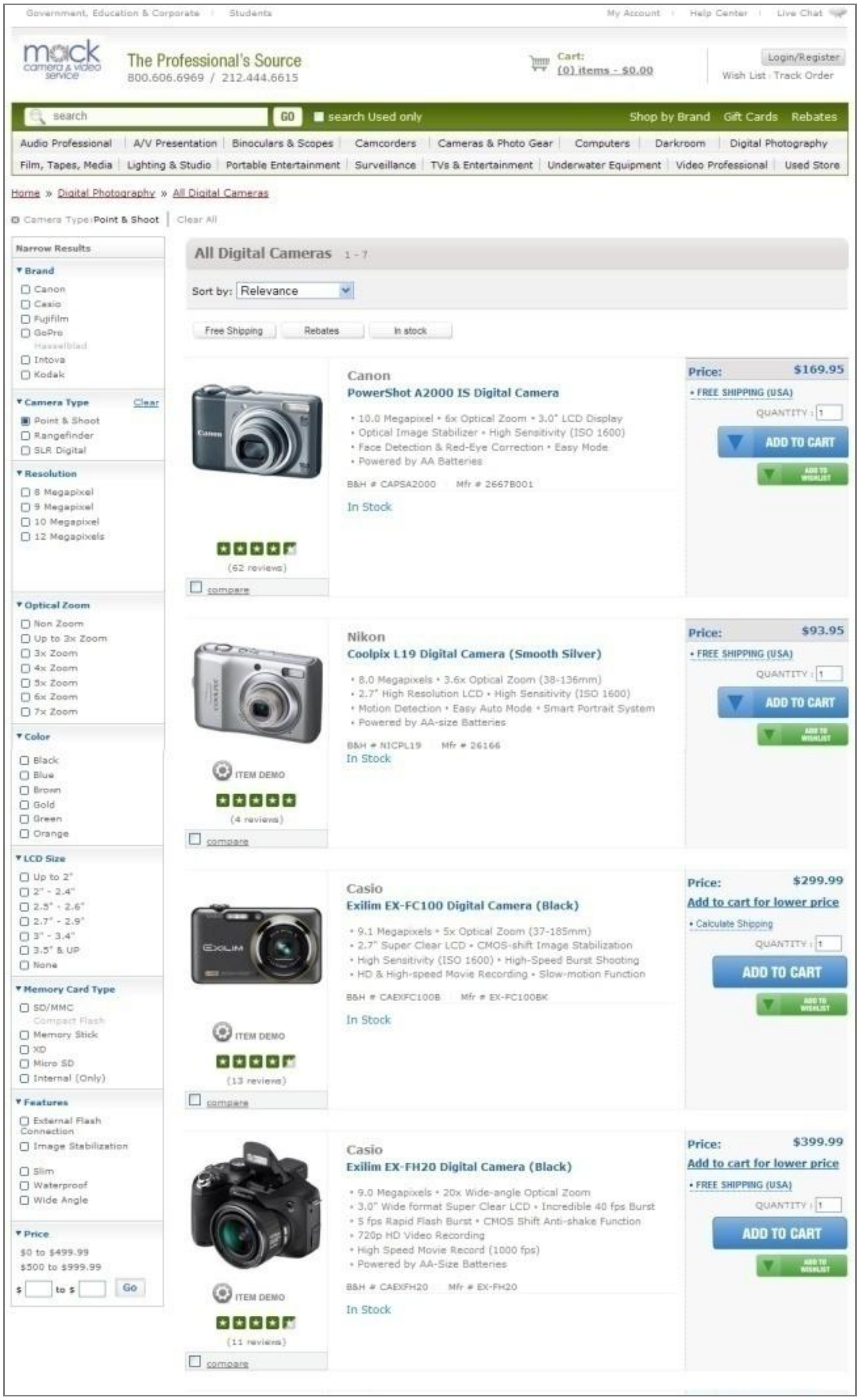


Figure 3. The second page of website stimuli in Pretest Three

Among them, only the 12 megapixels option under the resolution category was clickable. All the other links were deactivated.

The third page was also a production collection page showing a list of point-and-shoot digital cameras. Unlike the second page, which provided a variety of cameras with different resolutions, the third page only showed cameras with a resolution of 12 megapixels. It essentially served as the result of the selection conducted on the second page. Although a list of cameras was provided on this page, only the first camera had an active link. This link directed participants to the fourth page—the individual product page.

The fourth webpage, the individual product page, was also composed of three sections. The top section was the same as the other three webpages, including the website logo, shopping cart status, search tool bar, and menu bar. The center section included seasonal promotions, deals, as well product category lists with links to product collection pages. The bottom section showed information about customer services, company information, and other resources. The center section of this page was further divided into four parts: the product image(s), basic information about price, features/specifications, and "what's in the box". Figure 4 provides an example of this page. The "product image(s)" part was where different levels of modality interactivity were manipulated. For all conditions, there was an image showing the camera from a front perspective. There were three color blocks below this image, showing the alternative color options for this camera (more details on the manipulation in the next section). The "basic information" part listed the product brand, model, and the price. Four buttons, "add to cart", "continue shopping", "save for later", and "add to favorites" were placed below the information part. If participants clicked on the "add to favorites" button, the button would turn to a

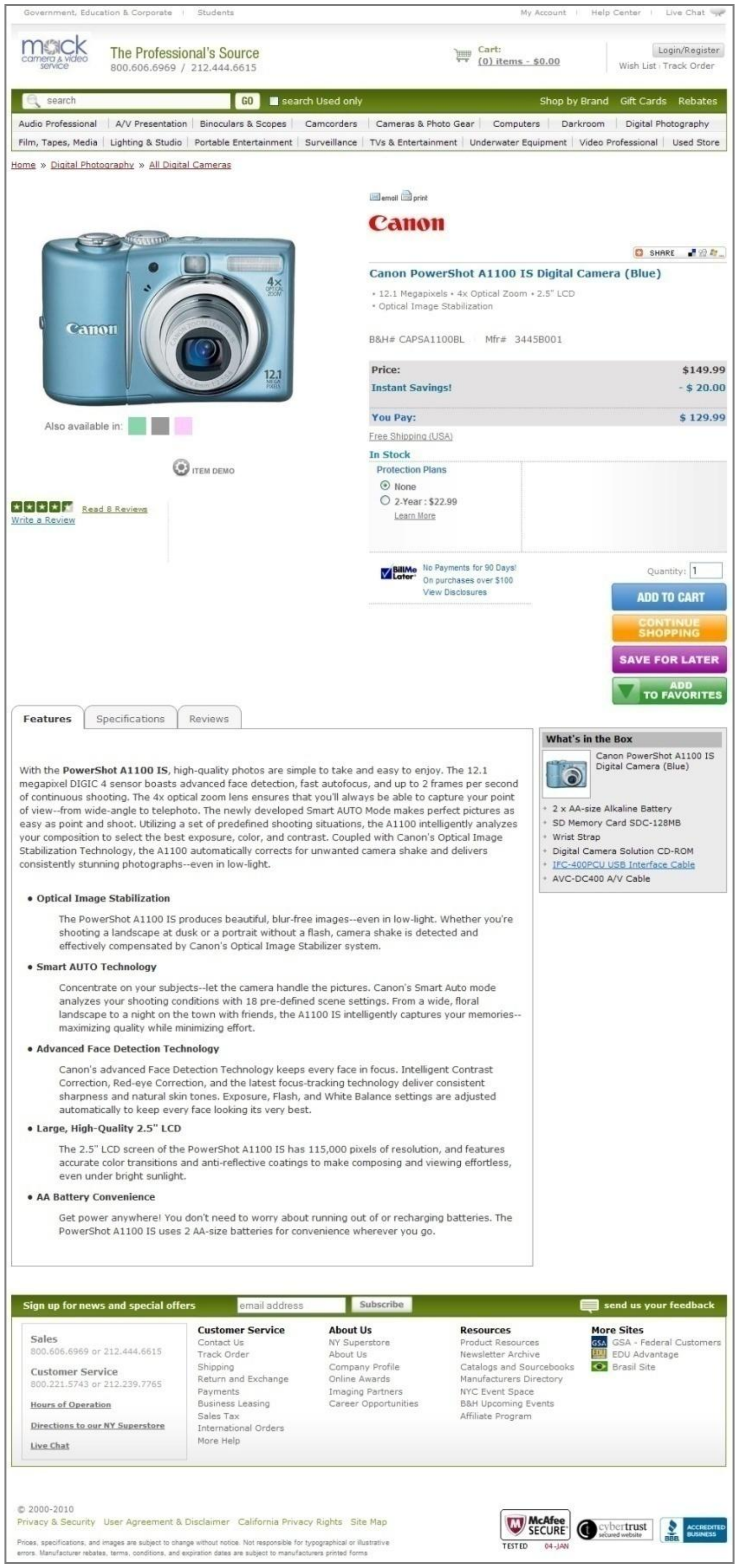


Figure 4. The individual product page of website stimuli in pretest three

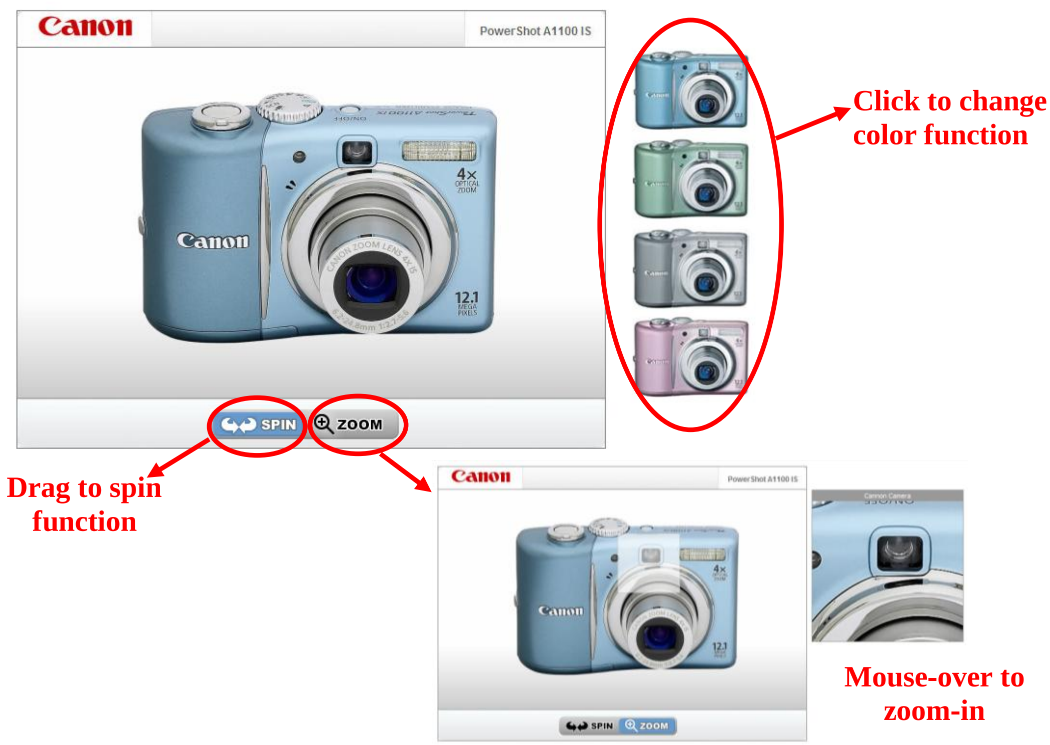
“remove from favorites” button. The color of this button would also change from green to red. Once the participants clicked on anyone of the other three buttons, they were directed to a thank-you page to finish the website browsing task. The “feature/specification” part was organized under two tabs. The feature tab highlighted the special aspects of the product, whereas the specifications tab provided all of the technical details about the product. The “what’s in the box” part described the materials included in the product package.

Modality interactivity manipulation. All three versions of the stimulus websites were made to look as similar as possible to avoid any incidental confounds. The individual product webpages for conditions were the same in content and differed from each other only in their levels of interactivity for the product image. In this study, level of modality interactivity was operationalized as the number of functional features presented for the image of camera.

In low-interactivity condition, there were four images showing the digital camera from different perspectives on the webpage. Similar to those in medium- and high-interactivity conditions, the front image of the camera was shown in its full size on the right side of the page. The other three product images with a smaller size were placed right below the front image. These product images were directly presented on the page. Participants were not able to do anything with them.

In medium-interactivity condition, there was also a front image shown in the product image area. A “more image” button was placed below the product image. Once participants clicked on that button, a smaller window would pop out showing the click-to-change image feature. This feature included four product images. Each of them showed

Medium-interactivity condition



High-interactivity condition

Figure 5. Examples of medium- and high-interactivity conditions in Pretest Three

the digital camera from a separate angel, such as front, back, left, and right. One of them was shown in bigger size in the center of the window whereas the other three were shown only as smaller thumbnails under the bigger one (Figure 5). Once the participants clicked one of the thumbnails, the bigger image would change accordingly.

Similar to the medium condition, high-interactivity condition also had an “item demo” button under the main product image. If participants clicked this button, a separate small window would pop out. Different from the medium condition, in high-interactivity condition, participants were able to drag to spin the image to see the product from different angles, to mouse-over to zoom-in for details, and to click to change the color of the product.

In summary, there was no interactive feature in low-interactivity condition, one interactivity feature of click-to-change in medium-interactivity condition, and three interactivity features in high-interactivity condition.

Procedure. Participants were randomly assigned to one of the three conditions. They were told that they were participating in a study exploring individuals’ online shopping behavior. They were asked to complete a gift-purchasing task based on a scenario provided by the experimenter. The scenario indicated that one of their friends was interested in a 12-megapixel Canon digital camera on Mack.com. They were thinking about whether to purchase it for him/her as a birthday gift. This friend cared about the appearance of the camera, especially the placement of function buttons on the camera. Therefore, they were asked to fully browse the camera website and examine the product features, just as what they would normally do when purchasing the product online. After they finished browsing the website, they would need to decide whether this product was a good choice. In order to view the product, they had to go through a few webpages to reach the actual product. Participants were also provided with a step-by-step instruction on how to locate the product by going through these webpages. They were instructed to open the stimulus website to first fully browse the homepage and then click the “camera” product category in the left menu on this page to access the camera product collection page. After they landed on the camera product collection page, they were instructed to select the “12-megapixel” category on the left side of the page to narrow down their search for the camera. They were told that the first product shown on the subsequent product-collection page was the one in which their friend was interested. This instruction not only served as navigational guidance for participants, but also ensured that every participant would go through the exact same process during the experiment. All the links and buttons on these webpages, except for the “camera” category link on the homepage, the“12-megapixel” link on the first product collection page, and the first product link on the second product collection page, were deactivated. This would further guarantee that all participants followed exactly the same navigational procedures on the websites. The stimulus websites were opened in Mozilla Firefox. The navigational tool bar for the browser was hidden so that participants were not able to see the website URL or tell whether the sites are real. After they finished browsing, they were told to first close the browser, and then filled out an online questionnaire about the perceived interactivity of the website.

Measures. In order to check whether the manipulations did differ with regard to the level of interactivity, this pretest used a perceived interactivity scale constructed by Sundar, et al. (2010). It included three items: “This website is interactive”; “This website allows me to perform a lot of actions"; and "This website allows me to access information in a variety of ways". All these items were measured on 7-point scales ranging from "strongly disagree" to "strongly agree".

Results. Analysis of variance (ANOVA) was used to test if different interactivity conditions indeed varied with regard to level of perceived interactivity. The result of this analysis showed that there was no significant difference among three interactivity conditions, F (2, 82) = .99, p = .38. High-interactivity condition (M = 4.72, SD = .24) was not perceived as having significantly higher interactivity than medium (M = 4.33, SD = .23), or low (M = 4.30, SD = .24) conditions. In other words, the manipulation of interactivity was not successful.

Discussion. By comparing the results from the current pretest with a previous study exploring the effect of website interactivity (Sundar, et al., 2010), this pretest found that the perceived interactivity in high-interactivity condition of the current pretest was not high enough and the one in low-interactivity condition was not low enough. In other words, the unsuccessful manipulation of interactivity might come from either the failure to boost interactivity in high condition, or the failure to lower the interactivity in low condition, or both.

By examining the screen-capture video which kept a record of participants' actual interaction with the website, this pretest found that many individuals in high-interactivity conditions failed to interact with the interactivity features. There appeared two primary reasons why participants missed the interaction with the product image on the website. 1) Participants were not able to figure out how to open the interaction window to access the interactivity features. They did not even observe the presence of interactivity features. 2)

Even though some participants successfully reached the interaction window and saw the interactivity features, they were confused with the button to switch between drag-to-spin function and mouse-over-to-zoom function and had no idea about how to deal with them. In these cases, the confusion and frustration led to little interaction with the interactivity features. For both situations, failure to interact with interactivity features in high condition was the reason to explain why participants indicated low level of interactivity for high-interactivity condition. Clearly, accessibility and usability of the interactivity features needed to be improved in order to solve this problem. Based on this analysis, three methods were taken to enhance the usability of interactivity features in the high interactivity condition: 1) adding instruction on how to access interactivity feature and making the "item demo" button more salient on the website; 2) separating drag-to-spin function and mouse-over-to-zoom function by adopting two different activation mechanisms; 3) providing clear instructions on how spin and zoom the product image in the interaction window.

In addition to increasing the interactivity in high condition, changes in design were also needed to decrease the level of interactivity in low condition. Based on pretest results and the observation of the screen-capture videos, four potential reasons were identified to explain why website in low-interactivity condition was not perceived as low enough: 1) Participants had to click through three webpages in order to get the individual product page where the interactivity manipulation was located. This procedure of clicking through might boost participants' sense of interactivity (Sundar et al., 2003), regardless of whether the manipulated features were interactive or not. 2) The individual page had three tabs of "features", "specifications", and "reviews". Participants were able to click to switch between them. The simple clicks performed over these three tabs may also boost their perceived sense of interactivity. 3) The last task that participants needed to accomplish during the experiment was to click the buttons. Once they clicked the “add to favorites” button, the button would change to “remove from favorites” from green to red. This clickable and changeable nature of the button might also give participants some impression that the website was interactive regardless of the differences in the manipulated interactivity features. The three above mentioned features probably boosted the baseline of interactivity across all conditions. The manipulation on the individual product page thus failed to make a difference with regard to the level of perceived interactivity. 4) In addition, the individual product page in low-interactivity condition had more product images placed at a more salient position than those in the other two conditions. These visual features constitute a type of modality (Sundar, 2000). Having more pictures might give participants a feeling that the website has higher level of interactivity.

Based on these analyses, the solutions to decrease perceived interactivity in the low condition include: 1) reducing the clicks across all conditions before participants reach the individual product page; 2) removing the “add to favorites” button; and 3) reducing the number of pictures on the individual product page in low conditions while keeping the available pieces of visual information consistent across all conditions.

Experiment Design

Based on the results from the third pretest, the study modified the stimulus websites and the instruction, as well as embedded the appropriate music stimuli into the websites for different conditions. The actual experiment of this study used a modified version of the stimulus websites discussed in the third pretest. It was a 3 (interactivity: low, medium, high) × 3 (arousal: control, low, high) between-subjects factorial experiment.

Participants. A total of 186 undergraduate students from several communication studies classes in a large northeastern university took part in this experiment for monetary compensation. The average age for these participants was 20.26 (*SD*= 1.10). There were almost equal numbers of female (92) and male (93) students, with one failing to indicate his/her gender. The majority of them were Caucasian (85.32%), with 5.44% African American, 4.89% Hispanic, 3.26% Asian, and 1.09% of other races. The majority of them (40.86%) were junior, with 24.73% sophomore, 22.04% senior, and 12.37% sophomore. Most of them (96.76%) indicated that they used the Internet for more than once a day. These participants were randomly assigned to one of the nine conditions.

Stimulus websites. Based on the results from the third pretests, the study modified the initial design of websites. The biggest change is that the first three pages of the website were removed. In the actual experiment, once participants clicked the URL linking to the stimulus websites, they would first see a loading page of Mack.com. The loading page was in translucent grey. It had a page loading progress bar flashing in the center of the page. Participants could barely see the product page underneath it, since the page was in translucent grey and was not clickable at all. The loading time would last around 7 seconds. Participants had to wait for the page loading progress bar to disappear to see the individual product page.

The design of the individual product page in the actual experiment was almost the same as that in the third pretest. However, the study adopted the following two modifications over the initial version. 1) The “add to favorites” button was removed. 2) The three tabs of “features”, “specifications”, and “reviews” were removed. The information about product features and specifications was changed into two blocks of texts stacked together in one column (Figure 6).

Interactivity manipulation. Similar to the stimulus website used in the third pretest, the stimulus for the actual experiment manipulated level of interactivity by varying the product image features. Based on the results from pretest three, it was decided to change the position of the images in low-interactivity condition, altered the instruction to facilitate usability in medium- and high-interactivity conditions, and modified the functional features in high-interactivity condition.

While keeping the amount of visual information equivalent to the medium and high conditions, low-interactivity condition only showed two images of the product: one from a front perspective and the other from a back perspective. In order to make the layout of the product webpages as similar as possible across all conditions, only the front image was shown in the product image area. The other image, the back image of the digital camera was placed below the “what’s in the box” part on the right side of the website (Figure 6). The visual difference caused by the additional product image on the product page in low-interactivity condition, as compared to medium and high conditions, would thus be minimized. The top parts of the websites, the most salient part which gave participants the initial impression, were kept consistent across the three conditions. Meanwhile, by placing an additional product image in low-interactivity condition, the current study was able to keep the amount of visual information disclosed on the website consistent across all conditions. The two product images in low-interactivity condition

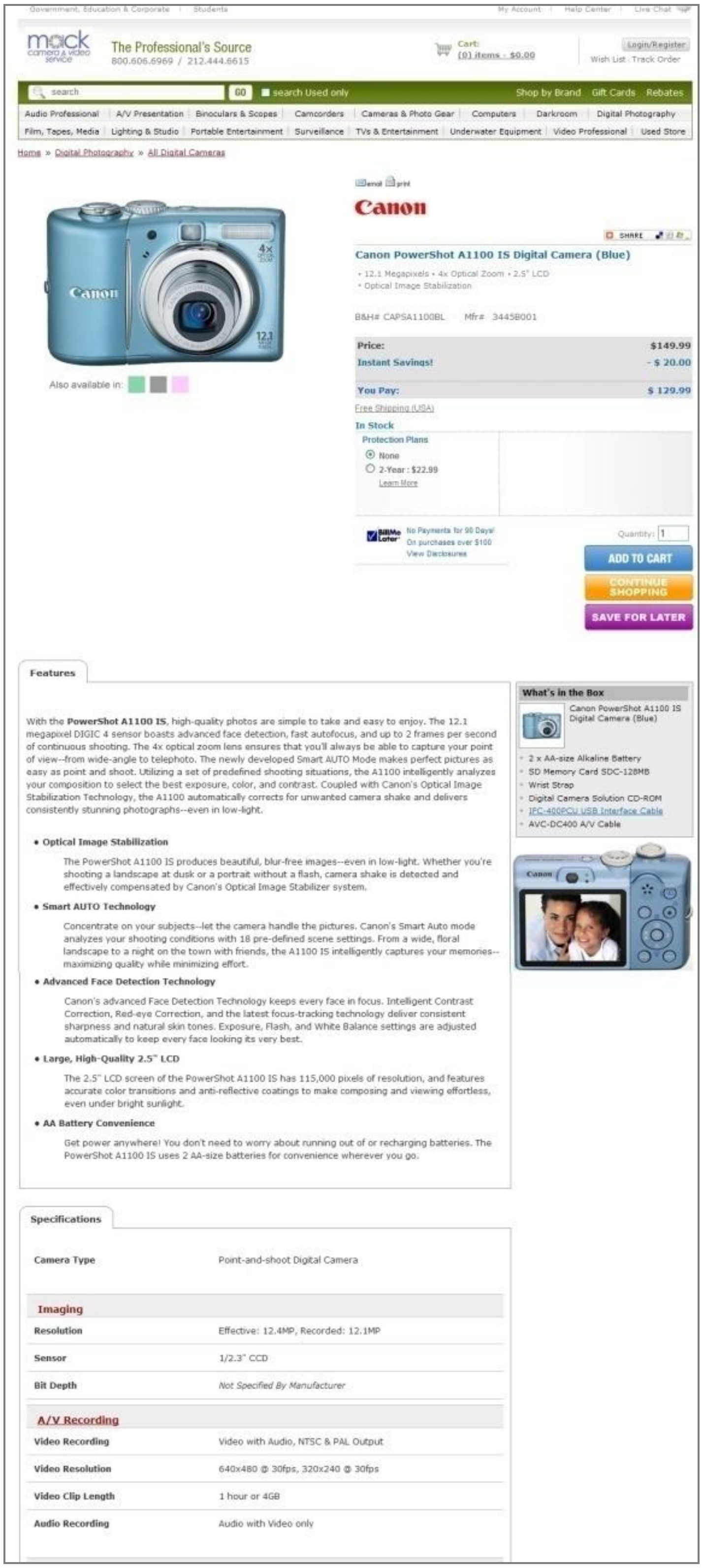
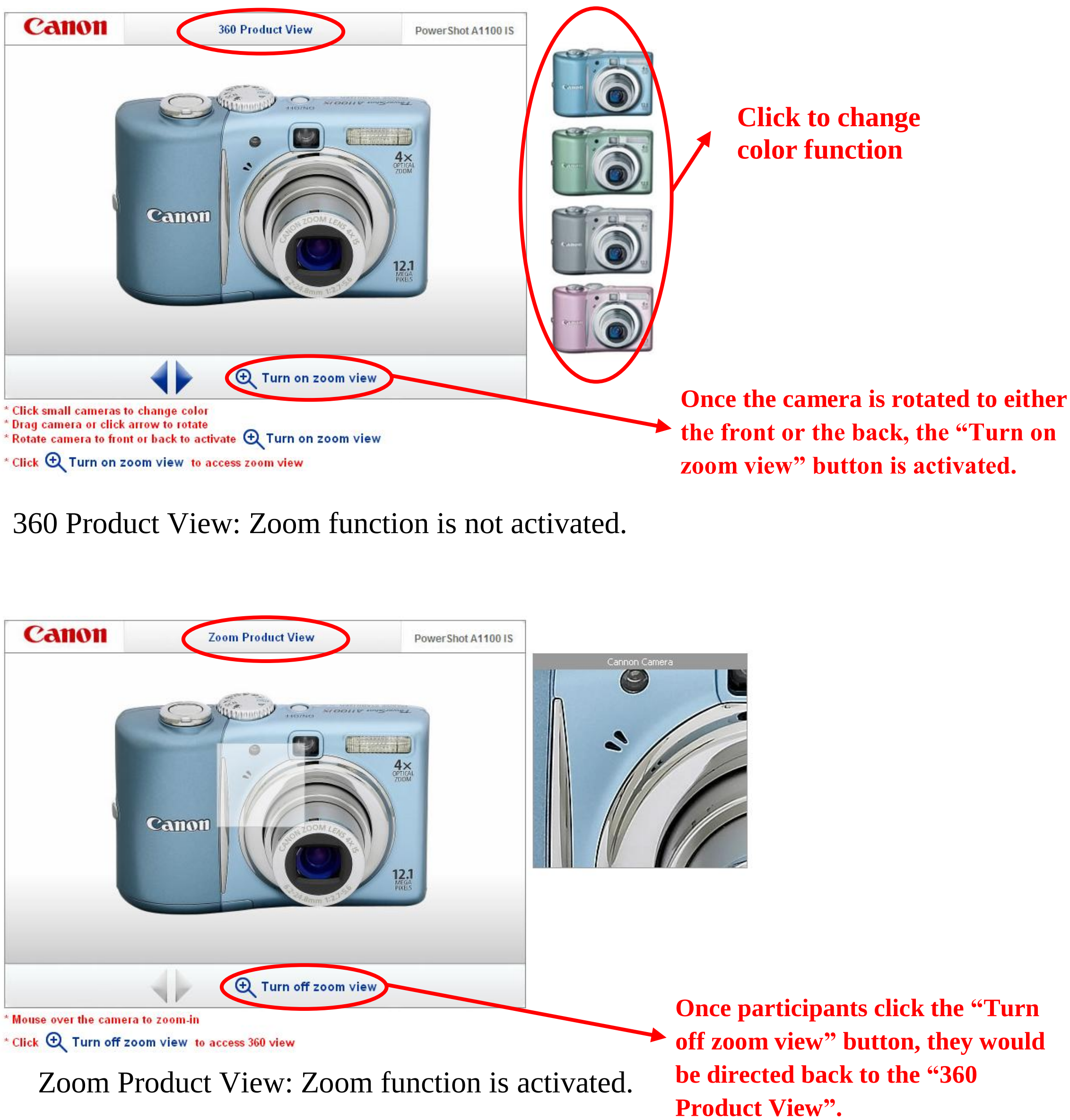


Figure 6. Individual product page (low-interactivity condition) for the experiment

were directly presented on the page. Participants were not able to perform any action over them.

The stimulus websites used in medium-interactivity conditions were kept the same as the ones used in the third pretest. Once participants clicked the product image or the “more images” button, an additional window would be opened. There were four small thumbnail images placed below a big image in the center of this window. Once participants clicked one of the thumbnail images, the bigger image shown in the center of the window would change accordingly. In order to make the interactive feature in medium-interactivity condition more accessible, the study added one more instruction line above the image of the camera on the product page: “click the camera for more images”.

In high-interactivity condition, an instruction to “click the image for interactive features” was placed above the product image on the product page. Once participants clicked the product image, a separate window with a combination of three interactive features would open. In the actual experiment, the features displayed in this window were very similar to those mentioned in the third pretest. Participants were able to drag or click to spin the camera for different perspectives, mouse-over to zoom-in for visual details, and click to change the color of the camera. Unlike the stimuli used in the third pretest which combined the spin and mouse-over functions into one switchable gadget, the stimuli used for the actual experiment separated the two functions into two gadgets: the click to spin button and the turn on zoom view button. Figure 7 provides a detailed illustration of these functions. In order to avoid participants’ confusion with various interactive features, instructions on how to spin and zoom were added and placed below the interactive product image. At the initial stage, the interactive product image was shown with the caption of “360 Product View” above it and the following instructions



360 Product View: Zoom function is not activated.

Zoom Product View: Zoom function is activated.

Figure 7. Example of high interactivity conditions in actual experiment

below it: 1) “Click small cameras to change color”; 2) “Drag camera or click arrow to rotate”; 3) “Rotate camera to front or back to activate Turn on Zoom View”, and 4) “Click Turn on Zoom View to access zoom view”. At this stage, only the drag/click to spin function and click to change product color function were active. The mouse-over to zoom function was deactivated. Once participants drag or click to rotate the camera to either the front or back angle, the “Turn on Zoom View” button would be activated (shown in blue). After clicking this button, the caption above the interactive product image changed to “Zoom Product View”. The instructions below the interactive product image accordingly changed to 1) “Mouse over the camera to zoom-in”; and “Click Turn off Zoom View to access 360 view”. When participants clicked the “Turn off Zoom View”, they were brought back to the 360 product view. At the same time, the zoom function would be deactivated, whereas the drag/click to spin and click to change product color functions would be activated. By separating the spin and zoom function and adding the captions and instructions, the current design would increase the usability of the interactive features in the high interactivity condition.

In summary, there is no interactive feature in low-interactivity condition, one feature—click—in medium-interactivity condition, and three features—drag/click- to-spin, mouse-over to zoom-in, and click- to-change product color—in high-interactivity condition.

Arousal manipulation. The result of the first pretest indicated that the slow tempo music of Ava Maria differed significantly from the fast tempo music of William Tell Overture with regard to level of arousal. However, they did not differ in level of pleasure. Based on these results, Ava Maria was selected as the stimulus for low-arousal condition, whereas William Tell Overture was chosen for high-arousal condition. In the experiment, the music excerpts started once participants click the URL linking the stimulus website. They kept playing while participants were waiting for the individual product page to download fully on the screen. The loading process would last around 7 seconds. By having a loading page, the study would guarantee that the arousal stimuli would happen before participants start interacting with the interactivity features. Once the music started, it would not stop until participants clicked one of the three buttons to finish the browsing task and left the websites. The music excerpts for high- and low-arousal conditions were both of one minute in length. The one-minute excerpts for both conditions were consistent in their respective beats-per-minute (BPM). The study was thus able to exclude any potential arousal change due to the changes in the rhythm of the music. When the excerpt finished playing after one minute, it looped and started playing again without any stop.

Procedure. The experiment was administered to groups of participants in the new media wing of the Media Effects Research Laboratory. They were randomly assigned to one of the nine conditions. They were told that they would be participating in a study exploring consumers' online shopping experience. After they finished reading the online implied consent form and clicked the "agree to participate" button, they were asked to fill out an online pre-questionnaire about their technology use, shopping orientation, and current state of arousal.

After they finished the pre-questionnaire, they were asked to complete a birthday gift purchasing task for their best friend. They were told that their friend was interested in a Canon digital camera on Mack.com, and that the friend cared quite a bit about the look of the camera and was very particular about where the function buttons are positioned on the camera. They were instructed to fully browse the camera website and examine the product features as what they would normally do when purchasing products online. They were also told to make the purchasing decision based on their own judgments. The instruction also asked them to decide whether the camera was worth buying at the end of website browsing by clicking one of the three buttons on the individual product page: "add to cart", "continue shopping", or "save for later". If they would want to buy the camera, they were instructed to click the "add to cart" button. If they would not want to buy the camera, they were instructed to click the "continue shopping" button. They were told to click the "save for later" button, if they would need more time to decide.

The stimulus websites were opened in Mozilla Firefox. The navigational tool bar for the browser was hidden so that participants were not able to see the website URL or tell whether the sites were real. The music automatically started once participants clicked the URL linked to the website. They first encountered a loading page which would last for 7 seconds. They were then directed to the individual product page. The music excerpt was on throughout the browsing process and would not stop until they clicked one of the shopping buttons and directed to the "thank you" page. After participants finished browsing, they were told to first close the browser for the stimulus and then fill out another online questionnaire about their arousal state, attention towards and memory of product information, engagement with product page, attitude towards the product and the website, and purchase intention. They were then debriefed and thanked for their participation.

Dependent/mediating variables. This section discusses the measures for dependent and potential mediating variables.

Perceptual bandwidth. Reeves and Nass (1996, 2000) defined perceptual bandwidth as the increased range of sensory experiences caused by perceptual interfaces, which would lead to automatic orientation, arousal, attention, and memory of the experience. Therefore in this study, perceptual bandwidth was measured in a post-hoc manner through two cognitive responses: 1) attention and 2) memory.

Attention. The attention aspect of perceptual bandwidth is measured through a set of self-reported items based on Chaffee and Schleuder (1986). Participants are asked to indicate how much attention they paid to the product information disclosed on the website, how much they focused on the product information on the website, and how much they concentrated on the product information while browsing the website, on 7-point scales ranging from “little” to “a lot”. These three items constituted a reliable index measuring attention (Cronbach’s α = .95).

Recall memory. In addition, recognition and recall memories (Lang, 1995) were employed in this study. Recall memory was captured by one open-ended question asking participants to list any product features or specifications that they remember seeing on the website. Their answers to these questions were coded by counting the number of facts that were consistent with what had been mentioned on the websites. The total number of facts that they recalled was divided into three subcategories, such as the number of facts about the visual aspect of product, the number of facts about the non-visual aspect of product, and the number of facts about prices. The total number of facts was calculated by adding up the pieces of information consistent with those revealed on the website. The number of visual facts referred to the pieces of information consistent with those revealed through product image(s), such as color options, button placement, and information etched on the camera. The number of non-visual facts is the pieces of information consistent with those disclosed by the text on the website. The number of price facts referred to the number of information consistent with the price of camera, the discount information, and the cost information for protection plans. For example, one response from a participant was "comes in light blue, silver, and rose colors. It had four colors to choose from, the camera could be adjusted according to different weather and lighting conditions (cloudy, night, etc), it requires 2 AA batteries, and had a 2.5 inch lcd screen. The protection plan is optional for $22.99." Based on the above mentioned coding scheme, the total number of facts consistent with information disclosed on the website was 8. The number of visual facts was 4, with 4 for non-visual facts and 1 for price.

In order to assess intercoder reliability, 15 responses from all participants were picked by using the random number table. A starting number was first randomly selected by dropping a pen on the page with researcher's eyes closed. The other 14 numbers were then selected by reading the random number table following an up-to-down direction. Two coders independently coded the randomly chosen 15 responses. Holsti's (1969) reliability formula (reliability = $2M/ (N_i+N_j)$, M = total items agreed upon, N_i = total items coder i selected, N_j = total items coder j selected) was used. Since initial intercoder reliability was not very high, the researcher and the other coder discussed the coding rationale and modified the coding scheme. Another 20 responses from participants were randomly drawn by using the random number table to establish intercoder reliability. Based on the modified coding scheme, the intercoder reliability reached 89.7%. The average number of recalled total facts was 2.92 (SD = 2.88). The average number of visual facts was 1.02 (SD = 1.39), 2.15 (SD = 2.50) for non-visual facts, and 0.13 (SD = .44) for price facts.

Recognition memory. For recognition memory, participants were given 14 multiple-choice questions pertaining to information about product shown on the website. Eight of them were relevant to the information disclosed in the product image either with or without interactive features. In order to guarantee that individuals in different conditions would not be biased by the presence or absence of interactivity features, all eight questions dealt with information that was accessible to participants in all conditions. The remaining six questions were about camera specifications and details. Information pertaining to these six questions was to be found exclusively in the textual part on the individual product page. For example, “In what other alternative colors is this product available?” with answer options of “blue, green, grey, pink”, “blue, purple, grey, orange”, “maroon, green, pink, blue”, and “green, silver, grey, pink” is an example of image-related question. “What is the price of the camera that you saw on the website?” with options of “$179.99”, “$159.99”, “129.99”, and “109.99” is an example of text-related question. The complete list of recognition memory questions is provided in Appendix 1. Participants were given 1 point for each correct answer. The highest possible score that they could get for all the questions is 14, 8 for image-related questions, and 6 for text-related questions. The average score for all fourteen question is 7.88 (*SD* = 1.96), 4.41 (*SD* = 1.25) for image-related questions, and 3.47 (*SD* = 1.46) for text-related questions.

Cognitive elaboration. Cognitive elaboration is measured by a thought-listing question developed based on Chaiken and Maheswaran (1994) and Maheswaran and Chaiken (1991). Participants were asked to type down any thoughts that came to their mind while they were browsing the camera on the website. Participants’ cognitive elaboration during website browsing was measured by the number of different kinds of thoughts that came to their mind. The number of thoughts in each category was coded for each participant and used to calculate the indices of total number of thoughts, number of thoughts on information revealed on the website, and thoughts beyond what had been disclosed on the website. The intercoder reliability calculated by Holsti's (1969) formula was 88.12% for thought-listing coding. The total number of thoughts (*M* = 2.48, *SD* = 1.71) was counted by the sheer number of different thoughts disclosed in online responses. For example, the following response "I liked the blue color it was in. I thought it was decently priced, but still would want to shop around more" was coded as with three pieces of thoughts. The total thoughts were further broken down into two categories: the number of thoughts on information revealed on the site (*M* = 1.45, *SD* = 1.18) and the number of thoughts beyond those shown on the site (*M* = 1.02, *SD* = 1.41). For example, "I thought it seemed like a good birthday present for someone who was interested in digital cameras" was coded as a piece of thought beyond what was disclosed on the site. "I don't like the fact that it uses AAA batteries" was coded as a piece of thought on information shown on the site. Each category was further divided into 1) product related thoughts and 2) website related thoughts. For product-related thoughts on information revealed on the site, the average number was 1.26 (*SD* = 1.43). For product-related thoughts beyond those shown on the site, the average number was .90 (*SD* = 1.35). The average number of website-related thoughts on information shown on the site was .21 (*SD* = .51), .12 (*SD* = .46) for the average number of website-related thoughts beyond those shown on the site.

Engagement with website content. Engagement is yet another multifaceted concept, which might mediate the relationship between the independent and dependent variables. This study evaluated participants' engagement with product webpage through the following two aspects: 1) absorption and 2) actual behavioral interaction with website.

Absorption. The absorption aspect of engagement was measured by self-reported questions through online questionnaire. The self-reported questions were developed based on Agarwal and Karahanna (2000). It included 14 items on 7-point agree/disagree scales, covering 5 aspects of engagement: temporal dissociation, focused immersion, enjoyment, control, and curiosity. An exploratory factor analysis using principal components extraction and varimax rotation was conducted over these fourteen items to identify several factors comprising this concept. The initial analysis revealed one cross-loaded item: "Browsing the product page bored me". It was therefore dropped from further analysis. The subsequent analysis revealed four factors with eigenvalues greater than 1, accounting for 75.65% of the variance. Table 3 reports the items and factor loadings for these four factors. The first factor was labeled "fun/interest" (Cronbach's α = .92, M = 3.43, SD = 1.36) and included the following five items: "I had fun interacting with the product page"; "Browsing the product page provided me with a lot of enjoyment"; "Browsing the product page excited my curiosity"; "Browsing the product page aroused my imagination"; and "Interacting with the product page made me interested in it". The second factor was labeled "immersion" (Cronbach's α = .86, M = 4.69, SD = 1.32) and included the following three items: "While browsing the product page, I was able to block out most other distractions"; "While browsing the product page, I was absorbed in what I was doing"; and "While browsing the product page, I was immersed in the task that I was performing". The third factor was labeled "time transformation" (Cronbach's α = .65, M = 3.54, SD = 1.14) and included the following three items: “Time appeared to go by very quickly when I was browsing the product page”; “I lost track of time when I was browsing the product page”; and “I spent more

Table 3. Principle component factor analysis result for absorption

Factor Item	Factor Loadings			
	1	2	3	4
1. Time appeared to go by very quickly when I was browsing the product page.	.39	.05	**.63**	-.05
2. I lost track of time when I was browsing the product page.	.23	.13	**.81**	-.10
3. I spent more time on the product page than I had intended.	.08	.15	**.70**	-.10
4. While browsing the product page, I was able to block out most other distractions.	.05	**.87**	.14	-.02
5. While browsing the product page, I was absorbed in what I was doing.	.31	**.84**	.11	-.16
6. While browsing the product page, I was immersed in the task that I was performing.	.34	**.81**	.14	-.09
7. I had fun interacting with the product page.	**.74**	.23	.23	-.33
8. Browsing the product page provided me with a lot of enjoyment.	**.76**	.27	.23	-.26
9. Browsing the product page bored me.	excluded from the final analysis			
10. I felt in control while I was browsing the product page.	.34	.22	.17	**-.80**
11. I felt that I had no control over my interaction with the product page.	-.09	-.01	-.08	**.93**
12. Browsing the product page excited my curiosity.	**.87**	.20	.21	-.04
13. Browsing the product page aroused my imagination.	**.84**	.09	.15	-.02
14. Interacting with the product page made me interested in it.	**.76**	.26	.19	-.29

Note. The current analysis adopted the principal component extraction method and the varimax rotation.

time on the product page than I had intended”. The final factor labeled “control”(r = 69, p<.01) and included the following two items: “I felt in control while I was browsing the product page”; and “I felt that I had no control over my interaction with the product page" (reverse-coded). Four scaled indices were created by averaging the ratings of the items that represented these four factors.

Actual behavioral interaction. Data for actual behavioral interaction with the website was collected by the log file. Log data were written as codes embedded in the website, which produced records of participants' time spent on the website, as well actions performed on the website. In the current study, the measures for actual browsing behavior were broken down into two categories: time-related measures and action-related measures. The time aspect was measured though 1) total time spent on the website, 2) time spent on the interactive feature(s) of the website, 3) time spent on the non-interactive part of the website, and 4) ratio of time on interactive features divided by total time spent on the website. The total time spent on the website (*M* = 9780.12 milliseconds, *SD* = 60604.59) was operationalized as the entire period that participants stayed on the website. The timer, built into the website, started when participants were directed to the product page after clicking the link embedded in the instruction page and stopped when participants left the website by either choosing one of the three actions buttons (add to cart, continue shopping, and save for later), or clicking the closing window button. This measure was captured across the three conditions. Total time spent on the interactive feature(s) was captured only for medium-interactivity (*M* = 15497.13 milliseconds, *SD* = 14740.34) and high-interactivity (*M* = 15963.50 milliseconds, *SD* = 2189.20) conditions. The timer commenced at the instance the participants started the interactive feature, and continued until they left the interactive window. However, once they came back to interact with the feature(s) again, the subsequent time spent on the features would be added up to the original time recorded. In other words, the log file for this measure was cumulative. Time spent on the non-interactive feature part of the website measured how much time participants spent on the other parts of the website excluding when they were on interactive features. In the medium and high interactivity conditions, it was calculated by subtracting the total time spent on the interactive feature from the total time spent on the website. In low-interactivity condition, there was no interactivity feature on the website. Therefore, time spent on non-interactive part of the website equaled the total time spent on the website. Ratio of time on the interactive features by total time on website was also computed for medium- and high-interactivity conditions dividing total time spent on the interactive features by total time spent on the website.

Number of actions was captured only for medium- and high-interactivity conditions. The actions included clicks, drags, and mouse-overs that were performed on the interactive features on the websites. In addition to the log files collected automatically by the codes embedded in the website, the screen capture function of QuickTime 10 was used to record the actual browsing process on the computer screen. The data captured by QuickTime 10 was treated as auxiliary information providing qualitative evidence to explain results found with quantitative data.

Attitudes toward website. Attitudes toward website was measured with 11 adjectives developed by Sundar (2000) and Yoon, Bolls, and Muehling (1999) on a 7-point scale ranging from “describes very poorly” to “describes very well”. These 13 items constituted a reliable index (Cronbach’s α = .91). They are “comfortable”, “trustworthy”, “organized”, “involving”, “useful”, “coherent”, “confusing”, “enjoyable”, “user-friendly”, “positive”, “favorable”, informative”, and “believable”.

Behavioral intention toward website. Five items developed by Hu and Sundar (2010) was used to measure participants' future behavioral intention toward website. These items included "I would like to browse more products on this website"; "I would discuss this website with my friends"; "I would recommend this website to others"; "I would like to visit this website again in the future"; and "I would consider this website if I need to do online shopping in the future", which together constituted a reliable index (Cronbach's α = .91).

Attitudes toward product. The measure for attitude toward product was modified based on Burton, Lichtenstein, Netemeyer, and Garretson (1998). Seven items of "This product is of poor quality"; "I think this product offers great value for money"; "This product is not worth the listed price"; "Viewing this product makes me feel good"; "I prefer this product to others in the same product category"; "This product is excellent"; and "I feel that I am a smart shopper if I buy this product", were measured on 7-point scales ranging from "strongly disagree" to "strongly agree". After reverse coding two of the items, the reliability of this index was .83.

Purchase likelihood. The current study used a four-item instrument developed by Bearden, Lichtenstein, and Teel (1984) to measure product purchase likelihood. It asked participants to indicate their purchase likelihood by marking on 7-point semantic differential scales with four pairs of adjectives: unlikely/likely, improbable/probable, uncertain/certain, and definitely not/definitely. The reliability of these items was fairly good (Cronbach's α = .86).

Actual purchase behavior. In addition to measure participants' intended likelihood to purchase the product, the study also captured their actual purchase decision by the actual behavior on the check-out button. There were three buttons on the product page: “add to cart”, “save for later”, and “continue shopping”. Participants were instructed to click “add to cart” button if they wanted to buy the product, or to click “save for later” button if they needed more time to decide, or to click “continue shopping” button if they did not want to buy the product. They were only allowed to click one of them. Therefore, these buttons constituted a three-level ordinal scale measuring participants’ actual purchase decision after browsing the product on the website. On this scale, “add to cart” was of the highest purchase possibility, whereas “continue shopping” was of the lowest possibility, with “save for later” somewhere in between. In the experiment, 70 people clicked the “add to cart” button, 40 chose the “save for later” button, and 73 opted for the “continue shopping” button.

Price sensitivity. There are different ways to determine consumer’s price sensitivity of a product. This study measured participants’ price sensitivity by asking them the following question “What did you think of the price of the camera that you saw on the website?” This question was administered on a 10-point scale ranging from “not at all expensive” to “very expensive”.

Moderating variable. Shopping orientation was a moderating variable in this study. There are different ways to operationalize the concept of shopping orientation (Stone, 1954; Darden & Howell, 1987; Li, Kuo, & Russel, 1999). The current study adopted the more parsimonious and frequently cited categorization of shopping orientation in the marketing literature: hedonic versus utilitarian orientation. Based on Li et al. (1999), this study constructed 6 items (Cronbach’s α = .71) to measure hedonic shopping orientation: “Window-shopping is usually a pleasant experience for me”; “I like to shop around and look at displays"; "I never feel bored when I go shopping"; I like to see and touch products before I buy them"; "I hate buying things without seeing what I am getting"; and "I like to try it before I buy a product". These six items could be further divided into the recreational aspect (the first three items) and the experiential aspect (the rest items).The utilitarian orientation was measured by both convenience and economic aspects (Li et al., 1999). It also included six items (Cronbach's α = .68): "Saving time while shopping is very important to me"; "I want to be able to shop at any time of the day"; "Being a smart shopper is worth the extra time it takes"; "I like to shop around for the best buy"; "I like to consider a wide selection before making a purchase"; "Having a wide selection of goods to choose from is very important to me".

Control variable. Power-usage, i.e., participants' prior experience with technology devices use was the control variable in this study. Seven items (Cronbach's α = .81) adapted from a study on the characteristics of power users (Marathe, et al., 2007) were measured on 9-point scales ranging from "strongly disagree" to "strongly agree". These items were "I think most of the technological gadgets are complicated to use"; "I make good use of most of the features available in any technological device"; "I have to have the latest available upgrades of the technological devices that I use"; "I love exploring all the features that any technological gadget has to offer", "I often find myself using many technological devices simultaneously"; "I prefer to ask friends how to use any new technological gadget instead of trying to figure it out myself"; and "Using any technological device comes easy to me".

Manipulation check measures. Perceived interactivity and level of arousal were used to check whether the manipulations of independent variables were successful.

Perceived interactivity. In order to examine whether the manipulation of different levels of interactivity was successful, the current study mainly used a perceived interactivity scale constructed by Sundar, Kalyanaraman, and Brown (2003). It asked participants to rate how interactive the website was on a 10-point scale ranging from "not at all interactive" to "very interactive". This item was designed to tap into layperson's understanding of the term interactivity (Sundar, Kalyanaraman, & Brown, 2003) without giving participants any academic definitions, which might otherwise affect their own conceptions of interactivity. After the data collection started, eight more items on 7-point strongly disagree/strongly agree scales measuring perceived interactivity by Leiner and Quiring (2008) were added into the questionnaire. These items were "I was delighted to be able to choose where and when to click"; "While I was on the site, I could choose freely what I wanted to see"; "While surfing the site, I had absolutely no control over what I could do on the site"; "I was able to do more than scrolling up and down on the website"; "The website is not manageable"; "While surfing the site, my actions decided the kind of control over my visiting experience at this site"; and "The website facilitates two-way communication between the visitors and the site". Although this index was a reliable measure (Cronbach's α = .87), it was added in the middle of the data collection and did not cover the responses from the first 22 participants. Even though it was used as manipulation check in the current study, its result should be interpreted with this caveat in mind.

Level of arousal. Six items developed by Mehrabian and Russell (1974) and Mummalaneni (2005) on 7-point semantic differential scales were used to measure the level of arousal, before and after being exposed to the music and the interactive product page. These items (Cronbach's α = .81) were "relaxed/stimulated", "calm/excited", "sluggish/frenzied", "dull/jittery", "sleepy/wide-awake", and "unaroused/aroused" The actual arousal caused by the experimental stimuli was calculated by subtracting the arousal scores before exposure to experimental stimuli from the one after exposure.

Exposure to music. The study used one question to check whether the manipulation of music was noticed. Participants were asked if they recalled hearing the music played on the website, with a yes/no question.

Data Analysis

Exploratory factor analysis using principal components extraction and varimax rotation was first employed to identify the components for potentially multifaceted variable of absorption. One-way analysis of variance (ANOVA) was used to check if the manipulations of interactivity and arousal were effective. Multivariate general linear models with hedonic shopping orientation and utilitarian shopping orientation as separately entered moderators were used to explore the main and interaction effect of levels of interactivity and arousal on the engagement, product and website related attitudinal and behavioral variables. Univariate analyses were then conducted to explore the main and interaction effects of independent variables on each of the dependent variables. Power-usage was entered as a control variable. Finally, the bootstrapping method, a resampling procedure that does not impose the assumption of normality of the sampling distribution, was used to test the multiple-step mediation model ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$) (Hayes, Preacher, & Myers, in press) proposed in RQ1and 2.

Chapter 4

Results

This chapter will first present the manipulation-check results for of the two independent variables--interactivity and arousal. The individual and main effects of interactivity and arousal on each dependent variable, with hedonic and utilitarian shopping orientations as separately entered moderators, will be presented next. Finally, the mediators for the relationship between the independent and dependent variables will be identified in an effort to explore underlying theoretical mechanisms.

Manipulation Check

Interactivity. One-way analysis of variance **(**ANOVA) with level of interactivity as the independent variable, and perceived interactivity as the dependent variable was used to examine whether the manipulation of interactivity was successful. As mentioned in the method part, the study actually involved both a one-item measure of perceived interactivity as well as an eight-item index. The results of the one-way ANOVA showed that the manipulated interactivity conditions differed in their levels of perceived interactivity for both the one-item measure, F (2, 183) = 18.23, $p < .01$ and the eight-item index, F (2, 161) = 29.08, $p < .01$. In order to further examine whether different levels differ from each other, post-hoc test by using student's *t* was conducted. High-interactivity condition (M = 5.97, SD = 2.75) was perceived as of possessing significantly higher level of interactivity than medium-interactivity condition (M = 4.59, SD = 2.14), and low-interactivity condition (M = 3.74, SD = 2.01) for the one-item measure. The same pattern held true for the eight-item measure as well. High-interactivity condition (M = 5.01, SD = 1.07), was significantly higher in perceived interactivity than medium-interactivity (*M* = 4.03, *SD* = 1.11) and low-interactivity (*M* = 3.46, *SD* = 1.01) conditions. However, since the eight-item measure was added during the middle of the experiment, it does not have data from the first 22 participants, whereas the one-item measure had data for the entire sample.

In addition to perceived interactivity, there was other evidence indicating that the manipulation of interactivity was successful. First, the free recall measure about their memory of the interactive features on the website could also serve as the ontological measure to check whether the participants indeed noticed the interactive features. The one-way ANOVA result showed that individuals recalled seeing significantly more interactive features in high-interactivity condition (*M* = 1.78, *SD* = 1.01) than in medium-interactivity condition (*M* = .79, *SD* = .66) and low-interactivity condition (*M* = .35, *SD* = .48), F (2, 183) = 59.97, $p < .01$. Second, the log data further indicated that participants not only perceived difference in high- and medium-interactivity conditions, but also did perform a lot more actions in high-interactivity condition (*M* = 32.98, *SD* = 47.05) than in medium-interactivity condition (*M* = 4.28, *SD* = 2.93), t (1) = 5.92, p <.01.

Based on the above-mentioned results, the manipulation of interactivity could be deemed as successful. It was successful not only with regard to perceived interactivity, but also the awareness of interactive features and participants' actual interaction with those features.

Arousal. One-way ANOVA with difference in arousal before and after experiment as the dependent variable and manipulated arousal conditions as the independent variable was used to determine whether the manipulation of arousal was successful. The result of the ANOVA test showed that three arousal conditions differed significantly with regard to changes in arousal, F (2, 183) = 21.68, $p < .01$. Subsequent post-hoc test using student's t indicated that high-arousal condition led to more changes in arousal after being exposed to the experimental stimuli (M = .81, SD = 1.24), than low-arousal condition (M = -.28, SD = 1.05), and control condition (M = -.28, SD = .85). However, there was no significant difference between low-arousal condition and control condition with regard to changes in arousal. Was the non-significant difference between low-arousal and control conditions a failure of participants' inability to hear the music? In order to answer this question, a Chi-square test was conducted to see if the numbers of individuals who heard or did not hear the music differed by arousal conditions. All participants in low- and high-arousal conditions indicated that they heard the music playing while browsing the website, whereas all participants in control condition indicated that they did not hear the music while browsing the website X^2 (2) = 236.78, p < . 01. This result indicated that ontologically, the music manipulation was successful. Participants in the music conditions did get exposed to music, whereas participants in the control condition (no-music condition) did not hear any music. In this study no-music condition was essentially considered as the control condition. Although there was no significant difference between control and low-arousal conditions, low- and high-arousal conditions did significantly differ from each other. Therefore, we can still say that the manipulation of arousal was successful.

Multivariate general linear models with interactivity and arousal as the independent variables were run on different sets of dependent variables with hedonic shopping orientation and utilitarian shopping orientation as separate moderators.

Perceptual Bandwidth

There were two variables to capture the concept of perceptual bandwidth: attention and memory. General linear model analyses were run for each of them separately to test the hypotheses shown in Figure 8.

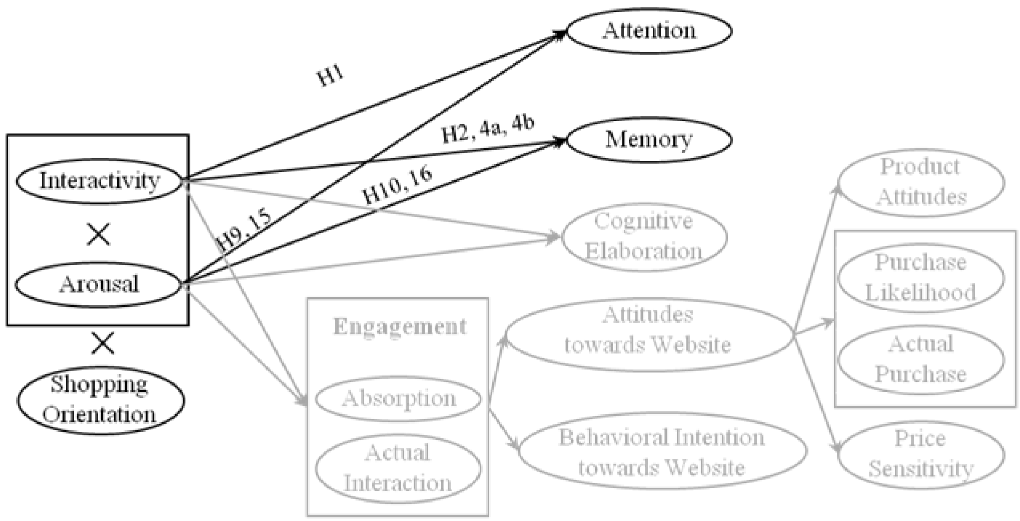


Figure 8. Research model for independent variables' effect on attention & memory

Attention. General linear model analyses with hedonic and utilitarian orientation as separate moderators were conducted for attention, as described below.

Hedonic shopping orientation as moderator. When hedonic shopping orientation was entered into the model as a moderator, the analysis showed significant main effects for both interactivity, F (2, 168) = 4.68, p <. 05, and arousal, F (2, 168) = 3.38, p <. 05. Post-hoc comparison based on student's t indicated that medium-interactivity condition led to significantly more attention (M = 5.09, SE = .17) than high-interactivity (M = 4.57, SE = .18) and low-interactivity (M = 4.39, SE = .17) conditions. However, there was no significant difference between high- and low-interactivity conditions with regard to attention. For the main effect of arousal, control (M = 4.91, SE = .17) and low-arousal (M

= 4.83, *SE* = .17) conditions did not significantly differ in their influences on attention. But both of them led to significantly more attention than high-arousal condition (*M* = 4.32, *SE* = .18).

Utilitarian shopping orientation as moderator. When utilitarian shopping orientation was entered into the model as a moderator, there were also main effects for interactivity, *F* (2, 168) = 4.51, *p*<. 05, and arousal, *F* (2, 168) = 3.56, *p*<. 05. Similar to the results from the model with hedonic orientation as moderator, this analysis showed that medium-interactivity condition (*M* = 5.07, *SE* = .18) led to significantly more attention than both high-interactivity (*M* = 4.51, *SE* = .17) and low-interactivity (*M* = 4.37, *SE* = .17) conditions. There was no significant difference between low- and high-interactivity conditions. Again, there was no significant difference between control (*M* = 4.84, *SE* = .17) and low-arousal (*M* = 4.84, *SE* = .17) conditions. But both of them led to significantly more attention than high-interactivity condition (*M* = 4.27, *SE* = .18).

Summary. Hypothesis 1 proposed that higher modality-interactivity would lead to greater attention to product information. The current findings indicated that regardless of the kind of shopping orientation that participants had, medium level of modality-interactivity led to greater attention than both high and low levels. The effect of modality-interactivity on attention followed a non-linear pattern. Therefore, Hypothesis 1 was supported only when we compared low- and medium-interactivity conditions.

As for the main effect of arousal, Hypothesis 9 proposed that higher arousal would lead to greater attention, whereas Hypothesis 15 posited that low arousal would lead to greater attention. Results showed that regardless of the type of shopping orientation that consumers had, control and low-arousal conditions led to significantly more attention than high-arousal condition. However, control and low-arousal conditions did not differ in their abilities to affect attention. By comparing low- and high-arousal, we could conclude that Hypothesis 9 was rejected, whereas Hypothesis 15 was supported.

Memory. Since recognition memory and recall memory were more logically related, multivariate general linear models were first run for them together, followed by univariate analyses with separate moderators.

Hedonic shopping orientation as moderator. The multivariate general linear model for memory (including both recognition and recall memories) with hedonic shopping orientation as moderator indicated main effects for both interactivity Wilks' $\lambda = .73$, F (12, 326) = 4.61, p <. 01, and arousal Wilks' $\lambda = .85$, F (12, 326) = 2.29, p <. 01.

Total recall memory. For recall memory in total, the univariate analysis revealed significant main effects for both interactivity, F (2, 168) = 3.18, p <. 05, and arousal, F (2, 168) = 3.10, p <. 05. Medium-interactivity condition (M = 3.66, SE = .36) led to significantly better recall memory than high-interactivity (M = 2.73, SE = .39) and low-interactivity (M = 2.43, SE = .35) conditions. There was no significant difference between low- and high-interactivity conditions. The main effect for arousal came from the significant difference between control condition (M = 3.68, SE = .36) and high-arousal condition (M = 2.47, SE = .38). There was no significant difference either between control and low-arousal (M = 2.68, SE = .36) conditions, or between low-arousal and high-arousal conditions. After further breaking total recall memory into recall about visual information and non-visual information, the study yielded some interesting findings.

Recall memory about visual information. There was a significant main effect of interactivity on recall memory about visual aspect of product, F (2, 168) = 3.11, p <.05, such that high- (M = 1.22, SE = .18) and medium-interactivity (M = 1.15, SE = .17) conditions led to significantly better recall memory about visual information than low-interactivity condition (M = .68, SE = .16). But there was no significant difference between medium- and high-interactivity conditions.

Recall memory about non-visual information. Significant main effects for interactivity, F (2, 168) = 3.12, p <.05, and arousal, F (2, 168) = 3.38, p <.05, were also obtained for recall memory about the non-visual aspects of the product. The main effect for interactivity came from the significant difference between medium-interactivity (M = 2.51, SE = .29) and high-interactivity (M = 1.50, SE = .31) conditions. There was no significant difference between low-and medium-interactivity, or between low- and high-interactivity. Control condition (M = 2.54, SE = .29) led to significantly more recall memory about the non-visual aspect of product than both low-(M = 1.72, SE = .29) and high-arousal (M = 1.51, SE = .31) conditions. There was no significant difference between low- and high-arousal conditions. Arousal had a significant main effect on recall memory about price, F (2, 168) = 4.06, p <.05. Participants recalled more information about price when they were in the control condition (M = .26, SE = .06) than they were in low-arousal (M = .10, SE = .06) or high-arousal (M = .03, SE = .06) conditions. The difference between low- and high-interactivity conditions was not significant.

Total recognition memory. The univariate analysis for total recognition memory revealed a significant main effect for arousal F (2, 168) = 5.01, p <. 01, such that participants in control condition (M = 8.47, SE = .25) recognized significantly more than those in high-arousal condition (*M* = 7.34, *SE* = .26). However, there was no significant difference between control and low-arousal (*M* = 7.89, *SE* = .24) conditions, or between low-arousal and high-arousal conditions. Just as with recall memory, we divided recognition memory into several subcategories.

Recognition memory about visual information. For recognition memory about visual information, there was a significant main effect of interactivity, *F* (2, 168) = 8.52, *p* <. 01. Participants in high-interactivity condition (*M* = 4.94, *SE* = .17) recognized significantly more visual information than those in medium-interactivity (*M* = 4.43, *SE* = .16) or low-interactivity (*M* = 3.99, *SE* = .15) conditions. But low-interactivity and medium-interactivity conditions did not differ significantly from each other.

Recognition memory about text information. For recognition memory about text information, there were both significant main effects for interactivity, *F* (2, 168) = 12.22, *p* <. 01, and arousal, *F* (2, 168) = 10.78, *p* <. 01, as well as an interaction effect of interactivity and arousal, *F* (4, 168) = 2.87, *p* <. 05. The post-hoc comparison showed that the three interactivity conditions were significantly different from each other, with low-interactivity condition (*M* = 4.02, *SE* = .16) leading to most text memory, followed by medium-interactivity condition (*M* = 3.49, *SE* = .17) and high-interactivity condition leading to the least text memory (*M* = 2.83, *SE* = .18). The three music conditions also differed significantly in their influence on recognition memory of text information. Control condition led to the most recognition memory about text information (*M* = 4.01, *SE* = .17), whereas high-arousal condition led to the least recognition memory (*M* = 2.88, *SE* = .18), with the influence of medium-arousal condition (*M* = 3.48, *SE* = .17) in between. The above main effects should be interpreted in light of the interaction effect of interactivity and arousal (Figure 9), which revealed that participants in high-arousal and high-interactivity condition recognized the least text information, whereas participants in low-interactivity and arousal control condition recognized the most. In general, participants recognized more in control conditions across all three interactivity conditions. There was no significant difference between low-arousal and control conditions when interactivity was high, or between low-and high-arousal conditions when interactivity was either medium or low.

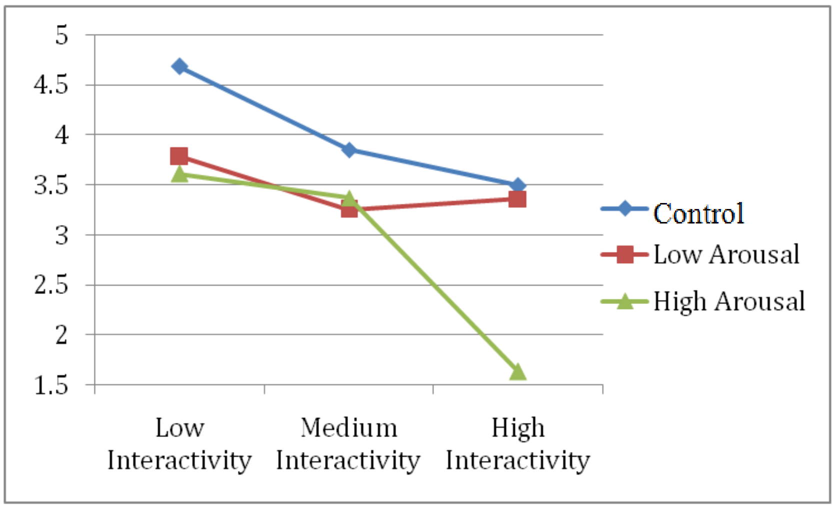


Figure 9. Interaction effect on recognition memory about text information

Utilitarian shopping orientation as moderator. When utilitarian orientation was entered as a moderator into both the multivariate and univariate linear models, the results for individual memory variables followed the same patterns as those in the models with hedonic orientation as the moderator. None of the analyses found any significant main or interaction effect for hedonic or utilitarian shopping orientation on memory variables.

Summary. Hypothesis 2 proposed that higher modality-interactivity would lead to better recall as well as recognition memory. However, Hypothesis 4 posited a difference across the two types of memory, that higher modality-interactivity would lead to better recognition memory, but worse recall memory. The results showed no main effect of interactivity for total recognition memory. High interactivity did lead to more recognition of visual information than medium and low conditions. At the same time, it also led to lesser recognition of text information. High and medium interactivity led to more total recall and recall about visual information than low interactivity. But for non-visual information, medium interactivity led to the most recall. These patterns held true for both hedonic and utilitarian shoppers. Therefore, Hypothesis 2 and 4a were supported for recognition of visual information when comparing high versus medium and low interactivity conditions. Hypothesis 2 was also supported for recall of visual information when comparing high and medium versus low interactivity conditions. Hypothesis 4b was not supported for any aspect of recall memory.

With regard to the effect of arousal, Hypothesis 10 proposed that higher the arousal, better the memory, whereas Hypothesis 16 posited that low arousal would lead to better memory. For both recall and recognition, low arousal did not significantly differ from high-arousal or control conditions. Therefore, neither Hypothesis 10 nor 16 was supported.

Cognitive Elaboration

General linear model analyses with the two shopping orientations, entered separately, were conducted to test the hypotheses about the effects of interactivity and arousal on cognitive elaboration (Figure 10). Cognitive elaboration was captured by following variables: total number of thoughts generated, number of thoughts of information revealed on the site and number of thoughts beyond those shown on the site.

The latter two variables were further divided by product related thoughts versus website related thoughts. Figure 11 provides a summary of the relationship between these variables.

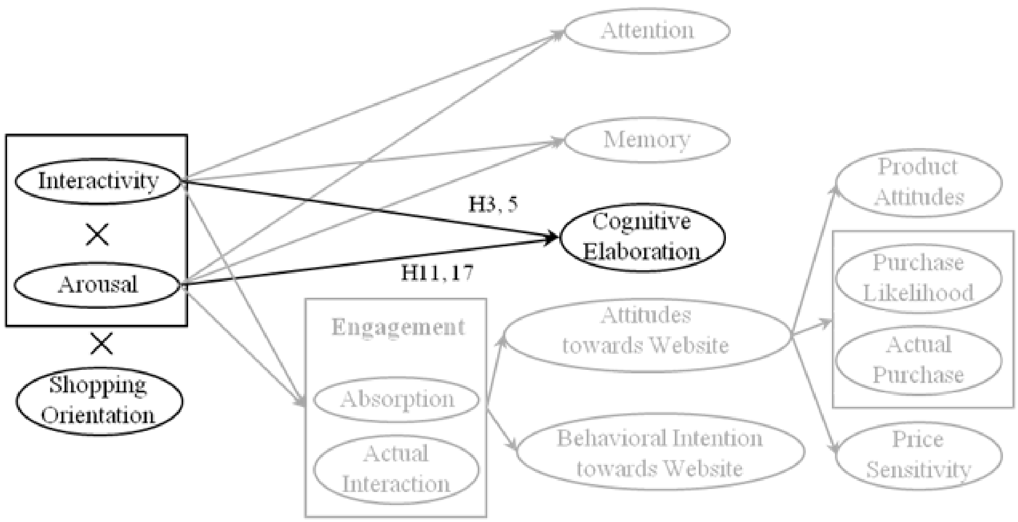


Figure 10. Research model for independent variables' effect on cognitive elaboration

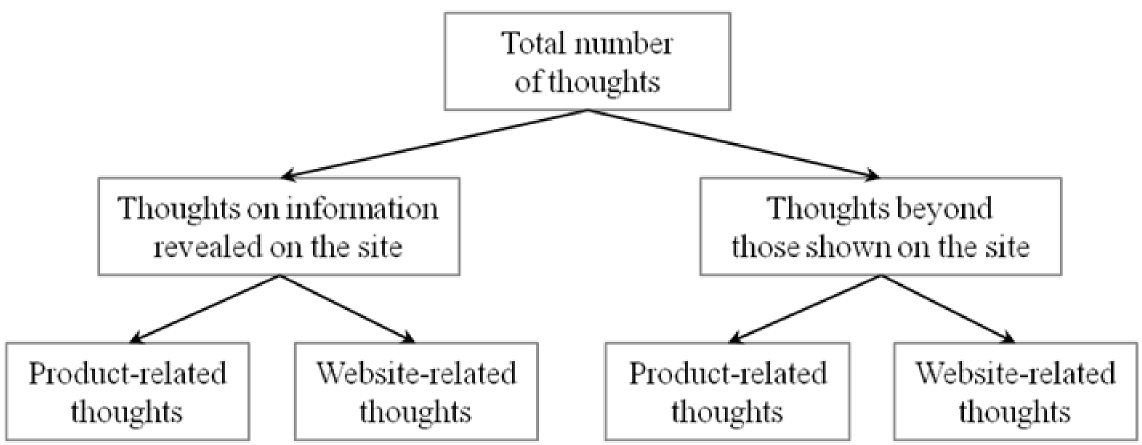


Figure 11. Variables measuring cognitive elaboration

Hedonic shopping orientation as moderator. General linear models with hedonic shopping orientation as moderator were first run for thought-listing measures.

***Total number of thoughts generated*.** When hedonic shopping orientation was entered into the model as a moderator, a main effect for arousal was found on total number of thoughts generated, F (2, 167) = 3.51, p<.05. This main effect came from the significant difference between control (M = 2.85, SE = .22) and high-arousal (M =2.03, SE = .23) conditions. There was no significant difference between control and low-arousal (M =2.55, SE = .22) or between low- and high-arousal conditions. When the total number of thoughts was broken down into thoughts about information revealed on the website versus thoughts beyond information revealed on the website, the study obtained the following interesting findings.

Number of thoughts on information revealed on website. For the number of thoughts about information revealed on the site, there was an interaction effect of interactivity and arousal, F (2, 168) = 4.77, p <.01(Figure 12). When the arousal was high, individuals generated more thoughts about information disclosed on the website in high-interactivity condition than in either low- or medium-interactivity condition. When arousal was low, individuals generated more thoughts about information disclosed on the website in low-interactivity condition. When there was no music, individuals generated most thoughts about the information disclosed on the website in medium-interactivity condition. If we broke down the total thoughts about information revealed on the website, different patterns emerged for total thoughts about product information and thoughts about website itself.

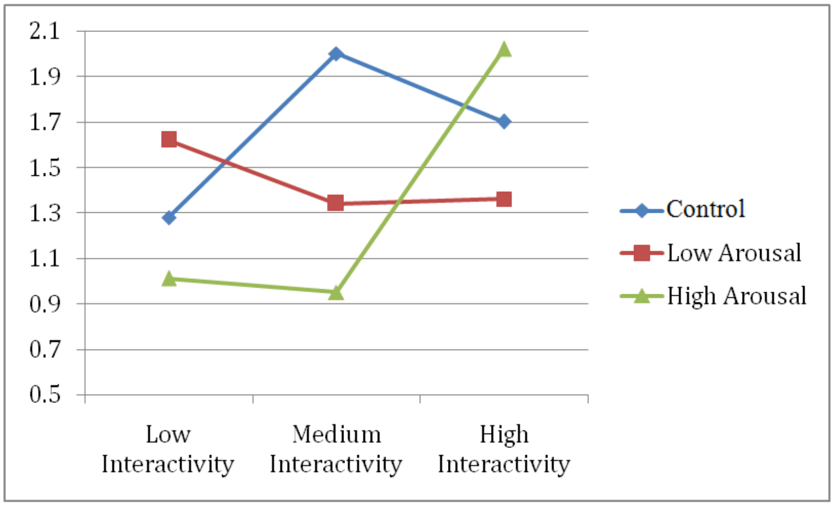


Figure 12. Interaction effect of interactivity & arousal on number of thoughts on information revealed on the website

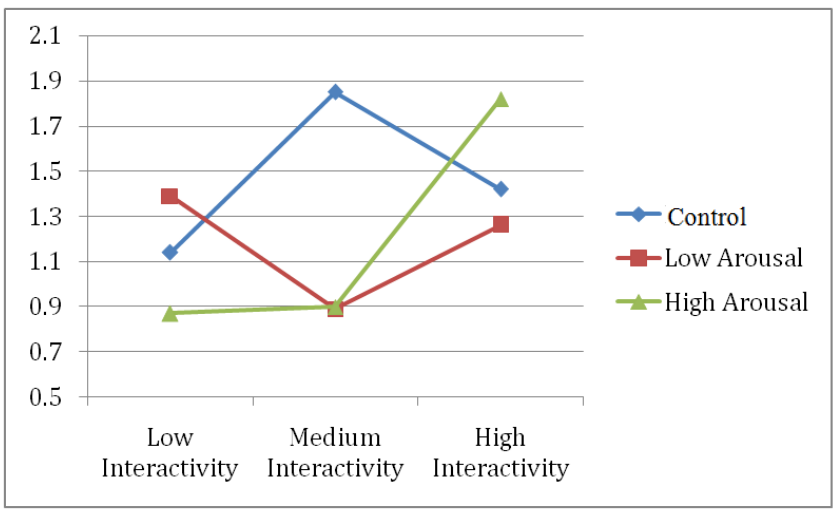
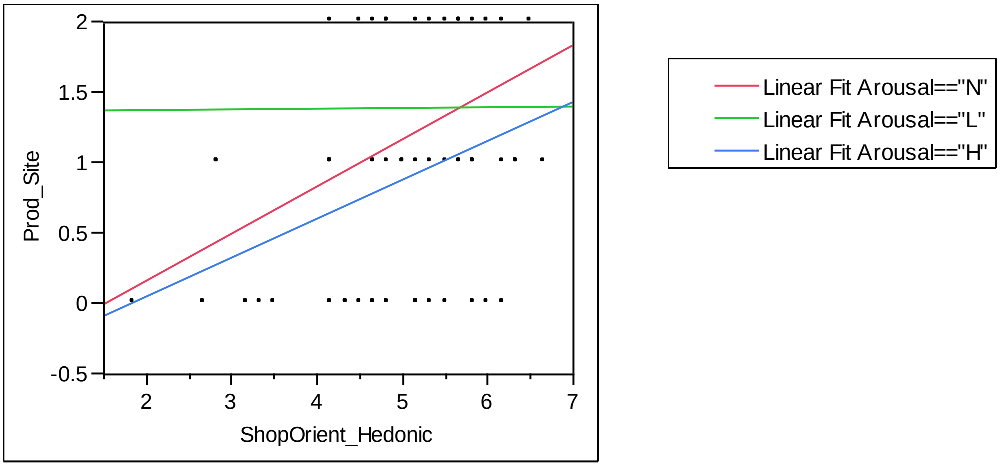


Figure 13. Interaction effect of interactivity & arousal on number of product-related thoughts of information revealed on the site

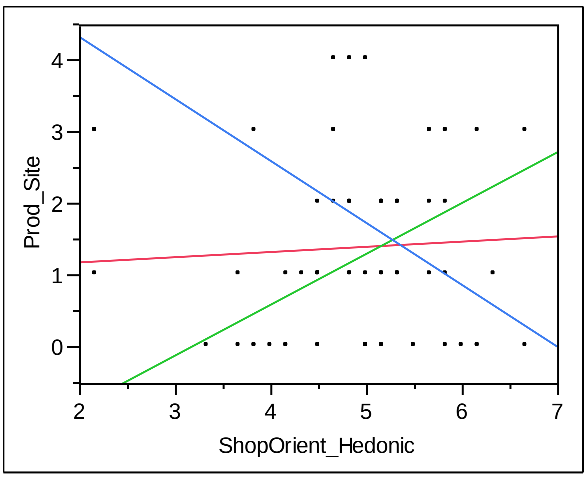
Number of product-related thoughts of information revealed on the site. For number of thoughts about product information disclosed on the website, there was a two-way interaction effect of interactivity and arousal, F (2, 168) = 2.98, p <. 05 (Figure 13).

When there was no music, medium-interactivity led to the most thoughts about product information disclosed on the website. When arousal was low, low and high interactivity led to more thoughts about product information disclosed on the website than medium interactivity. When arousal was high, high interactivity led to most thoughts about the product information disclosed on the site. There was also a three-way interaction effect of interactivity, arousal and hedonic shopping orientation on total thoughts about product information disclosed on the website, F (4, 168) = 2.67, p <. 05 (Figure 14). When interactivity was low, in control and high-arousal conditions, the number of thoughts about product information was a direct positive function of the degree of hedonic shopping orientation (i.e., the more hedonic they were, the greater the number of thoughts about the product). When interactivity was medium, in control condition, the number of thoughts about product was again positively related to hedonic orientation, whereas in low- and high-arousal conditions, it was negatively related (i.e., higher the hedonic shopping orientation, lesser the number of product-related thoughts). When interactivity was high, in high-arousal condition, the same negative relation was found, but in low-arousal condition, the relationship between hedonic orientation and number of product-related thoughts was positive. When there was no music, there was no significant relationship between hedonic orientation and thoughts about product information revealed on the site.

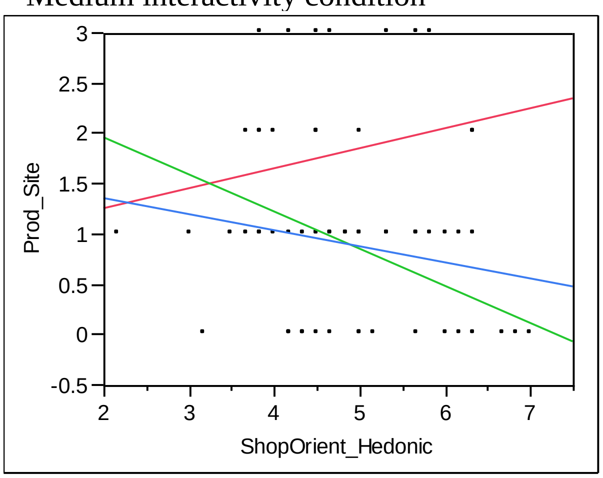
Number of website-related thoughts of information revealed on the site. For thoughts about website, there was a marginally significant interaction effect of arousal and hedonic orientation, F (4, 167) = 2.68, p =. 08 (Figure 15). Low- and high-arousal led



Low interactivity condition



Medium interactivity condition



High interactivity condition

Figure 14. Three-way interaction of interactivity, arousal, & hedonic orientation on number of product-related thoughts on information revealed on the site

to more thoughts about the website with increases in hedonic orientation; whereas control condition led to fewer thoughts about the website with increases in hedonic orientation.

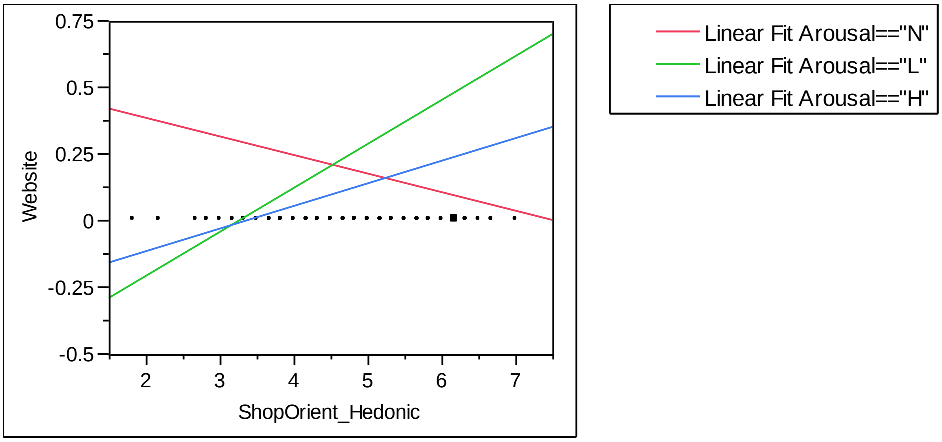


Figure 15. Interaction effect of arousal & hedonic orientation on number of website-related thoughts on information revealed on the site

Number of thoughts beyond those revealed on site. For the total thoughts on issues beyond those revealed on the website, there was an interaction effect of arousal and hedonic orientation interaction, F (2, 168) = 4.16, p <. 05 (Figure 16). In high-arousal condition, individuals with higher hedonic orientation generated more thoughts on issues beyond those revealed on the site. In low-arousal condition, individuals with higher hedonic orientation generated fewer thoughts on issues beyond those revealed on the site. In control condition, there was no significant relationship between hedonic orientation and thoughts generated.

Number of product-related thoughts beyond those shown on the site. For thoughts about product issues beyond those revealed on website, the interaction effect of interactivity and arousal was marginally significant F (4, 168) = 2.20, p =. 07 (Figure 17). In high-arousal condition, medium interactivity led to the most thoughts. In low-arousal condition, high interactivity led to the most thoughts. In control condition, the difference across three interactivity conditions was not significant. The interaction effect of arousal and hedonic orientation was also marginally significant, F (2, 168) = 2.87, p =. 06 (Figure 18). In high-arousal condition, the increase of hedonic orientation would lead to increased thoughts about product issues beyond those disclosed on the website. In low-arousal condition, the relationship was the opposite. In control condition, the relationship between hedonic orientation and thoughts was not significant.

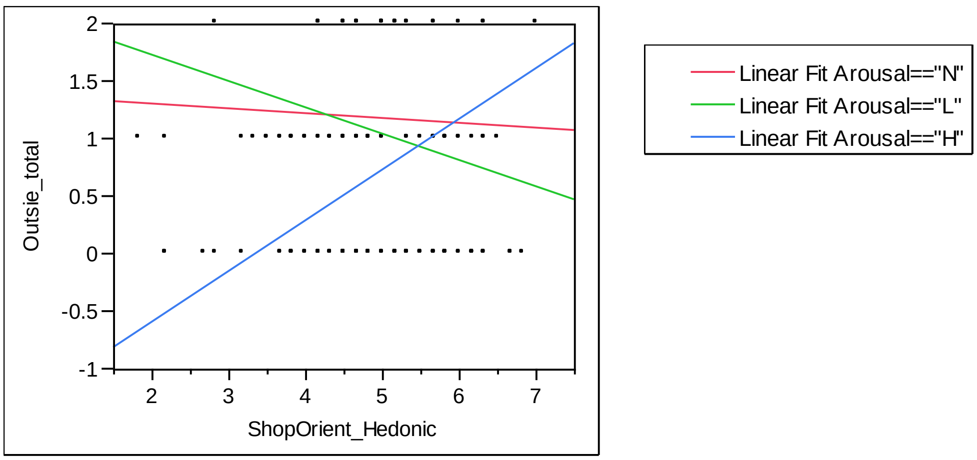


Figure 16. Interaction effect of arousal & hedonic orientation on number of thoughts on issues beyond those revealed on website

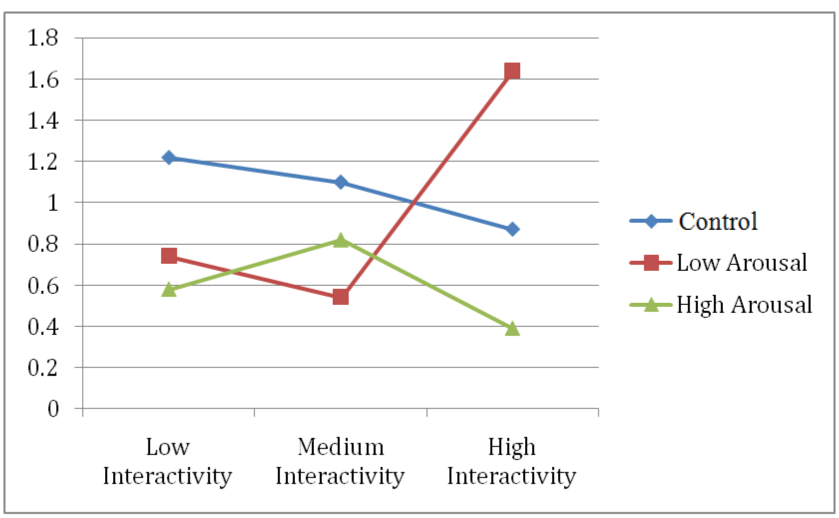


Figure 17. Interaction effect of interactivity & arousal on number of product-related thoughts beyond the site

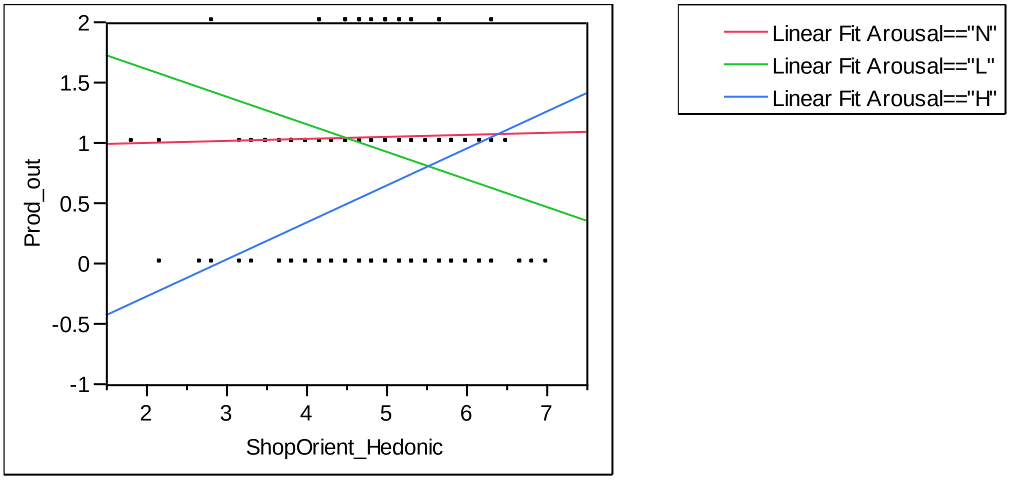


Figure 18. Interaction effect of arousal & hedonic orientation on number of product-related thoughts beyond the site

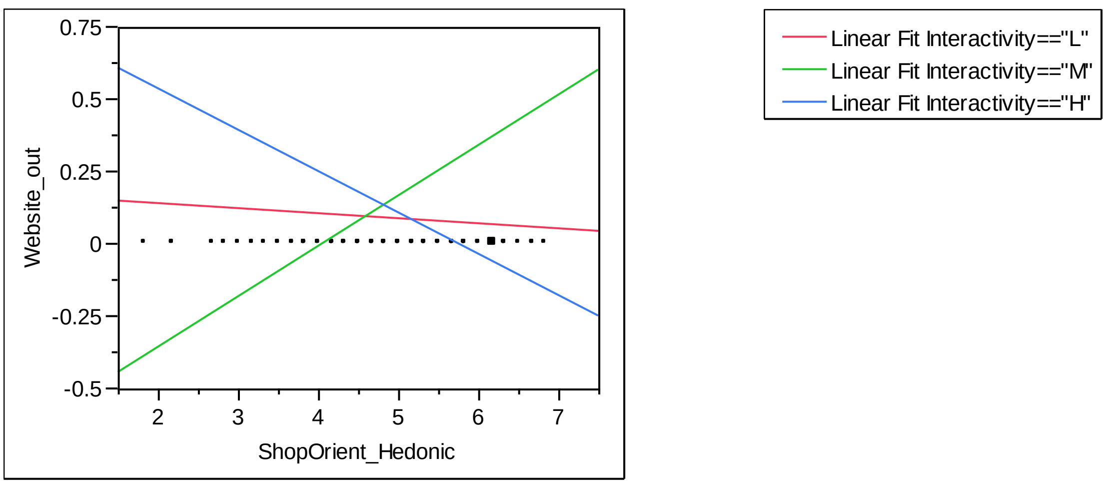


Figure 19. Interaction effect of interactivity and hedonic orientation on number of website-related thoughts beyond those disclosed on the site

Number of website-related thoughts beyond those shown on the site. For thoughts about website issues beyond those disclosed on the website, there was an interaction effect of interactivity and hedonic orientation, F (2, 168) = 5.02, p <. 01 (Figure 19). When interactivity is high, higher hedonic orientation led to fewer thoughts about website issues beyond those revealed on website. When interactivity was medium, high hedonic orientation led to more thoughts. When interactivity was low, there was no significant relationship between hedonic shopping orientation and thoughts.

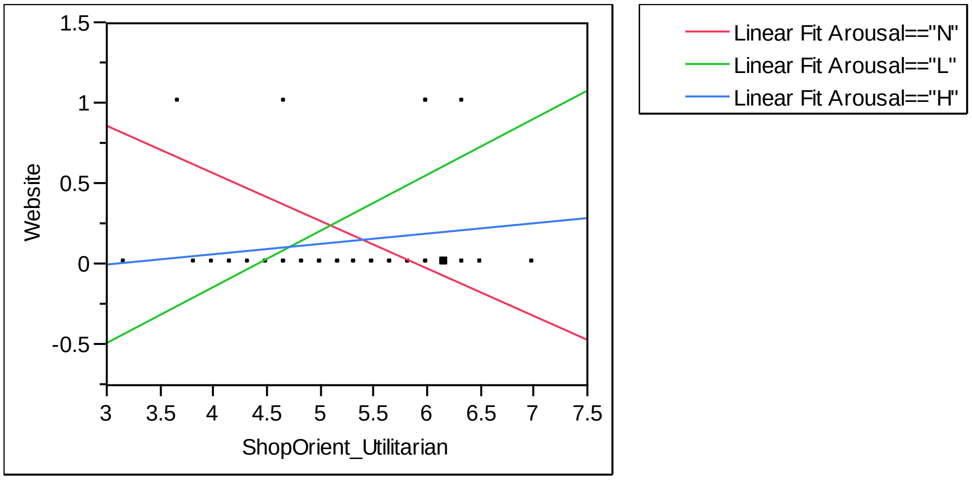
Utilitarian shopping orientation as moderator. General linear models with utilitarian shopping orientations as a moderator were then conducted for thought-listing measures.

***Total number of thoughts generated*.** When utilitarian shopping orientation was entered into the model as a moderator, a main effect for arousal was found on total number of thoughts generated, F (2, 167) = 3.72, p <.05. This main effect came from the significant difference between control (M = 2.84, SE = .22) and high-arousal (M = 2.03, SE = .22) conditions. There was no significant difference between control and low-arousal (M = 2.60, SE = .22) or between low- and high-arousal conditions. When the total number of thoughts was broken down into thoughts about information revealed on the website versus thoughts beyond information revealed on the website, we would obtain the following findings.

Number of thoughts on information revealed on website. For the number of thoughts about information revealed on the site, there was a marginally significant interaction effect of interactivity and arousal, F (2, 167) = 2.39, p =.05. The pattern for this interaction effect was the same as that for the model with hedonic orientation as moderator. When the arousal was high, individuals generated more thoughts about information disclosed on the website in high-interactivity condition than in either low- or medium-interactivity condition. When arousal was low, individuals generated more thoughts about information disclosed on the website in low-interactivity condition. When there was no music, individuals generated most thoughts about the information disclosed on the website in medium-interactivity condition. If we broke down the total thoughts about information revealed on the website, different patterns emerged for total thoughts about product information and thoughts about website itself.

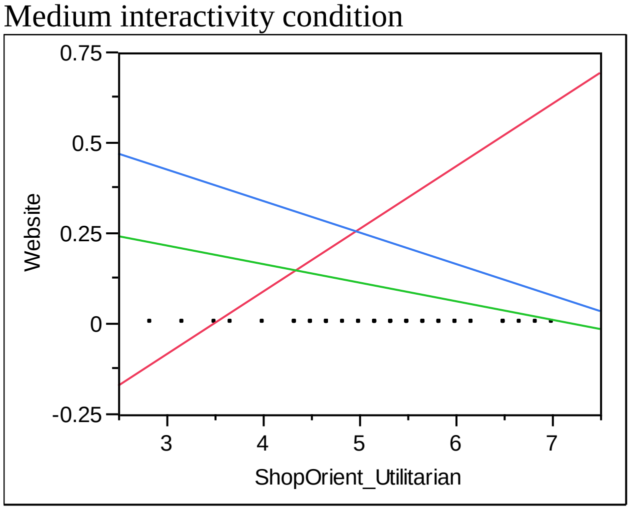
Number of product-related thoughts of information revealed on the site. For thoughts about product information disclosed on the website, there was a marginally significant two-way interaction effect of interactivity and arousal, F (2, 168) = 2.38, p =. 05. The pattern of this interaction effect was also the same as the one for the model with hedonic orientation as moderator. When there was no music, medium interactivity led to most thoughts about the product information disclosed on the site. When arousal was low, low and high interactivity led to more thoughts about product information disclosed on the site than medium interactivity. When arousal was high, high interactivity led to most thoughts about product information disclosed on the site.

Number of website-related thoughts of information revealed on the site. For thoughts about website, there was a significant three-way interaction effect of interactivity, arousal and utilitarian orientation, F (4, 167) = 3.09, p <. 01 (Figure 20). When interactivity was low, the increase in utilitarian orientation led to more thoughts about website as disclosed on the site with low arousal, fewer thoughts with no music, and no significant changes with high arousal. When interactivity was medium, higher utilitarian orientation led to more thoughts with low arousal, but no change with either low arousal or without music. When interactivity was high, high utilitarian led to more thoughts without music, less thoughts with high arousal, and no change with low arousal.



Low interactivity condition

Medium interactivity condition



High interactivity condition

Figure 20.Three-way interaction effect of interactivity, arousal, & utilitarian orientation on number of website-related thoughts on issues revealed on website

Number of thoughts beyond those revealed on website. For the total thoughts on issues beyond those revealed on the website, there was a marginally significant interaction effect of interactivity and arousal, F (2, 168) = 2.13, p =. 08 (Figure 21). When arousal was high, medium interactivity led to most thoughts on issues beyond those revealed on the site. When arousal was low, high interactivity led to most thoughts on issues beyond those revealed on the site. When there was no music, low interactivity led to most thoughts on issues beyond those revealed on the site.

Number of product-related thoughts beyond those shown on the site. For thoughts about product issues beyond those revealed on the site, there was no significant main or interaction effect.

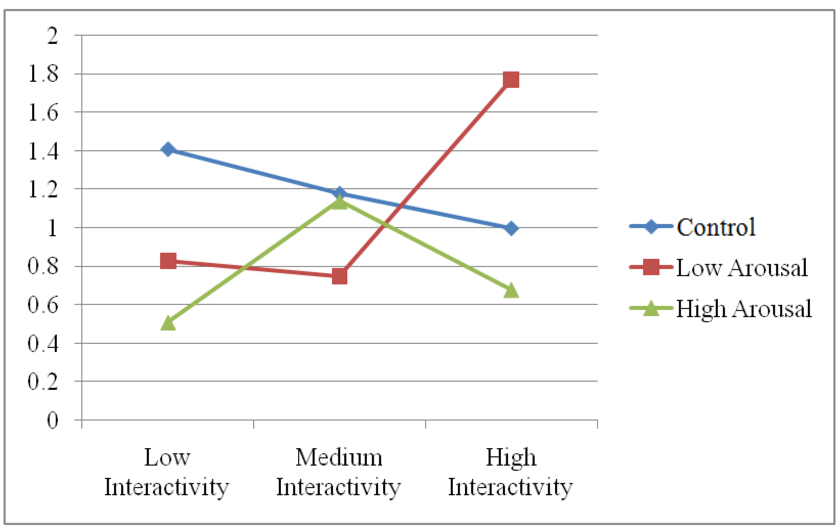


Figure 21. Interaction effect of interactivity and arousal on total number of thoughts on issues beyond those revealed on website

Number of website-related thoughts beyond those shown on the site. For thoughts about website beyond those disclosed on the site, there was a marginally significant interaction effect of interactivity and utilitarian orientation, F (2, 168) = 2.63, p = 0. 07

(Figure 22). When interactivity was high, there was no significant relationship between hedonic shopping orientation and thoughts. When interactivity was medium, higher utilitarian orientation led to more thoughts. When interactivity was low, high utilitarian orientation led to fewer thoughts.

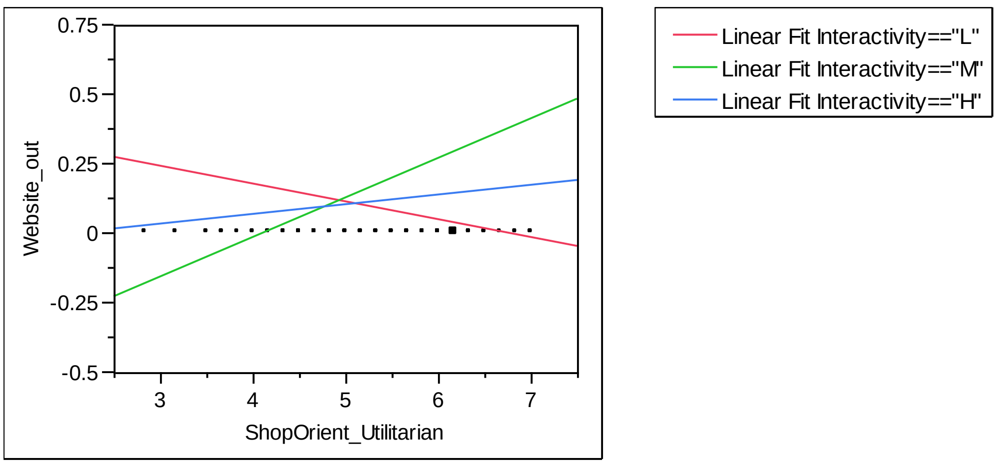


Figure 22. Interaction effect of interactivity and utilitarian orientation on number of website-related thoughts on issues beyond those revealed on site

Summary. Hypothesis 3 proposed that higher interactivity would lead to greater cognitive elaboration, whereas Hypothesis 5 proposed that effect would be in the opposite direction. However, since no main effect of interactivity was found on any aspect of cognitive elaboration, neither hypothesis was supported. Hypothesis 11 posited that higher arousal would lead to greater cognitive elaboration, whereas Hypothesis 17 proposed that low arousal would lead to greater cognitive elaboration. However, the results showed that in fact, control condition led to most elaboration in total, whereas no difference was found between low- and high-arousal conditions. Hypothesis 11 and 17 were thus not supported. All these main-effect hypotheses were probably not supported because of significant interaction effects of interactivity and arousal, indicating changes in cognitive elaboration as a result of the combination effect of the two independent variables. Shopping orientation did moderate the effects of interactivity, or arousal, or both of them. However, the two orientations served different roles in moderating the influence of interactivity and arousal. Hedonic orientation moderated the interaction effect of interactivity and arousal on product-related thoughts of information revealed on the site, the effect of arousal on website-related thoughts of information revealed on the site, total thoughts beyond those revealed on the site, and product-related thoughts of issues beyond those revealed on the site, and the effect of interactivity on website-related thoughts of issues beyond those revealed on the site. Utilitarian orientation affected the interaction effect of interactivity and arousal on website-related thoughts of information revealed on the site and the effect of interactivity on website-related thoughts of issues beyond those revealed on the site.

Engagement with Website Content

The engagement with website content was captured through two aspects: absorption and actual interaction with website. Based on an exploratory factor analysis, four sub-dimensions were identified for absorption (fun/interest, control, immersion, and time transformation) and two dimensions for actual interaction with website (time and action). Multivariate and univariate general linear model analyses were conducted to test Hypothesis 6, 12, and 18 (Figure 23).

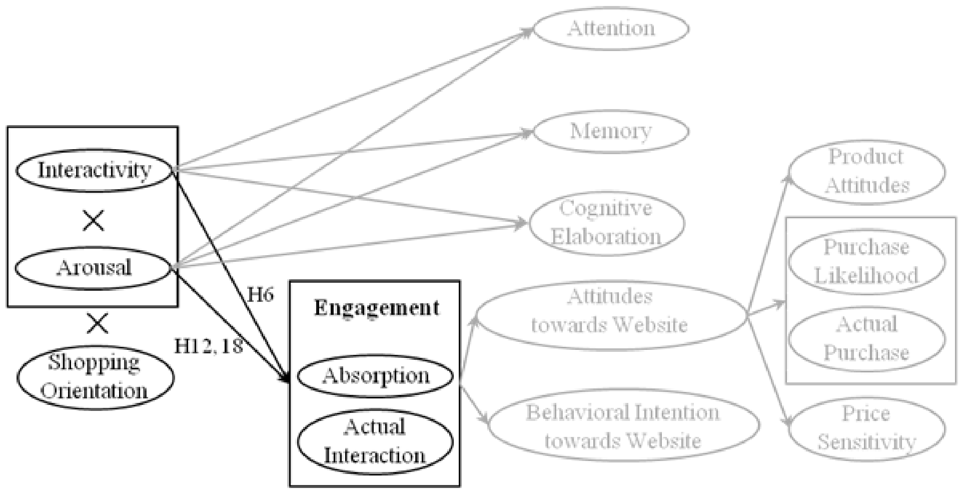


Figure 23. Research model for independent variables' effect on engagement

Absorption. Multivariate general linear models with interactivity and arousal as independent variables, hedonic shopping orientation and utilitarian shopping orientation as separate moderators were first conducted to examine the effects on absorption.

Hedonic shopping orientation as moderator. The multivariate analysis for the absorption aspect of engagement with hedonic shopping orientation as the moderator revealed a significant main effect for interactivity, Wilks' $\lambda = .84$, F (8, 330) = 3.66, p <. 01, a significant interaction effect for interactivity and arousal, Wilks' $\lambda = .83$, F (16, 504.72) = 2.03, p <. 05, and a marginally significant interaction effect for interactivity and hedonic shopping orientation, Wilks' $\lambda = .91$, F (8, 330) = 1.91, p =. 057.

Fun aspect of absorption. Subsequent univariate analysis for the fun aspect of absorption revealed a significant main effect of interactivity, F (2, 168) = 4.80, p <. 01. The post-hoc comparison indicated that high-interactivity condition (M = 3.89, SE = .18) was significantly higher than either medium-interactivity condition (M = 3.23, SE = .17) or low-interactivity condition (*M* = 3.22, *SE* = .16) with regard to fun. However, there was no significant difference between low- and medium-interactivity conditions.

Immersion aspect of absorption. The univariate analysis for the immersion aspect of absorption revealed a significant interaction effect of interactivity and arousal, *F* (4, 168) = 3.10, *p* <. 05, see Figure 24. When there was no music, low-, medium-, and high-interactivity conditions did not differ with regard to the reported immersion. When arousal was high, medium level of interactivity led to the highest immersion whereas high level of interactivity led to the lowest immersion. When arousal was low, medium level of interactivity led to significantly lower level of immersion than either high or low interactivity. Low level of interactivity with low arousal led to the highest level of immersion.

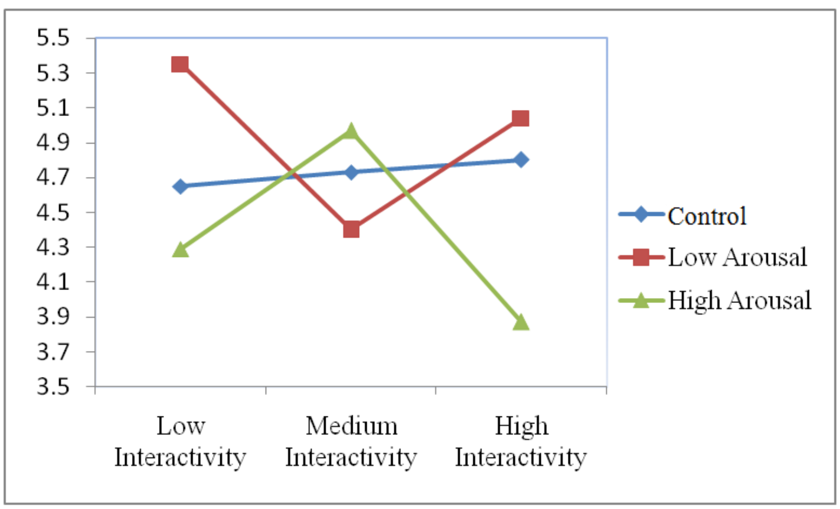


Figure 24. Interaction effect of interactivity & arousal on immersion aspect of absorption

Control aspect of absorption. The univariate analysis for the control aspect of absorption showed a significant main effect for interactivity, *F* (2, 168) = 8.67, *p* <. 01, such that participants in high-interactivity condition (*M* = 5.07, *SE* = .21) reported significantly more control than those who in medium-(M = 4.35, SE = .20) and low-interactivity (M = 3.90, SE = .19) conditions. There was no significant difference between low- and medium-interactivity conditions. In addition, there was an interaction effect of interactivity and hedonic shopping orientation, F (2, 168) = 4.77, p <. 01 (Figure 25). In low-interactivity conditions, participants with higher hedonic shopping orientation showed less control. In contrast, participants with higher hedonic shopping orientation showed more control in medium- and high-interactivity conditions.

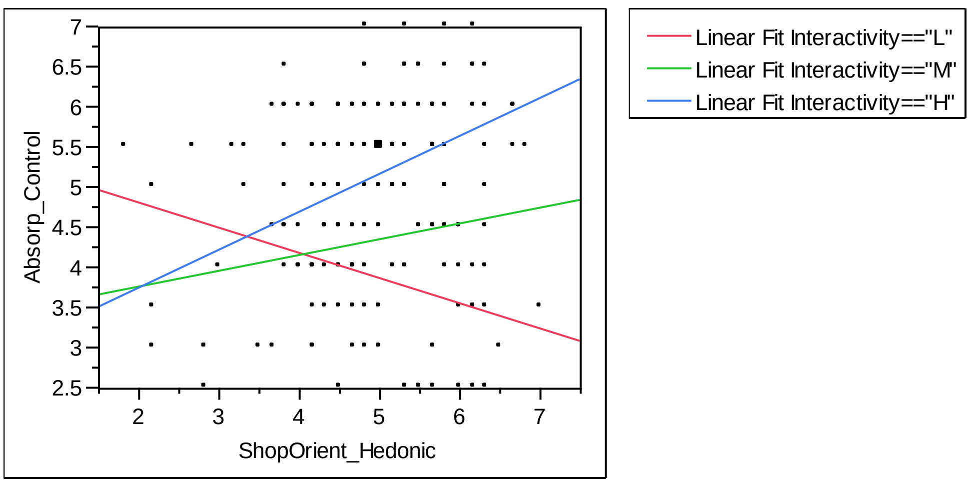


Figure 25. Interaction effect of interactivity & hedonic shopping orientation on control aspect of absorption

Time transformation aspect of absorption. The univariate analysis for the time transformation aspect of absorption showed a significant interaction effect for interactivity and arousal, F (2, 168) = 2.67, p <. 05 (Figure 26). When there was no music arousal, medium level of interactivity led to highest level of time transformation. When the arousal was either low or high, medium level of interactivity led to the lowest level of time transformation. Among all conditions, low interactivity with high arousal led to highest level of time transformation, whereas low interactivity without music led to lowest level of time transformation.

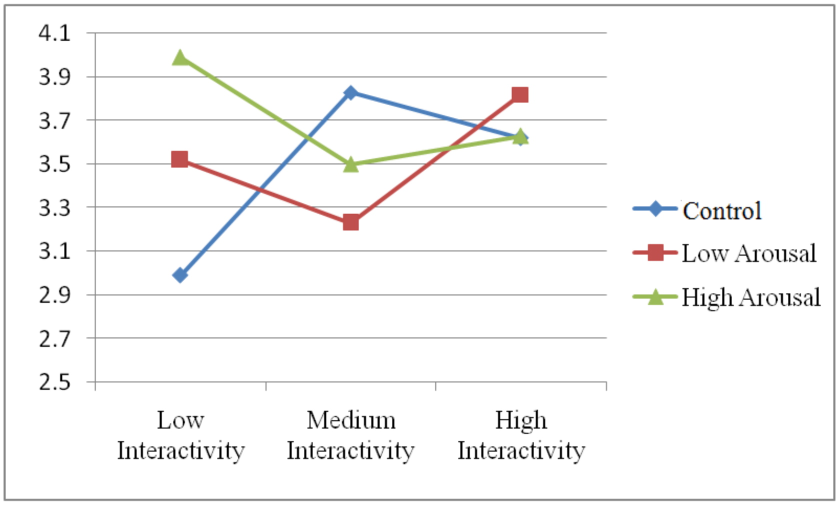


Figure 26. Interaction effect of interactivity & arousal on time transformation aspect of absorption

Utilitarian shopping orientation as moderator. The multivariate analysis for the absorption aspect of engagement with utilitarian shopping orientation as the moderator revealed a significant main effect for interactivity, Wilks' $\lambda = .84$, F (8, 330) = 3.80, $p <. 01$, and a significant interaction effect for interactivity and arousal, Wilks' $\lambda = .83$, F (16, 504.72) = 1.92, $p <. 05$.

Fun aspect of absorption. The univariate analysis for the fun aspect of absorption revealed a significant main effect of interactivity, F (2, 168) = 4.61, $p <. 05$. The post-hoc comparison indicated that high-interactivity condition (M = 3.85, SE = .17) was significantly higher than either medium-interactivity condition (M = 3.21, SE = .18) or low-interactivity condition (M = 3.20, SE = .16) with regard to fun. However, there was no significant difference between low- and medium-interactivity conditions.

Immersion aspect of absorption. The univariate analysis for the immersion aspect of absorption revealed a significant interaction effect of interactivity and arousal, F (4, 168) = 2.82, p <. 05, the pattern of which was the same as that from the model with hedonic orientation as moderator. When there was no music, low-, medium-, and high-interactivity conditions did not differ with regard to the reported immersion. When arousal was high, medium level of interactivity led to the highest immersion whereas high level of interactivity led to the lowest immersion. When arousal was low, medium level of interactivity led to significantly lower level of immersion than either high or low interactivity. Low level of interactivity with low level of arousal led to the highest level of immersion.

Control aspect of absorption. The univariate analysis for the control aspect of absorption showed a significant main effect for interactivity, F (2, 168) = 10.14, p <. 01, such that participants in high-interactivity condition (M = 5.16, SE = .20) reported significantly more control than those who in medium- (M = 4.36, SE = .21) and low-interactivity (M = 3.89, SE = .20) conditions. There was no significant difference between low- and medium-interactivity conditions.

Time transformation aspect of absorption. The univariate analysis for the time transformation aspect of absorption showed no significant result for either the independent variables or the moderator.

Summary. Hypothesis 6 proposed that higher interactivity would lead to greater engagement with website content. Main effects of interactivity were found on both fun and control aspects of absorption. High interactivity led to more engagement with website content than medium- and low-interactivity conditions. Therefore, Hypothesis 6 was supported for fun and control aspects of absorption. Hypothesis 12 and 18 respectively proposed a positive or a negative relationship between arousal and engagement. However, no main effect was found for arousal on absorption aspect of engagement. Neither of these hypotheses was supported. For the immersion and time transformation aspects of absorption, the study found interaction effects of interactivity and arousal. Hedonic shopping orientation was found to moderate the effect of interactivity on control aspect of absorption. Utilitarian shopping orientation had no effect on any of the relationships examined in this analysis.

Time. One of the actual interaction measures of engagement with website content was Time. It included two sub-measures: total time spent on the site and time spent on the non-interactive part of the site.

Hedonic shopping orientation as moderator. The multivariate analysis for the time aspect of engagement with hedonic shopping orientation as the moderator revealed a significant main effect for interactivity, Wilks' $\lambda = .68$, F (4, 330) = 17.46, $p <. 01$, and a significant main effect for hedonic shopping orientation, F (2, 166) = 3.95, $p <. 05$.

Total time on the site. The univariate analysis for total time spent on the website showed a main effect for interactivity, F (2, 167) = 7.30, $p <. 01$. Participants in high-interactivity condition (M = 74257.51, SE = 7992.51) spent significantly less time on the website than those in medium- (M = 110670.22, SE = 7490.89) and low-interactivity (M = 110758.74, SE = 7243.86) conditions. However, there was no significant difference between low- and medium-interactivity conditions.

Time on the non-interactive part of the site. The univariate analysis for time spent on the non-interactive part of website revealed a significant main effect for interactivity, *F* (2, 167) = 12.81, *p* <. 01. Participants in high-interactivity condition (*M* = 59144.14, *SE* = 7661.19) spent significantly less time on the non-interactive part of the website than those in medium- (*M* = 94905.43, *SE* = 7180.36) and low-interactivity (*M* = 110758, *SE* = 6943.58) conditions. Post-hoc comparison showed that low- and medium-interactivity conditions did not significantly differ from each other. There were no other main effects.

Utilitarian shopping orientation as moderator. The multivariate analysis for the time aspect of engagement with utilitarian shopping orientation as the moderator revealed only a significant main effect for interactivity, Wilks' λ = .68, *F* (4, 330) = 17.82, *p* <. 01, ut no other effects for the independent variables or the moderator.

Total time on the site. The univariate analysis for total time spent on the website showed a main effect for interactivity, *F* (2, 167) = 9.00, *p* <. 01. Participants in high-interactivity condition (*M* = 71849.34, *SE* = 7698.41) spent significantly less time on the website than those in medium- (*M* = 110837.61, *SE* = 7661.59) and low-interactivity (*M* = 11216l.14, *SE* = 7351.07) conditions. However, there was no significant difference between low- and medium-interactivity conditions.

Time on the non-interactive part of the site. The univariate analysis for time spent on the non-interactive part of website also revealed a significant main effect for interactivity, *F* (2, 167) = 15.37, *p* <. 01. Participants in high-interactivity condition (*M* = 56235.59, *SE* = 7422.98) spent significantly less time on the non-interactive part of the website than those who in medium-(*M* = 94960.75, *SE* = 7387.47) and low-interactivity (*M* = 112106.14, *SE* = 7088.06) conditions. Post-hoc comparison showed that low- and medium-interactivity conditions did not significantly differ from each other.

Action. The action aspect of engagement with website content was captured through two measures: number of actions performed on the site and ratio of time spent on interactive feature by total time spent on the site.

Hedonic shopping orientation as moderator. The multivariate analysis for the action aspect of engagement with hedonic shopping orientation as the moderator revealed a significant main effect for interactivity, F (2, 106) = 13.11, p <. 01, and an interaction effect for interactivity and hedonic shopping orientation, F (2, 106) = 3.28, p <. 05.

Total number of actions. The univariate analysis for number of actions performed on the website showed that participants performed significantly more actions in high-interactivity condition (M = 30.12, SE = 4.66) than in medium-interactivity condition (M = 3.07, SE = 4.36), t (1) = 4.24, p < .01.

Ratio of interaction time by site time. The univariate analysis for the time spent on the interactive feature by the total time spent on the website revealed a significant main effect for hedonic shopping orientation, F (1, 108) = 6.23, p <. 05. Higher hedonic shopping orientation led to greater ratio of time spent on the interactive feature by total time on the website. There was also a significant interaction effect of interactivity and hedonic shopping orientation, F (2, 108) = 4.21, p <. 05 (Figure 27). Participants in high-interactivity condition with low hedonic shopping orientation spent less portion of time on the interactive features than those who in medium-interactivity condition. However, participants in high-interactivity condition with high hedonic shopping orientation spent much more portion of time on the interactive features than those who in medium-interactivity condition.

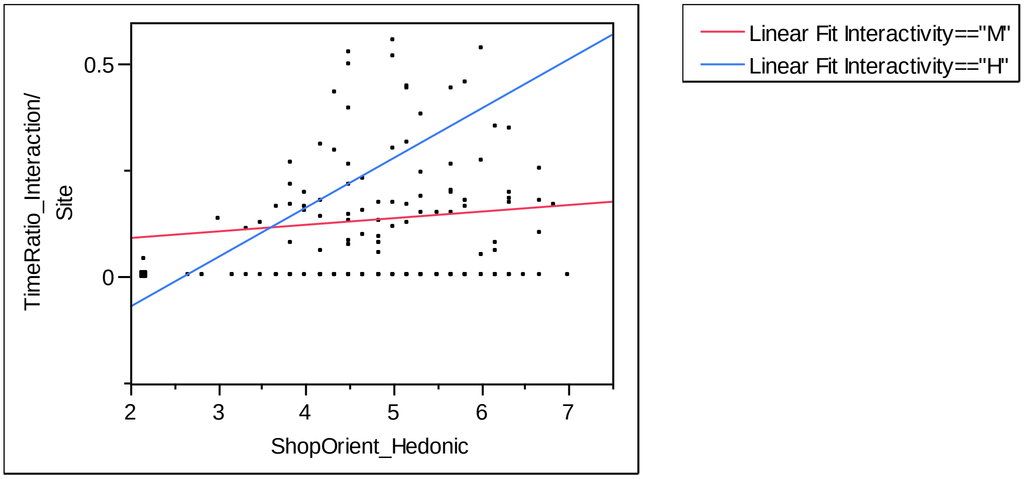


Figure 27.Interaction effect of interactivity & hedonic shopping orientation on time ratio of interaction by website

Utilitarian shopping orientation as moderator. The multivariate analysis for the action aspect of engagement with utilitarian shopping orientation as the moderator revealed a significant main effect for interactivity, F (2, 106) = 13.05, p <. 01.

Total number of actions. The univariate analysis for number of actions performed on the website showed that participants performed significantly more actions in high-interactivity condition (M = 31.81, SE = 4.57) than in medium-interactivity condition (M = 3.04, SE = 4.53), t (1) = 4.47, p < .01.

Ratio of interaction time by site time. The univariate analysis for the time spent on the interactive feature by the total time spent on the website also revealed no significant effect for any independent variable or the moderator.

Summary. No main effect of arousal was found on actual interaction aspect of engagement (for either time or action). Therefore, Hypothesis 12 and 18 were not supported with regard to actual interaction. Even though there were main effects of interactivity on total site time and time on the non-interactive part of the site, the direction of the effect was opposite of that in Hypothesis 6. However, Hypothesis12 was supported with regard to the number of actions performed on the site. Hedonic shopping orientation moderated the effect of interactivity on ratio of interaction time by total site time. In contrast, utilitarian shopping orientation did not have any significant effect.

Website-Related Measures

Multivariate and univariate general linear model analyses were conducted over the two website related dependent variables: attitudes towards website and behavioral intention towards website to test Hypothesis 7a,b, 13a, b, and 19a, b (Figure 28).

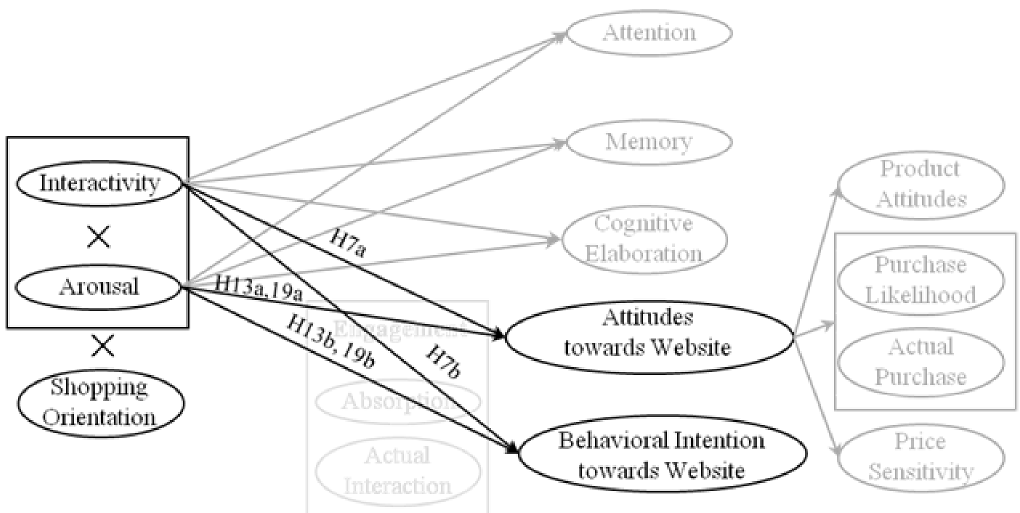


Figure 28. Research model for independent variables' effect on website-related variables

Hedonic shopping orientation as moderator. For website attitudes, the multivariate analysis with hedonic orientation as moderator revealed significant main effects for interactivity, Wilks' λ= .93, *F* (4, 334) = 3.30, *p* <. 05, arousal, Wilks' λ=.90, *F* (4, 334) = 4.34, *p* <. 01, and hedonic shopping orientation, *F* (2, 167) = 6.64, *p* <. 01.

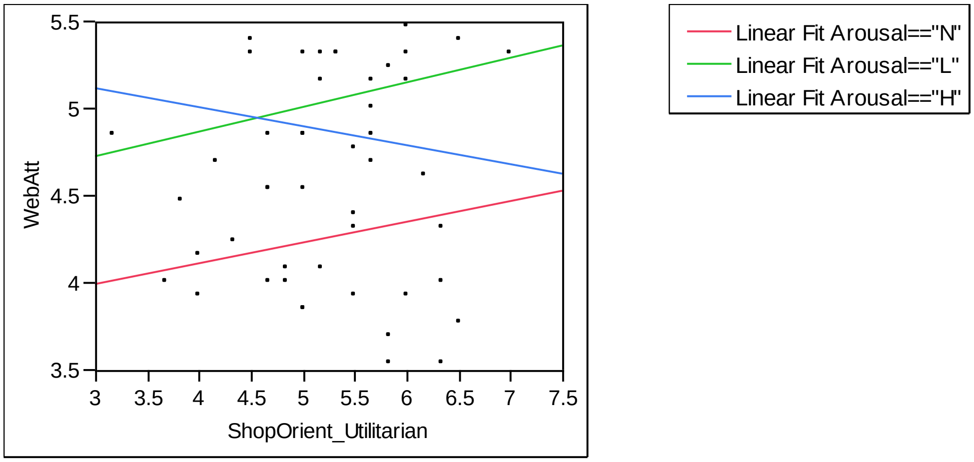
Attitudes toward website. The subsequent univariate analysis for attitudes toward website revealed a significant main effect of interactivity, *F* (2, 168) = 5.65, *p* <. 01.

Subsequent post-hoc comparison showed that high-interactivity condition (*M* = 5.24, *SE* = .10) led to significantly more favorable website attitudes than low-interactivity condition (*M* = 4.74, *SE* = .10). However, there was no significant difference between medium- (*M* = 5.02, *SE* = .11) and high-interactivity conditions. There was also a main effect for arousal, *F* (2, 168) = 7.23, *p* <. 01, with low-arousal (*M* = 5.29, *SE* = .11) leading to significantly more favorable website attitudes than high-(*M* = 4.98, *SE* = .11) and control (*M* = 4.73, *SE* = .11) conditions. In addition, there was a main effect of hedonic shopping orientation, *F* (1, 167) = 9.09, *p* <. 01, with higher hedonic orientation leading to more favorable website attitude.

Website behavioral intention**.** The univariate analysis for website behavior intention revealed main effects for both interactivity, *F* (2, 168) = 4.56, *p* <. 05, and hedonic shopping orientation, *F* (1, 168) = 11.90, *p* <. 01. Individuals in high-interactivity condition (*M* = 4.17, *SE* = .19) reported higher website behavior intention than those in medium (*M* = 3.67, *SE* = .18) and low (*M* = 3.38, *SE* = .18) conditions. Post-hoc comparison showed that only the difference between low- and high-interactivity conditions was significant. The relationship between hedonic shopping orientation and website behavior intention was positive.

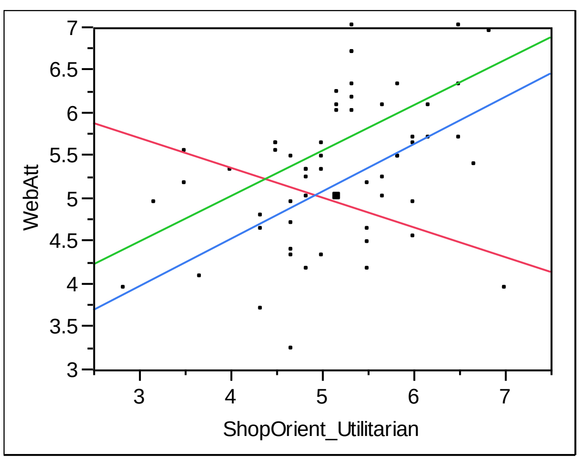
Utilitarian shopping orientation as moderator. The multivariate analysis with utilitarian orientation as moderator revealed significant main effects for interactivity, Wilks' λ= .91, *F* (4, 334) = 3.94, *p* <. 05, arousal, Wilks' λ=.89, *F* (4, 334) = 5.05, *p* <. 01, and utilitarian shopping orientation, *F* (2, 167) = 3.37, *p* <. 01. There was also three-way interaction effect of interactivity, arousal, and utilitarian shopping orientation, Wilks' λ= .88, *F* (8, 334) = 2.67, *p* <. 01.

Attitudes toward website. The subsequent univariate analysis for attitudes toward website revealed a significant main effect of interactivity, F (2, 168) = 7.27, p <. 01. High-interactivity condition (M = 5.28, SE = .10) led to significantly more favorable website attitude than low-interactivity condition (M = 4.73, SE = .10). However, there was no significant difference between medium- (M = 4.99, SE = .11) and high-interactivity conditions. There was also a main effect for arousal, F (2, 168) = 8.37, p <. 01, with low-arousal (M = 5.26, SE = .10) leading to significantly more favorable website attitudes than no-arousal (M = 4.68, SE = .10) condition. However, there was no significant difference between low and high (M = 5.07, SE = .10) conditions. In addition, there was a main effect of utilitarian shopping orientation, F (1, 168) = 5.56, p <. 05, with higher utilitarian orientation leading to more favorable website attitudes. However, all of the above mentioned main effects should be interpreted in light of a three-way interaction effect of interactivity, arousal, and utilitarian shopping orientation, F (4, 168) = 3.54, p <. 05 (Figure 29), such that in high-interactivity condition, with the increase of utilitarian shopping orientation, individuals in control condition showed less favorable attitudes towards the website, whereas individuals in low- and high-arousal conditions showed more favorable attitudes towards the website. In medium-interactivity condition, individuals in control condition showed more favorable website attitudes if they had higher utilitarian shopping orientation, whereas there was no significant relationship between utilitarian shopping orientation and website attitude for low- and high-arousal conditions. In high-interactivity condition, individuals with higher utilitarian shopping orientation showed more favorable website attitudes in control and low-arousal conditions. However, they showed less favorable website attitudes if they were in high-



Low interactivity condition

Medium interactivity condition



High interactivity condition

Figure 29. Three-way interaction effect of interactivity, arousal, & utilitarian shopping orientation on website attitude

arousal condition and with higher utilitarian shipping orientation.

***Website behavioral intention*.** The univariate analysis for website behavior intention revealed main effects for both interactivity, F (2, 168) = 5.41, p <. 01, and utilitarian shopping orientation, F (1, 168) = 5.32, p <. 05. Individuals in high-interactivity condition (M = 4.18, SE = .19) reported higher website behavior intention than those in medium (M = 3.65, SE = .19) and low (M = 3.32, SE = .18) conditions. However, there was no significant difference between low- and medium-interactivity conditions. With the increase of utilitarian shopping orientation, the website behavior intention increases as well.

Summary. In summary, there were main effects of interactivity on both attitudes and behavioral intention towards website. These main effects both resulted from the significant differences between low- and high-interactivity conditions, but not between medium- and high-interactivity conditions. Hypothesis 7a and b proposed that higher interactivity would lead to better attitude and greater behavioral intention towards website. Based on the current results, these two hypotheses were supported with regard to the comparison between low- and high-interactivity. Hypothesis 13a and b proposed that higher arousal would lead to better attitudes and behavioral intention towards website, whereas Hypothesis 19a and b proposed that low arousal would lead to better attitude and high behavioral intention towards website. A main effect of arousal was only found on attitudes towards website but not on behavioral intention. Therefore, Hypothesis 19a was supported, whereas Hypotheses 13a, 13b and 19bwere rejected. Hedonic shopping orientation did not significantly affect these results. Utilitarian shopping orientation moderated the interaction effect of interactivity and arousal on attitudes towards website.

Product-Related Measures

For the product related variables, such as attitudes towards product, purchase intention towards product, and price sensitivity, multivariate general linear models with interactivity and arousal as independent variables and hedonic shopping orientation and utilitarian shopping orientation as the respective moderators were first conducted to test Hypothesis 8a,b,c, 14a,b,c, and 20a,b,c (Figure 30). Chi-square tests were conducted for the effect of interactivity and arousal on actual purchase behavior, with hedonic and utilitarian shopping orientations as separate moderators.

Hedonic shopping orientation as moderator. The multivariate analysis with hedonic shopping orientation as the moderator revealed a significant main effect for interactivity, Wilks' $\lambda = .89$, F (8, 330) = 2.55, $p <.05$, a significant main effect for hedonic shopping orientation, F (4, 165)= 3.39, $p < .05$, but no significant main effect for arousal and no significant interaction effects among interactivity, arousal, and hedonic shopping orientation.

Attitudes toward product. The univariate analysis for product attitudes revealed a significant main effect for interactivity, F (2, 168) = 3.06, $p <. 05$. The subsequent post-hoc comparison with student's t test showed that high-interactivity condition (M = 4.37, SE = .12) differed significantly from medium-interactivity condition (M = 3.93, SE = .12) with regard to product attitude. However, medium-interactivity condition and low-interactivity condition (M = 4.05, SE = .12) did not significantly differ from each other for product attitudes.

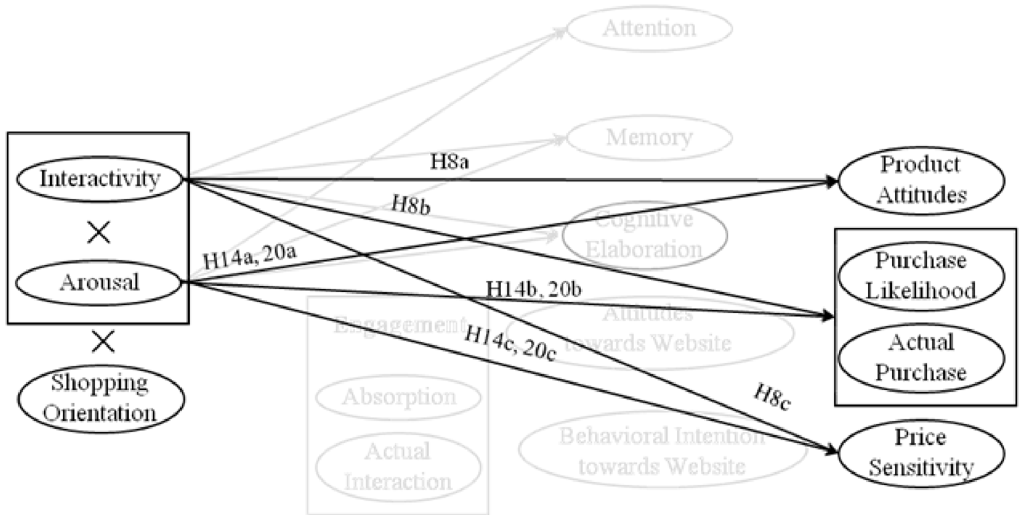


Figure 30. Research model for independent variables' effect on product-related variables

***Purchase likelihood toward product*.** The univariate analysis for purchase likelihood towards product also revealed a significant main effect for interactivity, *F* (2, 168) = 3.17, *p* <. 05. The post-hoc comparison showed that this main effect occurred because high-interactivity condition (*M* = 3.73, *SE* = .17) leading to significantly higher purchase likelihood towards product than both low-interactivity (*M* = 3.22, *SE* = .17) and medium-interactivity (*M* = 3.14, *SE* = .17) conditions. However, low- and medium-interactivity conditions did not significantly differ from each other. The analysis also found a significant main effect for hedonic shopping orientation, *F* (1,168) = 10.51, *p* <. 01. The higher the hedonic shopping orientation, the higher the purchase likelihood towards product.

***Price sensitivity*.** The univariate analysis for price sensitivity showed yet another main effect of interactivity, *F* (2, 168) = 4.41, *p*<. 05, with medium interactivity condition leading to the highest price sensitivity. The post-hoc comparison showed that this main effect emerged because individuals in medium-interactivity condition (*M* = 5.40, *SE* = .20) were significantly more sensitive about the price than those in high- (*M* = 4.58, *SE* = .20) and low-(*M* = 4.79, *SE* = .19) interactivity conditions. Low-interactivity condition and high-interactivity condition did not differ with regard to price sensitivity.

Utilitarian shopping orientation as moderator. The multivariate analysis with utilitarian shopping orientation as the moderator revealed a significant main effect for interactivity, Wilks' $\lambda = .87$, $F(8, 330) = 3.01$, $p < .01$, but no significant main effect for arousal or utilitarian shopping orientation and no significant interaction effects among interactivity, arousal, and utilitarian shopping orientation.

Attitude toward product. The univariate analyses showed a significant main effect of interactivity on attitude towards product, $F(2, 168) = 4.43$, $p < .05$, with high-interactivity condition (*M* = 4.42, *SE* = .12) leading to significantly more favorable attitudes than low-interactivity condition (*M* = 4.03, *SE* = .12) and medium-interactivity condition (*M* = 3.90, *SE* = .13).

Purchase likelihood toward product. There was also a significant main effect of interactivity on purchase likelihood, $F(2, 168) = 4.83$, $p < .05$. High-interactivity condition (*M* = 3.78, *SE* = .18) led to significantly higher purchase likelihood than low interactivity condition (*M* = 3.17, *SE* = .17) and medium-interactivity condition (*M* = 3.05, *SE* = .18).

Price sensitivity. A significant main effect of interactivity was also found on price sensitivity, $F(2, 168) = 3.75$, $p < .05$, with medium-interactivity condition (*M* = 5.39, *SE* = .20) leading more price sensitivity than low (*M* = 4.81, *SE* = .20) and high (*M* = 4.62, *SE* = .20) conditions.

***Actual purchase behavior*.** Actual purchase behavior was captured on a different level of measurement from the other product related variables. Therefore, separate Wald tests for logistic chi-square were conducted for the interactivity and arousal effects with hedonic and utilitarian orientations as moderators. When hedonic shopping orientation was entered as a moderator, the Wald test showed a main effect of interactivity, Wald X^2 (2) = 8.16, p <. 05, such that there were more percentage of individuals in high-interactivity condition (50.85%) clicking the "add to cart" button than those in low- (32.81%) and medium-interactivity (31.67%) conditions. At the same time, there were fewer individuals in the high interactivity condition (25.42%) clicking the "continue shopping" button than those in medium- (53.33%) and low-interactivity (40.63%) condition. Medium- interactivity condition (15.00%) had fewer individuals clicking "save for later" than low-interactivity (26.56%) and high-interactivity (23.73%) conditions. There was also a significant interaction effect of interactivity and hedonic shopping orientation, Wald X^2 (2) = 6.08, p <. 05. When interactivity was low or high, higher hedonic orientation led to more actual purchase behavior. When interactivity was medium, higher hedonic led to less actual purchase behavior. When utilitarian shopping orientation was entered in to the test model as a moderator, Wald test only revealed a significant main effect for interactivity, Wald X^2 (2) = 7.12, p <. 05. The pattern of this main effect was the same when hedonic shopping orientation was included in the model as a moderator.

Summary. In summary, no main effect of arousal was found on any of the product-related dependent variables. Therefore, Hypotheses 14a, b, c, and 20a, b, c, all of which proposed competing assumptions about the effect of arousal on product related variables, were not supported. On the other hand, significant main effects of interactivity were found for all of the product-related variables. In general, high interactivity led to better product attitude, higher purchase intentions, and more actual purchase behavior, thus supporting Hypothesis 8a and H8b. Medium interactivity led to the highest price sensitivity, inconsistent with Hypothesis 8c's prediction of a linear relationship between interactivity and price sensitivity. No moderating effect was found for utilitarian shopping orientation. However, hedonic shopping orientation was found to moderate the effect of interactivity on actual purchase behavior. When interactivity was high or low, hedonic orientation was positively related to actual purchase, but when interactivity was medium, it was negatively related to actual purchase.

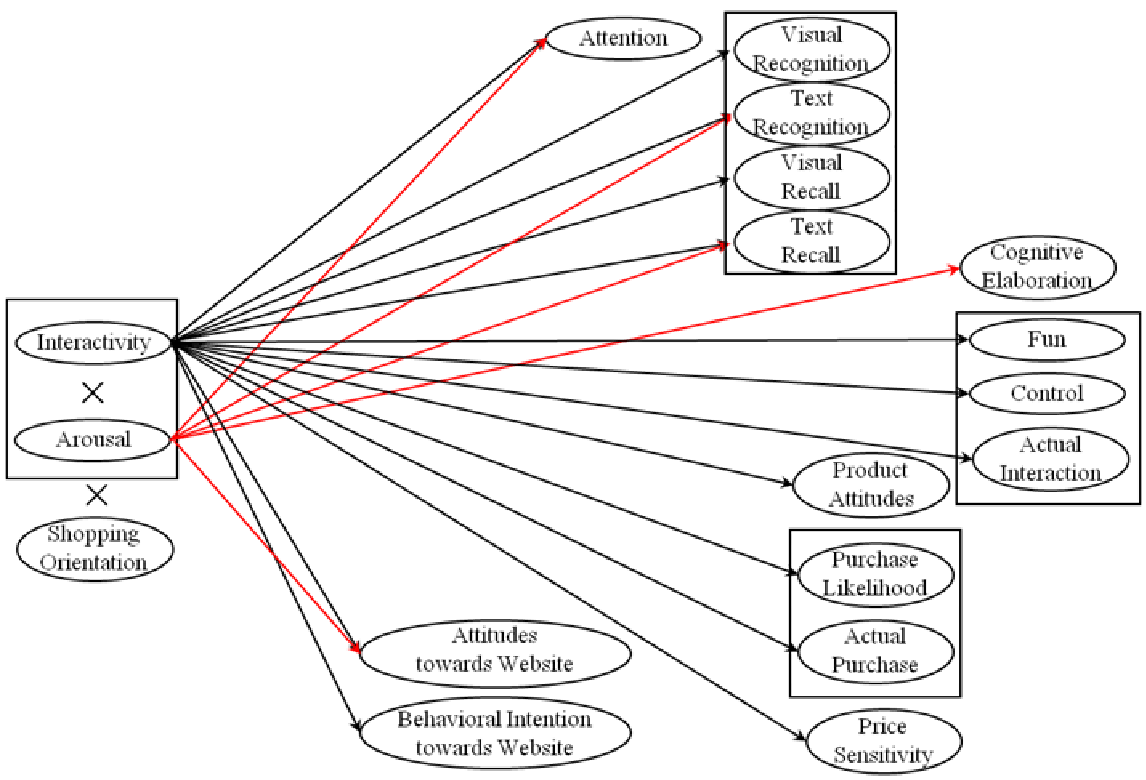


Figure 31. Summary of significantly main effects on mediators and dependent variables

Reanalysis of all the models tested thus far using Power-usage as a covariate yielded essentially redundant results, with absolutely no changes to the effect patterns of interactivity. Based on the above mentioned results, Figure 31 shows all the significant main effects. Table 4 and 5 summarize the directions of the main and interaction effects.

Mediation Effects

In order to identify potential mediators for website and product related variables, this study employed an approach advocated by Hayes et al. (in press) to quantify the indirect effects by multiplying the effect of the independent variable on the mediator(s) and the effect of the mediator(s) on the dependent variable. By using their SPSS macro (Hayes, Preacher, & Myers, in press) with 5000 bootstrap resamples, this multiple step model examines the potential effect of two mediators in the form of $X \rightarrow M1 \rightarrow M2 \rightarrow Y$. The key results generated from this method are the estimated indirect effect through each mediator, the total estimated effect from independent variable to dependent variable, and the corresponding confidence interval. In the current study, both interactivity and arousal have three levels. However, the method currently employed requires that the independent variable should be either dummy-coded variable or continuous variable. Therefore, the first step of the mediation test was to dummy-code interactivity and arousal. Interactivity was recoded into two dummy variables of High-Interactivity and Medium-Interactivity with low interactivity condition as the baseline (i.e., low interactivity was coded as zero in both dummy variables, with high interactivity coded as 1 in one dummy variable and medium interactivity as 1 in the other dummy variable). Arousal was recoded into two dummy variables of High-Arousal and Arousal-Low with control condition as the

Table 4. Summary of main and interaction effects on mediators and dependent variables (1)

			Interactivity	Arousal	Interactivity × Arousal	Interactivity × Hedonic	Interactivity × Utilitarian	Arousal × Hedonic	Arousal × Utilitarian	Interactivity × Arousal × Hedonic	Interactivity × Arousal × Utilitarian
Attention			M>H=L	N=L>H	-	-	-	-	-	-	-
Memory	Recognition	Total	-	N_a, L_{ab}, H_b	-	-	-	-	-	-	-
		Visual	H>M=L	-	-	-	-	-	-	-	-
		Text	L>M>H	N>L>H	Figure9	-	-	-	-	-	-
	Recall	Total	M_a, H_b, L_b	N_a, L_{ab}, H_b	-	-	-	-	-	-	-
		Visual	H=M>L	-	-	-	-	-	-	-	-
		Non-visual	M_a, L_{ab}, H_b	N_a, L_{ab}, H_b	-	-	-	-	-	-	-
Elaboration	Total		-	N_a, L_{ab}, H_b	-	-	-	-	-	-	-
	Issues on Site	Total	-	-	Figure12	-	-	-	-	-	-
		Product	-	-	Figure13	-	-	-	-	Figure14	-
		Website	-	-	-	-	-	Figure15	-	-	Figure20
	Issues beyond Site	Total	-	-	-	-	-	Figure16	-	-	-
		Product	-	-	Figure17	-	-	Figure18	-	-	-
		Website	-	-	-	Figure19	-	-	-	-	Figure22
Engagement	Absorption	Fun	H>M=L	-	-	-	-	-	-	-	-
		Immersion	-	-	Figure24	-	-	-	-	-	-
		Control	H>M=L	-	-	Figure25	-	-	-	-	-
		Time Transformation	-	-	Figure26	-	-	-	-	-	-

Note: For interactivity conditions, L=low interactivity, M=medium interactivity, H=high interactivity. For arousal conditions, N=no arousal, L=low arousal, H=high arousal. In each cell, the letters on the left are have higher means than the ones on the right. “>” means significantly higher. “=” means no significant difference. Conditions with different subscripts are significantly different from each other. Conditions with same subscripts are not significantly different from each other. All of the interaction effects are illustrated by the figures embedded in the text. Figure number was provided in the table. The cells with “-” means no significant results.

Table 5. Summary of main and interaction effects on mediators and dependent variables (2)

			Interactivity	Arousal	Interactivity × Arousal	Interactivity × Hedonic	Interactivity × Utilitarian	Arousal × Hedonic	Arousal × Utilitarian	Interactivity × Arousal × Hedonic	Interactivity × Arousal × Utilitarian
Engagement	Time	Total Site Time	L=M>H	-	-	-	-	-	-	-	-
		Time on Non-interactive Part	L=M>H	-	-	-	-	-	-	-	-
	Action	Total Actions	H>M	-	-	-	-	-	-	-	-
		Action Time/Site Time	-	-	-	Figure27	-	-	-	-	-
Website	Website Attitudes		H_a, M_{ab}, L_b	L>H=N	-	-	-	-	-	-	-
	Website Behavioral Intention		H_a, M_{ab}, L_b	-	-	-	-	-	-	-	Figure29
Product	Product Attitude		H_a, L_{ab}, M_b	-	-	-	-	-	-	-	-
	Purchase Likelihood		H>L=M	-	-	-	-	-	-	-	-
	Actual Purchase		H>M=L	-	-	*	-	-	-	-	-
	Price Sensitivity		M>L=H	-	-	-	-	-	-	-	-

Note: For interactivity conditions, L=low interactivity, M=medium interactivity, H=high interactivity. For arousal conditions, N=no arousal, L=low arousal, H=high arousal. In each cell, the letters on the left have higher means than the ones on the right. ">" means significantly higher. "=" means no significant difference. Conditions with different subscripts are significantly different from each other. Conditions with same subscripts are not significantly different from each other. All of the interaction effects were illustrated by the figures embedded in the text. Figure number is provided in the table. The cells with "-" means no significant results.
*Wald test was conducted for this interaction effect. However, it is dificult to illustrate the effect in graphical form. Please see p.122 for a description of the interaction.

baseline. In order to keep the degrees of freedom consistent before and after dummy-coding, while one dummy variable was entered as the independent variable, the other dummy variable was treated as the covariate in the analyses. The results from the multiple-step mediation analyses showed that for the comparison of high-interactivity to low-interactivity condition, evidence of mediation effects did emerge, such that interactivity's influence on product purchase likelihood was first mediated by fun aspect of absorption, and then by attitude towards product (b=.10, CI: .03, .20)(Figure 32). For the comparison of medium interactivity to low interactivity condition, no evidence of mediation effects emerged for the fun aspect of absorption and product attitude on purchase likelihood.

In a different model comparing the high interactivity and low interactivity's effect on purchase likelihood with control aspect of absorption and product attitude as mediators, the indirect path through both control and attitude towards product was significant, b = .09, CI = .03, .18 (Figure 32), indicating a significant, positive mediation effect on the relationship between interactivity and product purchase likelihood. No significant mediators were identified for the medium interactivity and low interactivity comparison. All of the coefficients shown in the graph are standardized estimates.

In the comparison of high interactivity to low interactivity's effect on website behavioral intention, two variables--fun aspect of absorption and attitude towards website--were entered into the model. The analysis indicated a significant indirect effect through both fun and attitude towards website, b = .07, CI = .02, .13 (Figure 32). No significant mediators were identified for the comparison between medium interactivity and low interactivity conditions.

When control aspect of absorption and website attitude were entered into the model testing the indirect effect of high versus low interactivity condition on website behavioral intention, the indirect effect through control aspect of absorption and website attitude was positive and significant, $b = .13$, $CI = .06, .23$ (Figure 32). No significant mediators were identified for the comparison between medium interactivity and low interactivity conditions.

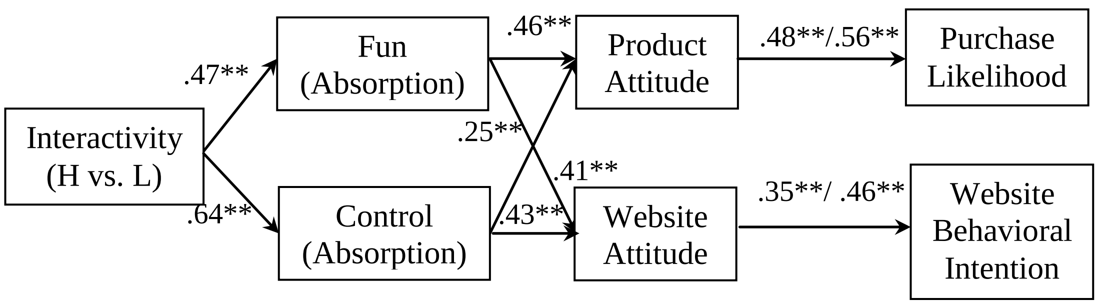


Figure 32. Indirect effects through fun, control, product attitude, and website attitude

When attention and website attitude were entered into the model testing the indirect effect of high interactivity versus low interactivity on website behavioral intention, the two-step indirect effect through both mediators was not significant. In the model testing the indirect effect of medium interactivity versus low interactivity on website behavioral intention, no significant two-step mediation effect was found either. Instead, the analysis revealed a significant positive indirect effect through attention on behavioral intention towards website, $b = .09$, $CI = .02, .18$ (Figure 33).

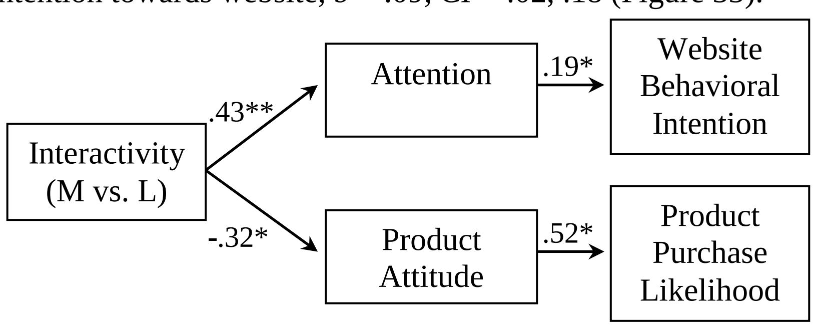


Figure 33. Indirect effects when comparing medium and low interactivity conditions

In comparing the indirect effect of high interactivity versus low interactivity through control aspect of absorption and website attitude on product attitude, a positive and significant indirect effect was found through control and website attitude *b* = .07, *CI* = .02, .15 (Figure 34). No significant indirect effect was found in the comparison of medium and low interactivity conditions.

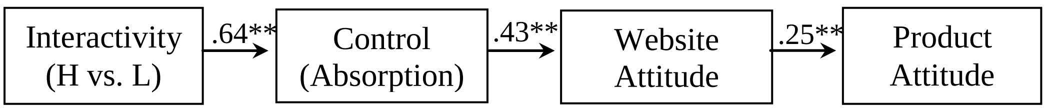


Figure 34. Indirect effects through control and website attitude

Finally, a positive and significant indirect effect through both website attitude and product attitude was found for the comparison between high interactivity and low interactivity's effect on product purchase likelihood, *b* = .07, *CI* = .02, .15 (Figure 35). In contrast, only a negative significant relationship through product attitude, *b* = -.17, *CI* = -.33, -.02 (Figure 34), was found on product purchase likelihood in the comparison of medium interactivity and low interactivity conditions. No indirect effect through both website attitude and product attitude was found for the medium and low interactivity comparison on product purchase likelihood.

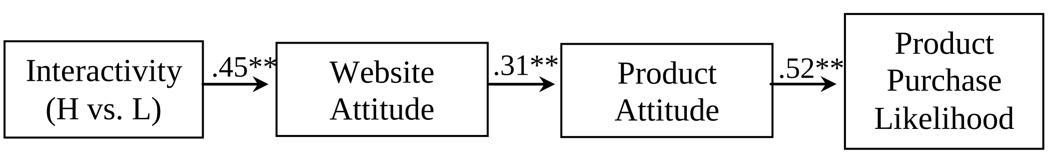


Figure 35. Indirect effects through website attitude and product attitude

Summary

The current study found that modality-interactivity had significant main effects on attention, total recall memory, fun and control aspects of absorption, total time spent on the site, number of actions performed on the site, attitudes and behavioral intention toward website, attitudes and behavioral intention toward product, actual purchase, and price sensitivity. Although no significant main effect of modality-interactivity was found for total recognition memory, it did have significant main effects on recognition of visual information and recognition of text information. Modality-interactivity had no main effect on cognitive elaboration.

Specifically, the effect of modality-interactivity on attention followed a non-linear pattern, i.e. an inverted-V shape. Regardless of the kind of shopping orientation that participants had, medium level of modality-interactivity led to more attention than both high and low levels. The same pattern also held true for the effect of modality-interactivity on total recall memory. However, different patterns emerged for recall of visual information over non-visual information. Individuals recalled significantly more visual information in medium- and high-interactivity conditions than in low condition, but significantly more non-visual information in low-and medium-interactivity conditions than in high condition. The effects of modality-interactivity on recognition of visual versus text information also differed from each other, such that high interactivity led to most recognition of visual information but least recognition of text information. High interactivity led to more fun and control than low- and medium-interactivity with regard to the absorption aspect of engagement. In contrast, for the actual behavioral aspect of engagement, low- and medium-interactivity led to more overall time spent on the site as well as more time spent on the non-interactive part of the site than high-interactivity condition, even though participants did perform more actions on the site in the high than in the medium condition. For both attitudes and behavioral intentions toward website, high-interactivity condition was significantly higher than low-interactivity condition, but no significant difference was found between medium- and high-interactivity conditions. The effects of modality-interactivity on product-related outcomes were less consistent. High interactivity led to significantly more favorable attitudes toward product than medium interactivity, but did not significantly differ from low interactivity. High interactivity also led to significantly higher purchase likelihood and more actual purchases than both low and medium interactivity. However, medium interactivity was found to lead to most price sensitivity than low and high interactivity.

Arousal had significant main effects on the following variables: attention, total recall, total recognition, total elaboration, and attitudes toward website. Control and low-arousal condition led to significantly more attention than high-arousal condition. For both total recall and recognition, control condition was only significantly higher than high-arousal condition, but not higher than medium-arousal condition. The same pattern emerged for cognitive elaboration. An inverted-V pattern emerged for the effect of arousal on attitudes toward website, such that low-arousal led to most favorable attitudes, whereas control and high-arousal did not significantly differ from each other.

Two-way interaction effects of interactivity and arousal were found for recognition of text information, cognition elaboration of information revealed on the site and beyond the site, and immersion and time transformation aspects of absorption. Hedonic and utilitarian shopping orientations differed in their respective roles in moderating the effect of interactivity and arousal, which was illustrated by a series of two-way and three-way interaction effects. If level of interactivity increased with an increase in hedonic shopping orientation, individuals generated more product-related thoughts on issues revealed on the site in control and low-arousal conditions, but fewer thoughts of the same kind in high-arousal condition. With the increase in hedonic orientation, individuals generated more website-related thoughts on issues revealed on the site in low- and high-arousal conditions, but fewer thoughts of the same kind in control condition. With the increase in hedonic orientation, individuals generated more thoughts beyond those shown on the site in general in high-arousal condition, fewer thoughts of the same kinds in low-arousal condition, and no change in control condition. The same pattern held true for product-related thoughts of issues beyond those shown on the site. For website-related thoughts beyond those revealed on the site, when hedonic orientation increased, individuals generated more thoughts with medium interactivity, fewer thoughts with higher interactivity, and no difference with low interactivity. For the control aspect of absorption, when hedonic orientation increased, medium- and high-interactivity conditions led to more control, with low condition leading to less control. This orientation also increased the ratio of time spent on the interactive features and that on the entire site in high-interactivity condition, with no change in the medium-interactivity condition.

Different from hedonic orientation, utilitarian shopping orientation only affected the interaction effect of interactivity and arousal on website-related thoughts of issues revealed on the site and on website attitudes, and the main effect of interactivity on website-related thoughts of issues beyond those revealed on the site. For website-related thoughts of issues revealed on the site, with the increase in utilitarian orientation and the increase in level of interactivity, individuals generated fewer thoughts in low- and high-arousal conditions, but more thoughts in control conditions. For website-related thoughts on issues beyond those revealed on the site, with the increase of utilitarian shopping orientation, medium interactivity led to more thoughts whereas low and high interactivity did not make a difference.

With regard to attitudes towards website, when hedonic orientation increased in low-interactivity condition, high arousal led to less favorable attitudes, whereas control and low arousal led to more favorable attitudes. But in medium-interactivity condition, the increase in hedonic orientation only led to more favorable attitudes when there was no music. Under high interactivity, with the increase in hedonic orientation, low- and high-arousal led to more favorable attitudes, whereas control condition led to less favorable attitudes. Individual differences in power-usage did not yield anything of interest. Table 7 summarizes all of the means for each dependent variable by conditions.

Results from multiple-step mediation analyses identified a series of mediators for the dependent variables. The positive indirect effects of interactivity on both behavioral intention and product purchase likelihood were found to be mediated through fun aspect of absorption and attitudes toward website, or through control aspect of absorption and attitudes toward website. The positive indirect effect of interactivity on attitudes toward product was found to be mediated through control and attitudes toward website. A significant positive indirect effect of interactivity through both attitudes toward website and attitudes toward product was also found for product purchase likelihood. However, all of the above-mentioned two-step mediations were only significant when comparing low- and high-interactivity conditions. In comparing low- and medium-interactivity conditions, no two-step mediation was found in this study, but two single-step mediation effects were found. The analyses revealed a significant positive indirect effect of interactivity on behavioral intention towards website through attention and a significant negative indirect effect of interactivity on product purchase likelihood through attitudes toward product. Table 7 summaries the significant correlations between mediators and the major dependent variables.

Table 6. Means by conditions

		Low Interactivity			Medium Interactivity			High Interactivity		
		No Music	Low Arousal	High Arousal	No Music	Low Arousal	High Arousal	No Music	Low Arousal	High Arousal
1.	Attention	4.48	4.70	3.93	5.32	4.87	4.95	4.82	4.78	3.95
2.	Recognition	8.50	7.70	7.85	8.45	7.60	7.67	8.35	8.35	6.45
3.	Recall	3.78	2.39	1.15	4.50	2.75	3.76	2.75	2.90	2.30
4.	Elaboration	2.68	2.50	1.65	3.15	2.05	2.00	2.70	3.10	2.45
5.	Fun	3.03	3.63	3.00	3.24	2.99	3.40	4.14	3.82	2.65
6.	Immersion	4.65	5.35	4.25	4.73	4.33	4.97	4.77	5.03	4.03
7.	Control	3.68	4.35	3.58	4.25	4.08	4.67	5.25	5.00	5.20
8.	Time Transformation	2.98	3.52	3.97	3.83	3.13	3.49	3.48	3.82	3.67
9.	Time on Website	122740.09	98026.74	109575.10	116373.00	91878.65	120911.95	80206.65	76140.95	59590.70
10.	Total actions	0	0	0	3.85	2.35	2.85	31.50	32.84	34.60
11.	Website Attitude	4.29	5.05	4.86	4.88	5.03	5.10	4.96	5.73	5.13
12.	Website Behavioral intention	3.23	3.63	3.30	3.43	3.71	3.80	4.32	4.31	3.92
13.	Product Attitude	4.27	4.03	3.86	3.91	3.96	3.90	4.58	4.06	4.59
14.	Purchase likelihood	3.05	3.46	3.23	2.97	3.25	3.20	3.74	3.96	3.64
15.	Price	4.95	4.78	4.60	5.40	6.00	4.81	4.50	4.85	4.55
16.	Hedonic orientation	4.91	4.96	5.05	4.93	4.76	4.90	4.70	4.92	5.24
17.	Utilitarian orientation	5.46	5.28	5.40	5.34	4.93	5.06	5.21	5.30	5.07

Table 7. Zero-order correlations between continuous variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Attention	1																
2.	Recognition	.20**	1															
3.	Recall	.33**	.12	1														
4.	Elaboration	.19*	0	.32**	1													
5.	Fun	.35**	.03	-.06	.09	1												
6.	Immersion	.31**	.12	.06	.06	.51**	1											
7.	Control	.19**	.10	0	.04	.46**	.29**	1										
8.	Time Transformation	.24**	.06	-.06	-.03	.55**	.38**	.32**	1									
9.	Time on Website	.34**	.26**	.46**	.09	-.06	.12	-.07	.12	1								
10.	Total actions	-.02	.06	-.10	-.13	.18	-.02	.29	.11	-.09	1							
11.	Website Attitude	.19*	.13	-.07	.05	.43**	.30**	.45**	.40**	0	.17*	1						
12.	Website Behavioral intention	.28**	.06	-.08	.02	.73**	.49**	.51**	.44**	-.05	.18*	.60**	1					
13.	Product Attitude	.18**	.07	0	-.13	.47**	.26**	.28**	.29**	-.03	.10	.31**	.44**	1				
14.	Purchase likelihood	.19**	-.01	-.06	-.04	.40**	.12	.15*	.20**	-.06	.14	.28**	.37**	.56**	1			
15.	Price	.06	-.06	-.10	-.10	.04	-.03	-.04	.02	-.08	-.07	-.11	-.05	-.21**	-.02	1		
16.	Hedonic orientation	.11	.02	.04	.13	.22**	.05	.07	.23**	.4	.09	.21**	.26**	.13	.24**	-.05	1	
17.	Utilitarian orientation	.05	.01	-.05	.13	.11	.16*	0	.03	-.04	-.01	.13	.12	.09	.03	-.08	.32**	1

Note: *$p<.05$, **$p<.01$.

Chapter 5

Discussion

This study examined the individual and interaction effects of interactivity and arousal on consumers' cognitive information processing, attitude, and behavior in online shopping experience. It adopted a functional view (Sundar, 2007; Sundar et al., 2003; Sundar et al., 2010) to operationalize interactivity in terms of modalities available on e-commerce website.

Findings from the study advance the existing literature on website interactivity by making the following contributions. First, it sheds light on the big debate about the consequence of interactivity — do interactive interface tools actually enhance processing of media content or diminish it? It extends our understanding of interactivity effects by exploring the mechanism by which interactivity affects information processing. Unlike previous studies (Sicilia et al., 2005; Sundar et al., 2003; Sundar et al, 2010) which manipulated interactivity at the website level, the current study operationalized interactivity in the form of specific tools on the website. As a result, the interactivity features varied only the ways in which consumers accessed the visual presentation of product, but not other parts of the website. By adopting such an operationalization, the study was able to provide insights into not only how interactivity changes the allocation of cognitive resources for specific media content that is presented interactively, but also how this may impact user attention to--and processing of--surrounding content that is non-interactive.

Information Processing Effects

Data analyses revealed that higher interactivity enhanced recognition memory of those aspects of the product that are presented interactively, but diminishes recognition memory for other, non-interactive content on the site. These findings suggest that although high interactivity may expand individuals' cognitive capacity to process the information with interactive features, it may, at the same time, deprive individuals of cognitive resources needed for processing information that is unaccompanied by interactive features. This is particularly true when two sets of information are placed on the same webpage. This explanation was corroborated by data relating to total time spent on the website, time spent on the interactive part, and time spent on the non-interactive part of the site. In general, individuals spent significantly less time on the website when interactivity was high. This is mainly because individuals in high-interactivity condition spent significantly less time on the non-interactive part of the website compared to participants in the low- and medium-interactivity conditions. However, compared to medium-interactivity condition, individuals in the high-interactivity condition spent a lot more time on the interactive part. By integrating this evidence, we may infer that by attracting attention to themselves, interactivity features were responsible for depleting cognitive resources that would have otherwise been available for non-interactive content. In general, individuals pay more attention to interactive content on a website while ignoring non-interactive content.

Both cue-summation theory (Severin, 1968) and limited capacity theory (Lang, 200) predict that higher interactivity would lead to greater attention and higher recognition memory. In other words, the patterns of interactivity's effect on attention and recognition should be consistent with each other. However, the current study failed to find this consistency. While high-interactivity condition led to the highest recognition memory for product information with interactive feature, it did not lead to the highest attention. Instead, medium-interactivity condition led to most attention. One of the potential reasons to explain the above-mentioned inconsistency lies in the self-reported nature of the attention measure. Since the study did not break down attention into attention to product information with interactive features versus attention to the product information without interactive features, it is difficult to tell which type of information that participants had in mind while answering the questionnaire. Furthermore, participants might interpret the phrase "product information" in the measures of attention differently. They might consider "product information" as either text information without interactive features, or visual information with interactive features, or both. Discussion with study participants during debriefing confirmed this speculation.

Regardless of the result of attention, the pattern of interactivity's effect on recall of visual information associated with the interactive feature was consistent with that of recognition memory for the same information. Higher interactivity led to both more recall and recognition of information associated with interactive features. This result generally supported the cue-summation theory (Severin, 1968), in that the increased number of modalities improved overall cognitive information processing. It also undermined the limited capacity theory (Lang, 2000) which predicts that more interactive features will lead to too much orienting response and thus improve recognition while inhibiting recall.

While the general pattern of interactivity's effect was the same for both recall and recognition of information with interactive features, it was divergent for non-interactive information. Low interactivity led to most recognition of non-interactive information, followed by medium and high interactivity; whereas medium interactivity led to most recall of non-interactive information, followed by low and high interactivity. In other words, modality-interactivity affects recognition and recall of interactively presented website content about equally, but varies in its effects on recall and recognition of other, non-interactive content present on the same website. As mentioned before, the consistent effects of modality-interactivity on recognition and recall of interactively presented content confirmed the hypothesis of cue-summation theory. However, the inconsistent effects on recognition and recall of non-interactive content might indicate that individuals in low-interactivity condition had more cognitive resources (which were not deprived by the interactive features) available to process the content and therefore paid more attention to the textual content. However, in doing so, if they allocated too much cognitive resources to encode the content, they might not have enough resources to store the content and subsequently had worse recall memory. On the other hand, medium interactivity might broaden their perceptual bandwidth through the initial interaction with the click-to-change image feature, but then leave them with more available cognitive resources than what is demanded by the interactive tools in that condition. These additional resources were probably allocated toward storage. Therefore whatever they read would be better stored in their mind, thus signaling an optimal level of interactivity for the processing of both interactive and non-interactive content on a given interface.

The other important independent variable involved in this study is physiological arousal stimulated by music with varied tempos. By incorporating this variable, this study extends arousal effects in offline shopping experience (Dubé, Chebat, & Morin, 1995;

Milliman, 1982; Yalch & Spangenberg, 2000) to the online domain. Therefore, in consideration of the changes in consumers' attention and memory due to features of the online medium, we should not forget the role of arousal. The consistent negative main effects of arousal on total recognition and recall memories, as well as recall and recognition memory of non-interactive content cannot be completely explained by either the excitation transfer theory (Zillmann, 1983) or the optimal level theories (Kahneman, 1973). The control condition without music always led to the best outcomes for memory, followed by low- and high-arousal condition. This suggests a distraction effect of arousal stimulated by music. High arousal might have interrupted the encoding of non-interactively presented content and therefore hindered memory. Similarly negative main effect of arousal was also found for total thoughts in cognitive elaboration, which further confirmed that high arousal by itself, might cause some distraction effect on information processing, rather than serving as an energizer to broaden the cognitive capacity. It is worth noting that no significant difference was found between low- and high-arousal conditions on recall for non-interactive content. But control condition did significantly differ from the other two conditions. These findings suggested a potential music effect. In other words, simply adding music itself would make a difference on recall for non-interactive content regardless of the tempo of the music. On recognition for non-interactive content, a similar music effect was found. In addition, the difference between low-arousal and high-arousal conditions also indicated an arousal effect elicited by varied levels of tempo. Therefore the music effect combined with the arousal effect would together offer better explanation for the significant differences across three arousal conditions.

The above-mentioned implications for the individual effect of interactivity and arousal on information processing should be read in light of the interaction effect of the two. The significant interaction between interactivity and arousal on recognition memory of non-interactively presented content revealed that high interactivity led to the worst recognition of this content when arousal was high. This can be interpreted as a cognitive resource deprivation effect of arousal. It is helpful to examine this finding together with the findings of the non-effect of arousal on recognition for the interactively presented content. When interactivity is high, the majority of cognitive resources is allocated to the interactively presented content, leaving a limited amount of resources to process other non-interactive content. Adding highly arousing music appears to exacerbate the resource-limitation problem and lead to even worse recognition memory for non-interactive content. However, the moderating role of arousal is only limited to the non-interactive content that competes with the interactive content for attention. In other words, arousal does not narrow the processing capacity for interactive content, but does further hinder processing of non-interactive content.

With regard to cognitive elaboration, the role of arousal on the effect of interactivity would be better explained by comparing thoughts of issues revealed on the site and thoughts about issues beyond the site. High interactivity and high arousal together enhanced the number of thoughts for issues revealed on the site, but inhibited the number of thoughts for issues beyond the site. At the same time, high interactivity with low arousal generated only moderate number of thoughts about issues revealed on the website, but significantly enhanced the number of thoughts beyond the site. It seemed that high interactivity served as the engine to expand elaboration in general, whereas arousal functions as the knob to adjust the balance of cognitive resources allocation between elaboration related to issues revealed on the site and elaboration about issues beyond the site. A similar moderating role of arousal was also found for thoughts about product issues revealed on the site and beyond the site. Therefore, while modality-interactivity expands the perceptual bandwidth for thoughts in general, arousal serves to focus those thoughts toward information presented on the site. Kahneman (1973) suggests that different levels of arousal may either enhance or inhibit an individual's information processing capacity. The current findings showed that the effect of modality interactivity on information processing under conditions of low arousal was very different from that of high arousal without any interactivity for elaboration on the interactive content. We may conclude that interactivity operates differently from arousal. High interactivity with high arousal led to more elaboration than either high interactivity with low arousal or without music, or low interactivity with high arousal. This additive effect indicates that arousal functions as an engine to magnify the effect of modality interactivity on cognitive processing.

User Engagement Effects

Another contribution of this study is that it treats engagement as a multifaceted concept that involves not only the psychological aspect of engagement, such as self-reported absorption, but also the behavioral aspect of it, including both interaction time and number of actions. By doing this, the study is able to provide insights into the influence of interactivity and arousal on specific aspects of engagement. In fact, interactivity and arousal did differ in their influence on different aspects of engagement. Interactivity by itself positively influenced the fun and control aspects of absorption, as well as number of actions and time of interaction. The influence of arousal on the immersion and time transformation aspects of absorption was dependent upon the effect of interactivity. For the immersion aspect of absorption, when arousal was high, the influence of interactivity followed the curvilinear relationship described earlier (i.e., the inverted V pattern, whereby medium-interactivity condition led to highest immersion). However, when arousal was low, the pattern was the exact opposite. Both high and low interactivity conditions led to more engagement than medium interactivity condition. These findings indicated that high arousal might suppress the effect of high interactivity while boosting the effect of medium interactivity. Low arousal boosted the effect of low and high interactivity on immersion, but the object of this immersion was likely to be different across these two conditions. In high-interactivity condition, individuals were probably more immersed in the visual part of the interface, where the interactivity feature was placed, while in low-interactivity condition, they were more absorbed in the textual information. An examination of the video files generated by screen capture software confirmed this speculation. The reason why medium interactivity led to less immersion when arousal was low can probably be explained by the expectation-matching effect. Let us assume that low arousal would motivate individuals to explore more on the website by not causing any interruption or distraction in general. In low-interactivity condition, this would lead to greater immersion in textual content; while in high-interactivity condition, this would lead to active engagement of the interactive features. However, in medium-interactivity condition, the manipulation probably promised more than it delivered. Interactive features, such as the click-to-change picture function, may have attracted users away from the text and raised their expectation of interactive level of the site, but when they further explored the visual aspects of the website, they probably failed to find sufficient depth of layers to keep them engaged with the website content. Therefore, the actual experience with the website failed to match their initial expectation of the site, leading to reduced motivation to further explore the site.

It is worth noting that in post-hoc tests of the effect of interactivity on some of the engagement outcomes, such as the fun and the control aspects of absorption, low- and medium-interactivity conditions did not significantly differ from each other, whereas high condition led to significantly higher engagement than the other two. These findings suggest that a moderate level of interactivity shown on the website might not be enough to effectively change consumers' engagement with website content. The same pattern was also shown for the effect of interactivity on product attitude, purchase intention, and actual purchase behavior. These variables would become more positive only when the level of interactivity is substantially increased. This finding seems inconsistent with the widely found curvilinear relationship (the inverted V pattern) between levels of interactivity and various outcome variables in previous studies (Sundar et al., 2003; Bucy, 2004), in which medium level of interactivity led to the best outcomes. Compared to these studies, the threshold of interactivity's effect seems rather high in the current study. One potential reason might be the way in which interactivity is operationalized. In the previous studies, interactivity was operationalized at the "website" level. However, in the current study, it was operationlized by way of individual tools employed by the website for specific content. Once an individual's perceptual bandwidth is broadened by some modality-interactivity tools, it appears that substantial depth of interactive exchange is needed to keep the enhanced cognitive system occupied. Otherwise, the individual is likely to feel either bored or de-motivated to further explore the website, once he/she finishes the initial interaction with modality features.

It is interesting that study participants rated the price for the camera as more expensive when they were in medium-interactivity condition. One potential explanation for this result again lies in the expectation-matching effect of medium level of interactivity. Individuals might get immersed in website content in low and high conditions through either being engaged in text part of product description or the interactive functions of the visual image respectively. In both these instances, they would then pay less attention to the price information listed on the right side of the page. When their perceptual bandwidth has been enhanced by some modality features, as happened under medium level of interactivity, they would expect to encounter more sensory stimuli to fully engage their enhanced cognitive capacity. Contrary to their expectation, they probably failed to find any more interactivity features on the site. This might have led to the comparatively lower engagement in the website content found in this condition, thus predisposing users to look for other things that would help them to make a quick judgment about product, such as price. So, the medium-interactivity condition focused user attention on price information because it did not engage them in either the interactive features or the content. Therefore, they were probably more sensitive about the price. Since the camera shown on the website was not the most recent model and looked somewhat bulky with the price of an above-average model, participants in the medium interactivity condition found it more expensive than their counterparts in low- and high-interactivity conditions (who did not pay as much attention to the price factor).

Attitudinal Effects

The mediation tests indicated that product purchase intention was both directly influenced by interactivity and via the fun aspect of absorption or control aspect of absorption and product attitude. This provides a logical account of interactivity effects on purchase intention. Higher interactivity calls for more engagement via fun and control. More feelings of fun and control lead to more positive attitudes toward the product and subsequently higher purchase likelihood. The path from experiencing the feeling of fun and control to attitude change might be explained by affect-as-information theory (Schwarz & Clore, 1983), such that perception of good feelings would affect their processing of the product information. In this case, the good feelings generated by being engaged in website tools and/or content might have subsequently affected attitudes toward the product. The path from attitudes to behavioral intention can be explained by traditional theoretical formulations such as Ajzen's (1991) theory of planned behavior, which predicts that positive evaluation and affirmation of positive outcomes from behaviors would result in greater intention to actually perform the action (behavior).

Of greater interest to this investigation is the finding that product purchase likelihood is also influenced by interactivity through website attitude and product attitude. This suggests that part of the favorable attitudes towards website is transferred to attitudes toward product, which in turn influence purchase intention. These mediation effects are consistent with both the interactivity effects model (Sundar, 2007) and the MAIN model (Sundar, 2008). As predicted by the interactivity effects model, the increased level of modality-interactivity serves to expand the user's perceptual bandwidth and enable a richer sensory experience of the interactive feature, leading to greater engagement with the underlying website content. Given persuasive content (such as the e-commerce marketing material used in this experiment), highly engaged users would develop favorable attitudes toward the site, subsequently leading to favorable attitudes and behavioral intention toward the product featured in the site. These outcomes are likely even without interactivity causing engagement, according to MAIN Model, which predicts that the mere presence of various interface tools could trigger cognitive heuristics about the role or value of the underlying content delivered by these tools. For example, based on the novelty heuristic (Sundar, 2008), the 360-degree viewing tool would be considered as innovative and therefore lead to better evaluations. At the same time, the mousing-over to zoom feature might trigger the being-there heuristic (Sundar, 2008), which makes individuals feel like they are physically present in a brick-and-mortar store playing with the camera to fully examine its appearance and functions. This would serve to enhance their perceived credibility of the camera and its features.

Hedonic and utilitarian shopping orientations do moderate the effects of interactivity and arousal on a variety of outcome variables, even though we did not find a significant connection between them and the information-processing variables related to attention, recognition, and recall memory. That said, their influences follow different patterns. In essence, utilitarian shopping orientation only affects outcome variables relevant to website, such as website-related thoughts of issues revealed on the site and issues beyond those disclosed on the site. Hedonic shopping orientation has a wider influence over both product and website-related variables, including almost all elaboration thoughts, control aspect of absorption, interaction time ratio of interactivity by site, and actual purchase behavior. The interaction between interactivity and hedonic shopping orientation indicates that the combination of higher hedonic orientation with higher interactivity would lead to greater engagement as well as actual purchase behavior.

However, the pattern for the interaction effect of utilitarian shopping orientation and independent variable(s) is more complex. In medium-interactivity without music condition, individuals with higher utilitarian shopping orientation would generate more favorable attitudes toward website. This might be explained by the earlier conclusion that medium-interactivity may open up the bandwidth but not fulfill the enhanced cognitive appetite, thus forcing individuals' attention towards price information. Utilitarian shoppers would care more about the factual information about the product, such as price. They are likely to appreciate learning about price information and generate better attitudes toward website. However, when the interactivity increases to a high level combined with some level of arousal (either low or high), increased utilitarian shopping orientation would lead to more favorable attitudes toward website. But if there is no music, increased utilitarian shopping orientation would lead to less favorable attitudes toward website.

Practical Implications

To e-tailers and website designers, the findings of the current study imply that they need to be very careful about where to employ interactivity features on the website: to incorporate interactivity at the website level or to embed interactive tools in specific parts of the website content. The part of website content with interactivity features might attract too much attention and consume cognitive resources that were originally available for other non-interactive content. Consumers might even totally ignore the other content on the website. However, this might also serve as a good strategy for e-tailers who would like to divert consumers' attention to specific parts of the website in order to achieve better promotional outcomes. In addition, e-tailers and website designers have to be careful about the number of interactivity tools that they deploy on a website. They will need to carefully match the potential expectation caused by consumers' contact with the initial set of interactivity features and offer sufficient depth of additional interactive activities in order to satisfy consumers' expanded perceptual bandwidth and keep their cognitive system occupied. Otherwise, the unmatched expectation may lead to lesser engagement with the site content and greater price sensitivity, potentially leading to negative outcomes.

As for whether incorporating atmospheric cues (such as music) to e-commerce websites, e-tailers and website managers would have to first decide what kind of outcome they would like to achieve: to generate more favorable attitudes toward website or to create more favorable attitudes toward product? If the only purpose is to increase purchase likelihood or product sales, embedding music on the site would not make a difference. If the aim is to increase favorable attitudes toward the site in general, music with slow tempo would be the best choice. E-tailers and managers would also have to strike a balance between encouraging more elaboration of website content and generating more engagement with website content while employing interactivity tools and embedding music. They would not be able to achieve both at the same time, since although high interactivity with high arousal would make consumers elaborate more of the website content, it might also inhibit consumers' immersion with website content. Even though low interactivity with high arousal would make consumers become more immersed with website content, they would elaborate less on the content. High interactivity with low arousal may lead to more immersion, but also to least elaboration. It seems that medium interactivity without music might lead to relatively high elaboration and a moderately high immersion. However, the main effects of interactivity and arousal would remind us that medium interactivity itself might lead to the less favorable attitudes toward product and website than high interactivity, whereas having no music might also lead to less favorable attitudes toward website. Therefore, the deployment of interactivity and arousal-inducing tools on a website is a complex decision and depends on the design goals and intended user outcomes.

Limitations

The study is not without its limitations. The current attention measures did not distinguish between attention toward interactive content and attention toward non-interactive content. Failure to distinguish them made it harder for researchers to tell where the participants had directed their attention--the interactive part or the non-interactive part or both. Future studies that adopt similar manipulation of interactivity might want to distinguish between questions addressing attention toward interactive content and those measuring attention toward non-interactive content. The measurement reliabilities for hedonic and utilitarian shopping orientation are not very high in this study. Future studies will need to find more reliable measures for them.

The manipulation check for arousal indicates that there is no significant difference between music with low tempo (low arousal) and control condition, even though the study does find significant difference between the two conditions on some outcome variables, such as website attitude. The current pretest can only assure that high and low arousal conditions are significantly different from each other, but cannot provide any psychological support for the difference between low-arousal and control conditions. If a future study wants to completely differentiate between low arousal and control, a pretest with all three arousal conditions should be conducted to address this problem.

Conclusion

In summary, this study provides insights into how interactivity and arousal affect individuals' online shopping experience from cognitive, attitudinal, and behavioral perspectives. The major contributions of the study can be summarized as follows. First, it finds that modality-interactivity may affect an individual's allocation of cognitive resources for interactive content versus non-interactive content on the same webpage. Although high modality-interactivity may expand individuals' cognitive capacity to process the interactive content, it may, at the same time, deplete cognitive resources needed for processing non-interactive content presented on the same page. It also supports the prediction derived from cue-summation theory that higher modality-interactivity would improve both recognition and recall memories.

By including arousal as another independent variable, the study discovered that high arousal by itself is not able to serve as an energizer to broaden cognitive capacity. In fact, it may have a distracting effect on information processing. However, the bigger contribution of this study lies in the discovery of the moderating role of arousal on the effect of interactivity. While high modality-interactivity expands the perceptual bandwidth in general, arousal controls the allocation of resources to interactive and non-interactive content. For interactive content, there is an additive effect of interactivity and arousal. High arousal further expands the processing capacity broadened by high interactivity for information encoding and elaboration. In contrast, for non-interactive content, high arousal exacerbates the cognitive-resource deprivation effect of high interactivity.

Another contribution of this study lies in the discovery of the effects of interactivity and arousal on different aspects of engagement. Interactivity by itself can positively affect fun and control aspects of absorption. However, arousal moderates the effect of interactivity on immersion and time transformation, such that high arousal might suppress the effect of high interactivity while boosting the effect of medium interactivity, whereas low arousal boosts the effect of low and high interactivity, while undermining the effect of medium interactivity. This inverted-V pattern can be explained partly by the differential engagement of different parts of website content based on interactivity conditions (focus on interactive content under conditions of high interactivity and on non-interactive content under low interactivity) and the mismatch between expectations triggered by the promise of interactivity and the actual interactivity offered by the website with medium-interactivity tools.

Mechanisms identified by multiple-step mediation analyses, suggesting that product purchase likelihood is influenced by interactivity through engagement and website attitudes, coupled with the strong impact of the interactivity manipulation on perceptual bandwidth, lend support to the main propositions relating to modality-interactivity in the interactivity effects model proposed by Sundar (2007). The importance of the fun element of engagement in predicting outcomes is consistent with affect-as-information theory (Schwarz & Clore, 1983) while the connections between attitudes and behaviors can be explained by any number of established theories of human psychology, such as the theory of planned behavior (Ajzen, 1991). In general, it appears that interactivity is seen both as a tool for user engagement as well as a cue on the interface that triggers positive evaluations by its sheer presence. The latter has theoretical implications for formulations such as the MAIN model (Sundar, 2008) and obvious practical implications for e-marketers.

The study also found that individual differences pertaining to hedonic and utilitarian shopping orientations influenced the effects of interactivity and arousal on a variety of outcome variables, especially those pertaining to attitudes and behaviors. However, their influences follow different patterns. In general, hedonic orientation has a wider influence over both product and website-related variables, whereas utilitarian orientation is limited to website-related outcomes, including price concerns. Therefore, as we go forward, it is important not only to consider technological aspects of new media interfaces but also the psychological states that they induce and the differential impact they may have for users with different backgrounds and motivations. By definition, interactivity as a feature of the medium is not invariant. Different individuals use it in different ways. Same individuals may use it in different ways, depending on their arousal levels and other psychological states. Therefore, interactivity holds different meanings for different individuals under different conditions. This dissertation is a step toward specifying some of those conditions in an e-commerce context. Future research with interactivity in a variety of other domains and moderators will serve to enhance our theoretical understanding of this concept.

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APPENDIX

A complete list of recognition memory questions

1) Among the following cameras, which was the one featured on the site that you just browsed? [Visual recognition item]

A.

B

C

D

2) Thinking back of the camera you browsed, which of the following buttons is on the right side of the “DISP” button? [Visual recognition item]

A

B

C

3) In what other alternative colors is this product available? [Visual recognition item]
A. Blue, green, grey, pink
B. Blue, purple, grey, orange
C. Maroon, green, pink, blue
D. Green, silver, grey, pink

4) The A/V output socket is _____ of the camera. [Visual recognition item]
A. On top
B. On the bottom
C. In the front
D. On the side

5) Please arrange the power button, the function button, and the zoom-in/out button as they are featured on the camera that you saw on the website. [Visual recognition item]
A. Function wheel, power button, zoom-in/out wheel
B. Power button, zoom-in/out wheel, function wheel
C. Power button, function wheel, zoom-in/out wheel
D. Zoom-in/out wheel, power button, function wheel

6) What is the maximum optical zoom for the camera that you saw on the website? [Visual recognition item]
A. 3X
B. 4X
C. 5X
D. 6X

7) What is the range for the optical lens of the camera that you saw on the website? [Visual recognition item]
A. 5.2-24.8mm
B. 5.2-32mm
C. 6.2-24.8mm
D. 6.2-32mm

8) What is the range for the lens aperture of the camera that you saw on the website? [Visual recognition item]
A. f/2.7-5.6
B. f/2.7-7.8
C. f/2.4-5.6
D. f/2.4-7.8

9) What is the price of the camera that you saw on the website? [Textual recognition item]
A. $179.99
B. $159.99
C. $129.99
D. $109.99

10) The camera has which of the following image stabilization technology? [Textual recognition item]
A. Digital image stabilization
B. Optical image stabilization
C. Zoom-in/-out stabilization
D. Image Detection stabilization

11) The point-and-shoot camera uses which type of battery? [Textual recognition item]
A. Lithium-ion battery
B. AA battery

C. Nickel-metal battery
D. Oxyride battery

12) What is the size of LCD screen of the point-and-shoot camera? [Textual recognition item]
A. 1.8”
B. 2.2”
C. 2.5”
D. 3.3”

13) What is the weight of the camera? [Textual recognition item]
A. 9.47 Oz
B. 7.47 Oz
C. 5.47 Oz
D. 3.47 Oz

14) Which of the following item is included in the camera product box? [Textual recognition item]
A. A SD memory card
B. A camera case
C. An extra lens
D. A UV filter

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