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Touch in Computer-Mediated Environments: An Analysis of Online Shoppers’ Touch-Interface User Experiences

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Touch in Computer-Mediated Environments:
An Analysis of Online Shoppers’ Touch-Interface User Experiences

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor of Philosophy

in

Management

by

Sorim Chung

March 2016

Dissertation Committee:

Dr. Thomas Kramer, Co-Chairperson
Dr. Elaine Wong, Co-Chairperson
Dr. Amnon Rapoport
Dr. Thomas Sy
The Dissertation of Sorim Chung is approved:

__________________________________________

__________________________________________

Co-Chairperson

__________________________________________

Co-Chairperson
Acknowledgements

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To my husband Jean-Suk and my parents for all their support.

Dedicated to the memory of my grandfather, who taught me the joy of research.
ABSTRACT OF THE DISSERTATION

Touch in Computer-Mediated Environments:
An Analysis of Online Shoppers’ Touch-Interface User Experiences

by

Sorim Chung

Doctor of Philosophy, Graduate Program in Management
University of California, Riverside, March 2016
Dr. Thomas Kramer, Co-Chairperson
Dr. Elaine Wong, Co-Chairperson

Over the past few years, one of the most fundamental changes in current computer-mediated environments has been input devices, moving from mouse devices to touch interfaces. However, most studies of online retailing have not considered device environments as retail cues that could influence users’ shopping behavior. In this research, I examine the underlying mechanisms between input device environments and shoppers’ decision-making processes. In particular, I investigate the impact of input devices on online shoppers’ product-information recall, purchase intentions, engagement, product choices, and immediate purchase decisions.

In Essay 1, I propose that touch interfaces result in lower product-information recall than mouse devices because operating a touch interface is more cognitively challenging. As touch interfaces tend to increase user engagement in computer-mediated environments, I predict a positive impact of touch interfaces on purchase intentions. In both cases, I propose shoppers’ involvement as a moderator and shoppers’ engagement as a mediator.
In Essay 2, I predict that the use of touch interfaces in online shopping may resemble the outcomes of affect-driven information processing. Based on the affective-cognitive theories, I propose that cognitive challenges and casual user-experiences of touch interfaces lead shoppers to choose hedonic products and make more immediate purchase decisions than mouse users.

The results of Essay 1 experiments indicated that shoppers who used a touch interface to browse products demonstrated significantly higher engagement in the low-involvement conditions and lower brand-name recall in the high-involvement conditions than shoppers using a mouse did. When highly engaged, touch-interface users displayed stronger purchase intentions toward the products than did mouse users. In Essay 2, touch-interface users were more likely to choose a hedonic product than mouse users, and touch-interface users were less likely to defer their purchase decisions than were mouse users. Overall, this research introduces device environments as new online retail cues that affect online shoppers’ purchase decision-making processes and provides strong evidence that using a touch interface has a significant impact on the shoppers’ engagement, memory, purchase intentions, and product choice.
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Chapter 1.

Introduction
Diversification of Computer Device Types

Online shopping is one of the most popular methods of product consumption. Global e-commerce sales have grown rapidly every year and are expected to grow another 18.6% in 2016 (eMarketer, 2015). With the growth of the market, online shoppers’ device environments have changed rapidly over the past few years, including increased options for computer device types, such as tablet PCs and smartphones. This increase in options means that shoppers’ device environments vary more than before when devices were mostly either desktop or laptop computers. During the 2015 holiday season in November and December, more than half of the e-commerce traffic came from mobile devices such as smartphones (40.46%) and tablet PCs (11.87%) while the rest of the traffic was from desktop computers (47.47%; IBM Commerce, 2016). Screen sizes and operating systems (e.g., Windows, Mac OS) have also become more diversified with the emergence of mobile devices. Among the new devices, one of the more dramatic changes in online shoppers’ user experiences has been in the input device, with the common input method shifting from mouse devices to touch interfaces.

Touch screens were available in various devices — such as information kiosks, ATMs, and computers — long before smartphones or tablet PCs became popular. From the 1960s to the 1990s, touch-screen technology evolved from the very primitive capacitive screen, which was used in radar screens, to resistive touch screens, which were often found in ATMs and checkout devices (“The evolution of touchscreen technology,” n.d.). Touch screens did not become popular until the launch of the iPhone and iPad, which use inexpensive, yet accurate, multi-touch screens that revolutionize how we use
computers and access the Internet. These new Apple devices came to the market when people started relying more on the Internet to manage their daily activities, moving beyond simply creating documents for work, to browsing product information and even purchasing houses. As a result, they needed simpler and more casual computing that did not always require the full functions or all the traditional external input devices (e.g., keyboards, mouse devices). Apple’s launch of the iPhone and iPad fulfilled such needs for casual computing, and the company became a powerful contributor in making it possible to have an easier computing experience.

As of 2014, about 87% of U.S. consumers used touch-screen devices, such as smartphones or tablets, for online shopping (Nielsen, 2014). The use of touch-screen devices is not limited to smartphones and tablet PCs. In 2016, in addition to thirteen other products, including digital cameras, navigation devices, and games, an estimated 78 million touch-screen-equipped laptops will ship, an increase from 4.6 million units in 2012 (Redux, 2015).

Touch-screen devices have made online shopping simpler and more accessible that users can now shop online almost anywhere. These devices have caused such a dramatic transformation in our current computer usage that it is extremely important for marketing researchers and practitioners to understand the impacts of device environments on online user experiences in general, and more specifically in the marketing context.

**Touch in Sensory Marketing**

In order to investigate the nature of touch interfaces in comparison to traditional non-touch devices, it is necessary to understand the key sensory cue of touch interfaces,
namely touch. In the sensory marketing literature, touch has been one of the important sensory cues that affect consumer behavior. Krishna (2010) and Peck and Childers (2008) have addressed the importance of studying sensory cues for marketers and researchers. Many marketing activities utilize consumers' senses in ways that affect their behaviors, and understanding how sensation and perception apply to consumer behavior has become very important in the field of sensory marketing (Krishna, 2012). Amongst the sensory cues - touch, scent, taste, vision, and sound - touch has been one of the most popular sensory cues that researchers have examined to understand its role in consumer behavior.

According to previous research, shoppers tend to develop a personal preference for retailers that allow them to touch products with mostly material properties (e.g., clothing or carpeting; McCabe & Nowlis, 2003). Allowing customers to touch products also leads to increased affective response and persuasion (Peck & Wiggins, 2006) and increased impulse-purchasing behavior (Peck & Childers, 2006). Without touch, shoppers are likely to develop negative evaluations of products (Peck, 1999; Peck & Childers, 2003).

Peck (2010) states that touch is classified into four types: 1) touch to purchase, 2) touch to obtain non-haptic product information, 3) touch to obtain haptic product information and 4) hedonic touch. The first three types refer to “instrumental touch” (p.20), which is an exploratory procedure with a clear goal. The first type, touch to purchase, is the simplest one because it refers to simply touching a product with the intention to buy it, but without a need for additional information (e.g., placing a product in the cart). The second type is touching a product in order to obtain specific non-tactile information from visual, olfactory, auditory or gustatory input. The third type of touch involves evaluating
tactile properties or material properties including texture, hardness, weight or temperature of a product. The last type of touch, hedonic touch has no apparent goal. Instead, hedonic touch is touch behavior that involves habitual or automatic responses during the shopping experience. There are shoppers who touch products as part of their shopping habits, whether for general exploration of sensory experience or just for fun, without any pre-determined purpose (Peck, 2010).

Even in non-touch media, such as computer-mediated environments, people do experience touch. They tap on a touch screen to navigate a website, touch keypads to type, and hold a mouse or a joystick to perform various tasks. In particular, operating touch screen devices involves much more tactile interaction than operating other types of devices. However, the purpose of these touch interactions is not to evaluate tactile properties of objects displayed on a screen but rather to navigate interactive content. Nevertheless, because consumers these days experience products in online retail channels as often as in offline retail stores, it is important to understand how this new type of touch-sensory experience influences consumer behavior.

**Retail Environmental Cues: Offline vs. Online**

Despite the importance of touch in computer-mediated environments, very little research has investigated device-driven touch experiences. Most previous studies of online retailing have limited their focus to cues from web environments, such as types of product information, interactivity (e.g., Eroglu, Machleit, & Davis, 2001; Kim, Fiore, & Lee, 2007; Xu & Sundar, 2012), and quality of promotional information (e.g., Kim, Kim, & Park, 2010). Some studies have examined other online retail cues, such as scent (e.g.,
Bone & Ellen, 1999), color, and music (e.g., Parsons & Conroy, 2006). On the other hand, research on offline retail experiences has examined a much wider range of environmental factors that influence consumer behavior. For example, research has found that in offline stores, having matching scents, visual displays, or background music is likely to enhance positive shopping experiences (e.g., Bone & Ellen, 1999; Demoulin, 2011; Mattila & Wirtz, 2001; Michon, Chebat, & Turley, 2005; Soars, 2009). Multiple store characteristics including the quality of customer service, store location, and store atmosphere are also offline retail cues that affect shoppers’ in-store emotional experience, store evaluations (Donovan & Rossiter, 1982; Donovan, Rossiter, Marcoolyn, & Nesdale, 1994; Yoo, Park, & MacInnis, 1998), amount of time spent in the store, willingness to spend more money, willingness to visit again (Donovan & Rossiter, 1982; Donovan, Rossiter, Marcoolyn, & Nesdale, 1994), and shopper engagement (Swinyard, 1993). As offline retail literature has done, research on online retail environments should expand its scope wider beyond the cues in web environments and consider physical device types as potential retail cues.

**Research on Touch Screens**

Despite its importance, marketing research has not actively investigated touch in computer-mediated environments and still has little research on the role of device environments as part of retail sensory cues. However, a vast amount of research in human-computer interactions (HCI) has examined touch in computer-mediated environments, with the purpose of investigating the optimal designs for touch interfaces (e.g., Anthony, Kim, & Findlater, 2013; Jin, Plocher, & Kiff, 2007; Page, 2014; Perry &
Hourcade, 2008) and advanced touch-screen technologies such as 3D display (e.g., Bruder, Stenicke, & Sturzlinger, 2013), force touch (e.g., Roudaut et al., 2013), air touch (e.g., Han, Ahn, & Lee, 2015), and transparent touch (e.g., Jung et al., 2013). The education literature has also examined the various impacts of touch-screen devices on learning (Enriquez, 2010; Neumann, 2014). However, compared to HCI and education, research on marketing has done very little to understand the role that touch interfaces play in consumer behavior.

**Overview of This Dissertation Study**

The purpose of this dissertation is to fill the gaps in the literature by investigating the impact of computer input-device environments on online shopping experiences. I examine the impact of different input devices (i.e., touch interface vs. mouse) on online shoppers’ purchase-decision processes. Through several experiments, I measure the impact of the devices on information recall, purchase intentions, product choices, and likelihood of immediate purchase decisions.

Given multi-channel shopping trends involving both online and offline retail channels, shoppers’ cognitive ability to recall product information has become more critical because shoppers often review and compare products not only in stores but also on multiple websites even when they shop in stores. In addition to information recall, I measure purchase intentions and product choices as these are important indicators that marketers and retailers commonly use to predict the effectiveness of marketing activities. Determining whether different input devices lead to either higher or lower willingness to purchase products may provide important practical implications for understanding the
impact of device types on consumer behavior. For example, if one device significantly increases purchase intentions in particular situations, adjustments would be advisable and necessary, at least to web content. Likewise, knowing the product types shoppers tend to choose as a function of either touch interface or mouse device environments would also assist retailers project sales of such product categories.

In Chapters 2 and 3, I introduce my two studies, Essays 1 and 2. In these two studies, I found both positive and negative effects of touch interfaces on online shoppers’ decision-making processes. Device types influenced the cognitive performance of online shoppers, such that using a touch interface led to lower information recall than using a mouse when users were highly involved prior to shopping. However, using touch interfaces also positively impacted users’ decision-making processes. Specifically, when browsing products in low-involvement conditions, touch-interface users were more likely to be engaged with their shopping and showed higher purchase intentions, as opposed to mouse users. In making a final decision on product options, shoppers were more likely to choose a hedonic option when using a touch interface than when using a mouse. Touch-interface users were also more likely to make immediate purchase decisions than mouse users.

Future Implications

This research provides several contributions to the field of marketing. The present investigation is one of the first studies seeking to examine the impact of sensory cues driven by different computer device environments on consumer behavior. One of the most meaningful contributions is expanding the theoretical definition of online retail
environments in the retailing literature by adding computer device type as a retail cue. Device environments have become more diverse than ever; therefore, a re-establishment of the definition of online retail environments benefits both marketing researchers and practitioners by addressing the need to more deeply understand individual shoppers’ device environments. As device environments continue to advance, these findings provide a strong foundation for future investigation of touch-screen technologies and new device environments. More importantly, this research suggests the need for further exploration of additional sensory cues in online retail environments that the existing literature has not explored.
References


eMarketer (December 23, 2015), Retail sales worldwide will top $22 trillion this year. Retrieved from http://www.emarketer.com/Article/Retail-Sales-Worldwide-Will-Top-22-Trillion-This-Year/1011765


Chapter 2.

Essay 1: The Impact of Touch Interfaces on Online Shoppers’ Information Recall and Purchase Intentions
**Introduction**

The computer device types that consumers use for online shopping have diversified more than ever in the past few years. Despite the magnitude of this change, marketing research has not sufficiently investigated the role of device environments in the context of online retail experiences. As one of the first studies on the role of devices in online retailing, the present study investigates whether touch interfaces and mouse devices differentially influence online shoppers’ product-information recall and purchase intentions that are important indicators for determining the effectiveness of retail businesses.

**Literature Review**

**Touch in Online Environments**

In online environments, sensory experiences are limited to those touch sensations received from the computer’s input devices. For example, in order to operate a touch interface, users swipe, tap, drag, pinch in, and draw out the content displayed on the screen using their fingers. These gestures are called “interface touch” (Brasel & Gips, 2014). But, the tactile sensations felt from the screen surface are not relevant to what users see on the screen (e.g., seeing which links are clicked) because users feel the same screen surface regardless of which interface touch gesture they perform. On the other hand, when using a non-touch input device, such as a mouse, users navigate by clicking buttons on the mouse or by rolling the scroll wheel. Unlike touch interfaces, mouse users receive relevant tactile responses to their fingers. For example, when users click a
“purchase” button on a web page using a mouse, they feel the left button of the mouse click as they press down and visually see the purchase button become shadowed on the screen. Thus, mouse users’ touch tends to match the visual information they receive whereas touch-interface users are likely to experience inconsistency between visual and tactile cues. This mismatch between vision and touch is explained in more depth below.

**Vision and touch conflict.** Often used together, vision and touch are not completely independent of one another (Lederman & Abbott, 1981; Heller, 1982; Jones & O’Neil, 1985). A considerable amount of research in psychology and marketing has suggested that having bi-modal cues from both vision and touch improves tactile evaluations. This improvement occurs if the cues interdependently support each other, while using a single modality does not seem to make much difference (Heller, 1982; Jones & O’Neil, 1985). For instance, judgments of shape or surface texture tend to be more accurate when both tactile and visual information are present than when only tactile information is present (Heller, 1982; Manyam, 1986; Warren & Rossano, 1991).

However, such intermodality between vision and touch could be problematic if the modalities do not match (Warren & Rossano, 1991). According to the load theory, the capacity at which people can cognitively process irrelevant or unmatching cues depends on the availability of their working memory (e.g., Lavie, Hirst, De Fockert, & Viding, 2004). For example, if tactile cues are not relevant to the task, a task requiring high working memory tends to create greater interference (Dalton, Lavie, & Spence, 2009). The Stimulus-Organism-Response framework (Eroglu, Machleit, & Davis, 2001) also supports the importance of having relevant cues. Environmental or sensory cues with
high task-relevance are useful for achieving shopping goals, while cues with low task-relevance are not (Eroglu et al., 2001). Therefore, when tactile responses do not match visual responses, it is more difficult for people to evaluate tactile information than when vision and touch match.

According to the theories of intermodality and task-relevance, the sensory experience of a touch interface would be more likely to result in vision-touch conflict, whereas a mouse interface would be likely to lead to vision-touch intermodality. As briefly discussed above, the key tactile stimulus in a touch interface is the screen surface; this stimulus does not vary for different touch gestures (e.g., swiping, tapping). This indiscriminant tactile feedback cannot help users to differentiate the visual responses they see on a web page, such as menus clicked or images swiped. Tactile sensory cues are irrelevant; thus, touch-interface users have to rely on visual information to navigate content while at the same time ignoring these irrelevant tactile responses. This renders the user experience with touch more cognitively demanding.

**Body movements and touch.** Touch gestures such as swiping or tapping involve active bodily movements, and these gestures are also considered to be cues in computer-mediated environments. Body movements add even more conflict and distraction to the already discordant visual and tactile characteristic of touch-interface environments. People tend to respond more slowly to tactile stimuli if they are moving parts of their body (Chapman & Beauchamp, 2006; Jackson, Parkinson, Pears, & Nam, 2011) or if the tactile stimuli are moving (Evans & Craig, 1992). For example, when people move their hands and fingers, their sensory system suppresses tactile sensation (e.g., Williams,
Shensasa, & Chapman 1998; Chapman & Beauchamp, 2006; Cybulska-Klosowicz, Meftah, Raby, Lemieux, & Chapman, 2011; Juravle, Deubel, & Spence, 2011; Juravle, Deubel, Tan, & Spence, 2010; Voss, Ingram, Haggard, & Wolpert, 2006). Thus, it is expected that when people try to answer an incoming call or message on their mobile phone, their body’s sensitivity to other tactile stimuli decreases due to the hands and finger movements needed to operate the device or to send a message (Gallace & Spence, 2014). When people try to concentrate on visual inputs as they move objects, they are likely to perform more poorly in detecting spatial perception and geometric shapes than when they are not moving (Grande, 1990). In touch-interfaces, users move their hands more actively (e.g., swiping, tapping) to operate the device than when using a mouse, which may amplify the distractions caused by the vision-touch conflict.

Due to the vision-touch conflict and body movements, touch-interface environments are more likely to be distracting and cognitively demanding than mouse environments. Recent studies of visual interfaces support the theory that touch interfaces may increase cognitive load because the interface requires more effort to operate especially when it involves active movements, such as walking (Negulescu, Ruiz, Li, & Lank 2012) and cycling (De Waard, Lewis-Evans, Jelijs, Tucha, & Brookhuis, 2014). When people use a touch-screen smartphone while walking, their walking speed tends to be slower if they are moving objects displayed on a touch-screen than if they are tapping on these objects (Negulescu et al., 2012). When operating a touch-screen mobile phone while riding a bicycle, people are likely to detect fewer objects in the periphery and are more likely to remain in a central position in the cycle lane (i.e., keeping more distance
from the curb) if they are texting or playing a game compared to when using a conventional phone (De Waard et al., 2014).

To understand whether such an increase in cognitive load and a corresponding decrease in cognitive performance are similar in the context of online shopping, I examine the cognitive performance (product-information recall) of online shoppers who are using different devices. As the literature suggests that touch interfaces are more cognitively demanding to operate, I propose that touch-interface users (vs. mouse users) are more likely to result in lower information-recall:

**H1.** Online shoppers using a touch interface to browse products have less accurate product-information recall than those using a mouse device.

**Interface Touch and Engagement**

Despite the importance of touch in online environments, there is very little research investigating how touch interfaces influence consumers as compared to traditional input devices. Previous, albeit limited, marketing research has found that using a touch-screen is related to consumers’ perceived connections or engagement with the products. In definition, engagement is “a psychological state that occurs by virtue of interactive, concreative customer experiences with a focal agent/object (e.g., a brand) in focal service relationships” (Brodie, Hollebeek, Juric, & Ilic, 2011, p. 9). Engagement represents perceived connections or perceived attachment with the products or brands, as well as perceived focus with particular aspects of customer experiences. A recent study found that browsing on touch-based tablets results in higher reported product evaluations and an increased perception of psychological ownership of a product (Brasel & Gips,
Another study suggests a connection with self-identification that consumers who use touch-screen mobile devices are likely to create a more direct association with their extended selves (Hein, O’Donohoe, & Ryan, 2011).

No further published research has directly examined the role of computer devices in the context of online retail environments, but relevant findings exist in the research regarding human-computer interaction (HCI) and education. According to the literature in HCI and education, touch-interface users tend to be more engaged with various types of interactive content than are non touch-interface users. Using a touch interface results in increased engagement with games (Thompson, Nordin, & Cairns, 2012) and with learning (Enriquez, 2010). Touch interfaces also tend to improve students’ performance on literacy tasks (Neumann, 2014) and note taking ability (Enriquez, 2010). These findings suggest that touch-interface usage tends to result in higher user engagement, and I expect similar effects in online shopping:

**H2.** Online shoppers using touch interfaces to browse products display higher engagement than those using a mouse.

Engagement research indicates a direct effect of engagement on purchase intentions. Engagement is a primary driver of sales growth (Neff, 2007) and enhances profitability (Voyles, 2007). Perceived engagement or perceived association with any part of the shopping experience may mediate the impact of touch interfaces on shoppers’ purchase intentions. A recent study found that online shoppers using a touch interface to review products are likely to display increased perceived ownership of the products, which results in a higher endowment and willingness to accept (WTA) the chosen
products (Brasel & Gips, 2014). As engagement leads to increased sales and higher purchase intentions, I propose that engagement has an indirect effect on the impact of touch interfaces on purchase intentions. Specifically, I hypothesize that engagement mediates the effect between touch interfaces and purchase intentions:

**H3.** Online shoppers using a touch interface to browse products have higher purchase intentions towards the chosen products than when using a mouse.

**H4.** Shopper engagement mediates the impact of a touch interface on purchase intentions.

Engagement also leads to higher recall of TV commercials (Moorman, Neijens, & Smit 2007) and higher recall of memories manipulated by advertising messages (Braun-La Tour and Zaltman, 2006). Consumers’ engagement levels also have a positive influence on information processing and memory (Blackwell, Miniard, & Engel 2005; Sprott, Czellar, & Spangenberg 2009). Based on these close associations between engagement and memory, it is expected that higher shopper-engagement induced by the use of a touch interface affects recalling product information such as brand names, prices, or product specifications:

**H5.** Shopper engagement mediates the impact of touch interfaces on product-information recall.

However, due to the cognitively challenging nature of touch interfaces, it is likely that such associations exist only when cognitive load from other sources is minimal. In other words, high shopper-engagement may help reduce shoppers’ perceived cognitive challenges induced by touch interfaces, but such attenuation is only possible if shoppers
do not have to process much information. The amount of information to process is often determined by involvement levels, which represent their perceived relevance to shopping tasks or product categories. Therefore, involvement levels may be good indicators in predicting the amount of cognitive load and the magnitude of engagement effects on information recall.

**Involvement (Personal Relevance)**

Marketing research has found that involvement is one of the common antecedents of consumer engagement (Brodie et al., 2011; Eroglu et al., 2001; Kearsley & Schneiderman, 1999; O’Brien & Toms, 2008, 2010). Involvement positively influences engagement (Schiffman & Kanuk, 2010) in various marketing channels, including shopping, websites, and advertisements. In the context of shopping, involvement refers to shoppers’ perception of the personal relevance of products, brands, or shopping tasks, which can determine their level of motivation prior to shopping. Typically, consumers in high involvement conditions tend to find the products more personally relevant and more intrinsically important to them than those in low-involvement conditions (Petty & Cacioppo 1979; Sherif & Hovland, 1961). In some marketing literature, the terms involvement and engagement are used interchangeably. Here, however, I use *involvement* to describe the levels of shoppers’ perception of *personal relevance or motivation* toward shopping tasks or product categories, while I use *engagement* to refer to a *perceived cognitive state during navigation* driven by shoppers focused attention.

Consumers become highly involved when they personally feel that product categories (e.g., cars) or shopping tasks are important to them. Thus, shopping for a high-
involvement product often leads to greater perceived risk than shopping for a low-involvement product (e.g., a can of Coke) does (Bloch & Richins, 1983). In order to reduce the risks that result from making a poor product choice, consumers evaluate high-involvement product categories more carefully (Bart, Stephen, & Sarvary, 2014) and with greater attention to detail (Celsi & Olson, 1988). During high-involvement product purchases, consumers tend to have increased motivation to process relevant cognitive cues (Petty & Cacioppo, 1979), including such as relevant arguments about products, detailed product specifications, or information about product quality, which results in central-route processing (MacKenzie & Spreng, 1992; Petty, Cacioppo, & Schumann, 1983). In contrast, when consumers are less involved, they tend to focus more on incidental, affective, or experiential environmental cues such as store atmosphere rather than on the relevant information itself (San Martin, Camarero, & San José, 2011; Bart et al., 2014).

Involvement levels seem to have a meaningful association with touch as well, at least in offline marketing environments. Specifically, research has found that involvement levels play a significant role between touch and persuasion. Under low-involvement conditions, people tend to be persuaded by haptic elements (e.g., a tree bark sample for an arboretum brochure, a paper or velvet band for invitations or promotional mailings; Peck & Johnson, 2011). However, in touch-interface environments, due to the more cognitively challenging user experience as discussed, touch-interface users are likely to experience a greater cognitive load. This increase in cognitive demand may increase when involvement levels are high. Therefore, in online shopping, consumers’
involvement levels are likely to amplify the negative impact of touch interfaces on information recall:

**H6.** The negative impact of touch interfaces on shoppers’ product-information recall is greater under high-involvement conditions than under low-involvement conditions.

On the other hand, under low-involvement conditions, consumers are more likely to rely on affective or experiential cues, which leads consumers to make less deliberate, more immediate, and almost-automatic purchase decisions (Shiv & Fedorikhin, 1999). In other words, it takes less time for shoppers in low-involvement contexts to make a purchase decision or a final product choice than it does for those in high-involvement contexts. Thus, purchase intentions immediately after shopping while using a touch interface are likely to be higher when involvement level is low. In H7 and H8, I propose that a low-involvement context positively moderates the impact of touch interfaces on higher engagement, resulting in higher purchase intentions:

**H7.** The positive impact of touch interfaces on engagement is greater in low-involvement conditions than in high-involvement conditions.

**H8.** The positive impact of touch interfaces on purchase intentions is greater in low-involvement conditions than in high-involvement conditions.
Study 1

Method

**Design.** I recruited 127 participants (55.1% males) by sending e-mail announcements to current and former students registered at the lab database. Eighty-four percent of the participants were between 18 and 23 years old, 13% were 24 and 29 years old, and 3% were 30 years old or older. Participants were mostly students (82.7%), followed by full-time working professionals (11.8%), and other unspecified occupations (5.5%). The experiment had a $2 \times 2$ between-subjects design (device (touch interface vs. mouse) $\times$ involvement (high vs. low)), and was conducted at a university research lab in California. According to the pilot study results, computers and electronics categories were likely to increase shoppers’ involvement levels while simple clothing items such as sweatshirts were the opposite. Thus, in this study, I manipulated participants’ involvement levels by using different product categories: cameras as high involvement and sweatshirts as low-involvement conditions.

The lab environment consisted of partitioned sets of desks and chairs, each of which had a desktop computer with a 22-inch touch-screen monitor, a mouse, and a keyboard. During the experiment, each participant was seated at a private partitioned desk to prevent him or her from being disturbed by other participants, and to increase their engagement during the session. Subjects were randomly assigned to four conditions, each of which contained between thirty and thirty-four subjects. Participants in conditions 1 and 3 browsed a fictitious camera retailer’s website, using either a touch interface or a non touch-interface monitor with a keyboard and a mouse to navigate the website,
whereas participants in conditions 2 and 4 browsed a fictitious sweatshirt retailer’s website, again using either a touch interface or a non touch-interface with a keyboard and a mouse.

Table 1. Experiment Conditions (Study 1)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Device</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>Touch Interface</td>
<td>High (Camera)</td>
</tr>
<tr>
<td>Condition 2</td>
<td>Touch Interface</td>
<td>Low (Sweatshirt)</td>
</tr>
<tr>
<td>Condition 3</td>
<td>Mouse</td>
<td>High (Camera)</td>
</tr>
<tr>
<td>Condition 4</td>
<td>Mouse</td>
<td>Low (Sweatshirt)</td>
</tr>
</tbody>
</table>

**Procedure.** Until participants completed reading the instructions on paper, the computers’ monitors remained turned off. Each condition was staged separately, and all four conditions were assigned to one of two shopping scenarios (Table 2), according to the product category. After the participants read the instructions, they began navigating a website as instructed. Each website displayed twelve products, either twelve point-and-shoot cameras or twelve long-sleeve sweatshirts from three brands, of which each had four different products. After browsing the site for ten minutes, I asked participants to stop browsing, turn off the monitor, and complete a paper questionnaire. The questionnaire had multiple questions to measure the level of engagement with the overall shopping experience, aided and unaided product-information recall, purchase intentions, and a few other purchase-related evaluations. Participants received a cash payment ($20.00) after they completed the questionnaire.
Table 2. Shopping Scenarios (Study 1)

<table>
<thead>
<tr>
<th>Scenario 1. High Involvement</th>
<th>Scenario 2. Low Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Conditions 1 &amp; 3)</td>
<td>(Conditions 2 &amp; 4)</td>
</tr>
</tbody>
</table>

Imagine that you have booked a trip to go to an exotic island with your best friends this summer. You are excited about the trip and are interested in purchasing a brand new point-and-shoot camera with which you can capture special moments during the trip. A $400 gift card has been given to you to buy a point-and-shoot camera. You are thinking of visiting several websites to find the perfect one, and you are about to navigate the first site.

Imagine that you have booked a trip to a mountain resort with your best friends this summer. You are excited about the trip and are interested in purchasing a new sweatshirt that you can wear at night during the trip. A $100 gift card has been given to you to purchase a sweatshirt. You are thinking of visiting several websites to find the perfect one, and you are about to navigate the first site.

Material 1: Websites. In this experiment, participants browsed one of the two test websites. The camera site offered twelve point-and-shoot cameras from three brands (Sony, Olympus, and Canon), and the sweatshirt site offered twelve unisex long-sleeve sweatshirts from three brands (Jerzees, American Apparel, and Alternative Apparel).

Each site had a fictitious business name, which appeared on the landing page only. The business name of the camera site was “AGSM Camera,” and the name for the sweatshirt site was “AGSM Sweatshirt” for the sweatshirt site. The camera products ranged in price from $79.99 to $399.99, while the sweatshirts ranged from $24.99 to $56.99. All prices were within the allocated budget (gift-card balance) stated in Scenarios 1 and 2. The pilot study results determined the common design components of the websites, which do not significantly increase or decrease shopper engagement. Both sites were concurrently hosted by a third party hosting service.
**Material 2: Questionnaire.** Participants completed a paper questionnaire consisting of both multiple-choice and open-ended questions. The multiple-choice questions used a seven-point scale, except for product-information recall, demographic information, involvement levels, and engagement.

**Product-information recall.** I measured both unaided and aided (i.e., recognition) product-information recall regarding product design, features, prices, colors, brand names, and product names. An open-ended question measured unaided information recall and asked participants about one of the products on the website that they were most likely to purchase (i.e., “According to the camera website you browsed today, which product do you like the most for the occasion? Please fill out the following in as much detail as possible”). Participants filled out product information with as much detail as possible in four items (i.e., brand name, product name, price, and color) of the product that they would most prefer purchasing. I coded the answers into five categories, of which each was evaluated from 0 to 1 point, as follows: answers that were correct, including minor typos (1 point; e.g., “Cannon” instead of “Canon”); answers that were mostly correct but were missing one or two words or used alternative words (.75 - .8 point; e.g., “Cyber Shot” instead of “Sony”); answers that were half correct (.5 - .55 point; e.g., “American Jerzees” instead of “Jerzees”); answers of which less than half were similar to the correct answer (.25 - .3 point; e.g., “Ameri Sweatshirt” instead of “American Apparel”); and completely incorrect or no answer (0 point). Demographic information questions measured included gender, age, occupation, and income, as well as previous experiences with touch interfaces and the tested products (i.e., cameras and sweatshirts).
In addition to the open-ended question, eight multiple-choice questions tested aided product-information recall, displaying four options for each question. These aided-recall questions measured information recall on price ranges, brand names, distinctive product features including specific design, functions, and colors. Each question displayed four options from which the participants choose one.

**Engagement.** Engagement questionnaire consisted of thirty-one questions. All the questions came directly from the “User Engagement Scale,” which specifically measures engagement of online shopping and other types of interactive content (O’Brien, 2010; O’Brien & Toms, 2008, 2010). I used the average of the ten questions from the scale to determine the participants’ engagement levels (α = .90) and used the rest of the questions as additional measures to determine involvement and perceived usability.

Table 3 Engagement Questions (Study 1)

Based on your experience with the site today, how much do you agree or disagree with the following statements? (1 = Strongly Disagree, 5 = Strongly Agree; 6 = Not Applicable)*

| FA (Focused Attention) | 1. I lost myself in this shopping experience.  
|                        | 2. I was so involved in my shopping task that I lost track of time.  
|                        | 3. I blocked out things around me when I was shopping on this website.  
|                        | 4. When I was shopping, I lost track of the world around me.  
|                        | 5. The time I spent shopping just slipped away.  
|                        | 6. I was absorbed in my shopping task.  
|                        | 7. During this shopping experience, I let myself go.  |
| FI (Focused Involvement) | 8. I was really drawn into my shopping task.  
|                          | 9. I felt involved in this shopping task.  
|                          | 10. This shopping experience was fun.  |
The ten questions for engagement consisted of seven questions under the sub-component “Focused Attention” (FA) and all three questions under the sub-component “Focused Involvement” (FI). These questions used a six-point scale ranging from 1 (Strongly Disagree), to 5 (Strongly Agree), and an additional response option of 6 (Not Applicable).

**Purchase intentions.** Shoppers’ purchase intentions were measured on a seven-point scale ranging from 1 (Extremely Unlikely) to 7 (Extremely Likely) ($\alpha = .76$). One question measured the general purchase intentions toward at least one of the products that the participants browsed during the experiment session, and three additional questions measured purchase intentions toward each of the three camera brands or each of the three sweatshirt brands.

**Other variables.** In addition to the proposed variables, I measured additional factors to ensure if there were any issues with the study design in terms of website usability, quality of product information, mood, and involvement manipulations. To avoid a significant impact of website content on engagement, I checked perceived website usability. Seven questions measured website usability in terms of participants’ satisfaction with overall shopping experiences, such as quality of product information, ease of use, and website design using a seven-point scale ranging from 1 (Completely Dissatisfied) to 7 (Completely Satisfied) ($\alpha =.79$). Two additional questions measured the participants’ current mood on a seven-point scale ranging from 1 (Very Negative) to 7 (Very Positive) ($\alpha =.42$). An additional question served as an involvement manipulation check where the participants answered if they felt interested in their shopping task on a
six-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) with an additional response option of 6 (Not Applicable).

**Control variables.** The experiment controlled several factors to reduce possible confounding effects. First, to examine the perceived time-lapse as part of the engagement scale, participants were not allowed to carry watches or electronic devices during the session, participants were not informed about how much time had passed during the experiment, and the clocks on the computer monitors were hidden by displaying the websites in full-screen mode.

Second, in testing product-information recall, participants were not allowed to have writing tools while they browsed the site, and they had no access to the computers after they received the questionnaire. Participants only received the questionnaire after they had turned off their monitors. Third, to keep the data from each condition comparable, both touch conditions and mouse conditions used the same desktop computers with the same monitors. Touch conditions used the monitor only, whereas mouse conditions used the monitor with a keyboard and a mouse. Fourth, to create an adequate level of positive motivation for shopping, both scenarios used relatively similar scenarios in which participants were instructed to shop for their upcoming trips with their best friends. I avoided using scenarios such as shopping for luxury items or last minute shopping for holiday gifts because such occasions may result in overly high or low motivation. Fifth, the prices of products on the experiment websites were well under the gift-card balance (as explained in the scenarios) in order to avoid potential effects from perceived budget constraints. Lastly, in order to minimize the potential device effects on answers, I used
paper questionnaires only, and all the instructions were also on paper only. The participants used the computer devices only when they browsed the test website. Lastly, based on the results of the pilot survey, I adjusted the websites’ level of visual aesthetics, speed, and usability (easiness to navigate) to minimize the influence of website design on engagement. All of these features are known to influence shopper engagement levels (O’Brien & Toms 2008, 2010).

Results

As hypothesized, using touch interfaces for online shopping influenced consumers’ product information recall and engagement, but the impact of device on information recall was significant only when recalling brand names. Participants using touch interfaces recalled brand names less accurately than those using a mouse in high-involvement conditions, however, device type did not significantly affect recall of other product information such as color, price, and product name. Touch-interface users were also more engaged with their shopping experiences when shopping for sweatshirts (i.e., low-involvement) than were mouse users.

The manipulation on involvement was implemented as proposed. The two product types (i.e., cameras and sweatshirts) successfully manipulated participants’ perceived involvement levels. The camera group’s average involvement level ($M = 3.92, SE = .12$) was significantly higher than that of the sweatshirt group ($M = 3.47, SE = .13; F(1, 125) = 6.63, p = .01$). This result indicates that, as planned, the participants perceived cameras as high-involvement and sweatshirts as low-involvement.
**Product-information recall.** In Hypothesis 1 (H1), I hypothesized a negative impact of using touch interfaces on product-information recall and proposed a moderation effect of involvement level in H6 that such negative impact would be stronger in high-involvement conditions. As predicted, device types were important in recalling brand names only among camera shoppers (high-involvement), but the results were not significant in recalling other types of information. Camera shoppers who used a touch interface were less likely to recall camera brand names accurately than those who used a mouse device (touch ($M = .79$) $<$ mouse ($M = .97$); $F(1, 123) = 4.09, p < .05$).

Although there was a significant interaction effect between device type and involvement on brand-name recall ($F(1, 123) = 5.67, p = .02$), device type had no overall main effect on brand-name recall ($F(1, 123) = .20, p = .66$). Involvement did not affect brand-name recall significantly ($F(1, 123) = .43, p = .51$). In addition, regardless of involvement levels, there was no significant difference between the two devices when recalling other types of product information such as price ($F(1, 123) = .70, p = .41$), product names ($F(1, 123) = .18, p = .68$), and product colors ($F(1, 123) = 1.83, p = .18$). Involvement did not play a significant role, either (price: $F(1, 123) = .63, p = .43$; product names: $F(1, 123) = .19, p = .67$; product colors: $F(1, 123) = .20, p = .66$).

Aided-recall (i.e., recognition of information) was not significantly different between device types ($F(1, 123) = .03, p = .87$) and involvement levels ($F(1, 123) = 3.25, p = .07$). As the direct effect of touch interfaces on information recall was only partially significant, H5, the mediation effect of engagement, is not supported. In summary, using a touch interface had a negative impact on brand-name recall in the high-involvement
conditions only while displaying no significant effect on recalling other types of information including aided recall. The findings of this study are relatively limited and cannot fully confirm my predictions on product-information recall; H1 and H6 are partially supported — at least for recalling brand names.

Table 4. Product-Information Recall (Study 1)

<table>
<thead>
<tr>
<th>Type of Information</th>
<th>Information Recall (High-Involvement)</th>
<th>Information Recall (Low-Involvement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Touch</td>
<td>Mouse</td>
</tr>
<tr>
<td>Brand Name</td>
<td>.79 (SE = 0.06)</td>
<td>.97 (SE = 0.06)</td>
</tr>
<tr>
<td>Color</td>
<td>.89 (SE = 0.05)</td>
<td>.94 (SE = 0.05)</td>
</tr>
<tr>
<td>Product Name</td>
<td>.74 (SE = 0.07)</td>
<td>.77 (SE = 0.08)</td>
</tr>
<tr>
<td>Price</td>
<td>.56 (SE = 0.09)</td>
<td>.65 (SE = 0.09)</td>
</tr>
</tbody>
</table>

\(^a\)The mean differences between touch interface and mouse are statistically significant at \(p < .05\)

Engagement. In H2, I proposed that touch interfaces would lead to higher shopper engagement; in H7, I predicted the moderation effect of involvement levels. The results support H2 in that the use of a touch interface led to significantly higher shopper engagement; the effect was stronger among low-involvement shoppers (vs. high-involvement shoppers). Overall, device type and involvement level had a significant interaction effect on engagement \((F(1, 123) = 5.69, p = .02)\), suggesting that the impact of devices on engagement varied by shoppers’ involvement levels. Involvement had a
significant main effect on shopper engagement ($F(1, 123) = 5.54, p = .02$), while device types had no significant main effect on engagement ($F(1, 123) = .50, p = .48$).

Studying the interaction effect in more depth, a simple effect analysis showed that using a touch interface (vs. mouse) led to higher engagement among low-involvement (sweatshirt) shoppers ($F(1, 123) = 4.67, p = .03$), while no significant effect existed among high-involvement (camera) shoppers ($F(1, 123) = 1.45, p = .23$). As proposed, touch-interface users with a low-involvement level (condition 2) were significantly more engaged with their shopping session than those who used mouse devices in the same involvement level (condition 4; touch ($M=3.21, SE = .14$) > mouse ($M=2.80, SE = .13$); $F(1, 123) = 4.67, p = .03$). High-involvement shoppers did not significantly differ between devices and did not display significantly different engagement levels. However, high-involvement shoppers who used a mouse (condition 3) were slightly more engaged than touch-interface users (condition 1), although the difference was not statistically significant (touch ($M=3.21, SE = .13$) < mouse ($M = 3.44, SE = .14$); $F(1, 123) = 1.45, p = .23$) (see Table 1 for the information about conditions 1, 2, 3, and 4).

As shown in Figure 3, among mouse users, high-involvement shoppers ($M=3.44, SE = .14$) were more engaged than were low-involvement shoppers ($M=2.80, SE = .14$; $F(1, 123) = 11.16, p = .001$). However, there were no significant differences between involvement levels among touch-interface users ($p > .05$). In summary, the results support H2 and H7, as predicted. The impact of the touch screen was clearly salient among low-involvement (sweatshirt) shoppers while there was no significant impact on high-involvement (camera) shoppers. However, it is important to note that high-
involvement shopper engagement was steady regardless of the device type, which indicates a potential ceiling effect because these shoppers were manipulated to be highly involved prior to the experiment.

Furthermore, regardless of the device type and involvement level, high engagement did not lead to higher product-information recall ($\beta = .07, t = .73, p = .47$), suggesting no potential mediation effect of engagement. However, the shoppers with higher engagement predicted higher purchase intentions ($\beta = .27, t = 3.01, p = .002$).

**Purchase intentions.** I proposed that touch-interface users would display higher purchase intentions (H3), with shopper engagement as a mediator (H4). In H8, I expected the moderating effect of involvement between devices and purchase intentions. In contrast to the hypotheses, purchase intentions did not significantly differ by device type. Purchase intentions of touch-interface users ($M = 4.94, SE = .22$) were slightly lower than those of mouse users ($M = 5.40, SE = .23$) although the difference was not statistically significant ($F(1, 123) = .03, p = .86$). Purchase intentions differed by involvement levels, such that camera shoppers reported significantly higher purchase intentions than sweatshirt shoppers ($F(1, 123) = 6.75, p = .01$) and displayed no significant interaction effect between the device types and involvement levels ($F(1, 123) = 2.58, p = .11$). Thus, the results do not support H8. In addition to the overall purchase intentions, purchase intentions toward each individual camera and sweatshirt brand were also not statistically significant ($p > .10$). As the results do not support the direct effect of touch interfaces on purchase intentions, it is not necessary to conduct further analysis on the mediation effect of engagement, as hypothesized in H4.
**Supplemental analyses.** Perceived usability of the test websites was controlled as planned. Both website design/structure \((r = .15, p = .11)\) and the site’s ease of use \((r = .05, p = .55)\) were not significantly correlated with engagement. In other words, the website was neutral in its design and usability, such that it did not affect engagement levels. Both device type \((F(1, 123) = .19, p = .66)\) and involvement level \((F(1, 123) = 2.88, p = .09)\) did not have a main effect on the perceived usability and displayed no interaction effect with each other, either \((F(1, 123) = .16, p = .69)\). To ensure the validity of the usability results, I also investigated usability with the questions from the “Perceived Usability” sub component of the “User Engagement Scale” (O’Brien 2010). The results were consistent with the above results. Device type \((F(1, 123) = .30, p = .58)\) and involvement level \((F(1, 123) = .004, p = .95)\) did not differ in perceived usability, and there was no significant interaction between the device types and involvement levels \((F(1, 123) = .07, p = .79)\), suggesting the website usability was controlled as planned.

Furthermore, device type displayed no significant main effect on mood \((F(1, 123) = 1.15, p = .29)\) and no significant interaction effect with involvement level \((F(1, 123) = .64, p = .42)\). However, participants’ mood was positively correlated with engagement \((r = .50, p < .001)\), purchase intentions \((r = .42, p < .001)\), product evaluations \((r = .36, p < .001)\), and satisfaction with overall shopping experience \((r = .65, p < .001)\), implying a potential role of mood in purchase-decision making processes.

**Discussion**

As reported in both the marketing and education literature, touch-interface users in the present study were also more engaged than non-touch users, and engagement led to
higher purchase intentions. However, higher engagement among touch-interface users did not lead to higher information recall as found in the previous literature on offline marketing. This suggests little or no association between engagement and cognitive performance within the tested device environments.

A possible limitation of this research is that touch-interface users’ negative information-recall was significant when recalling certain type of product information (i.e., brand names) only. This result is not sufficient to confirm the earlier argument that touch-interface users are likely to have less working memory to cognitively process product information due to the vision and touch conflict and increased distractions by extensive hand/finger movements. Also, the result does not support my prediction that high engagement reduces the negative impact of touch interfaces on information recall. Participants who used a touch interface did not necessarily recall product information better than those who used a mouse regardless of involvement levels, even though engagement levels were higher among touch-interface users. In summary, although touch interfaces led to higher engagement and higher purchase intentions, suggesting a moderating role of shoppers’ involvement levels, the overall outcomes on information recall are limited in corroborating the negative effects of touch interfaces.

Another possible limitation of this study is using different product categories (i.e., camera vs. sweatshirt) for involvement manipulation. This manipulation may cause confounding effects and might have affected the results. In order to strengthen these findings in Study 1, I conducted a second study using pre-tested involvement-manipulation scenarios instead of varying product categories to influence involvement
levels. In addition, I measured pre- and post-manipulation involvement levels to ensure the effectiveness of the manipulation procedure.

**Study 2**

**Method**

The purpose of Study 2 was to explore the findings in Study 1 further and to determine if the device effects of Study 1 replicate when I directly manipulate involvement levels without varying product categories.

**Design.** I recruited 135 participants (57% males) by sending e-mail announcements to current and former students registered at the lab database. The age percentage breakdown was similar to Study 1, such that 84% were between 18 and 23 years old. More than a half of the participants (51.1%) were between 24 and 29 years old, followed by those between the ages of 18 and 23 years old (41.5%), those ages 30 years or older (5.9%), and those with no answer (1.5%). Participants consisted of mostly students (96.3%) as in Study 1, followed by full-time working professionals (3.0%), and other unspecified occupations (.7%). The experiment had the same 2 × 2 between-subject design (device [touch interface vs. mouse] × involvement [high vs. low]) as in Study 1. The key difference from Study 1 was the involvement manipulation, which specified different scenarios for each involvement level, keeping the product category constant. I conducted all experiment sessions in the same lab where I conducted Study 1.

**Procedure.** Study 2 used the same procedure as in Study 1, except for payment, involvement manipulation, and the number of questionnaires. Unlike the cash payment compensation for Study 1, compensation for full participation in Study 2 was either cash
payment ($5.00) or course credit (2 points). For the involvement level manipulation, instead of using two product categories as was the case in Study 1, in the present study, I used only a single product category (cameras) and manipulated involvement level using involvement scenarios from Zhang and Markman’s (2001) study. The table below shows the slightly modified scenarios for Study 2, such that the product category and local area were specified as camera products and southern California, respectively:

Table 5. Shopping Scenarios (Study 2)

<table>
<thead>
<tr>
<th>Scenario 1. High Involvement (Conditions 1 &amp; 3)</th>
<th>Scenario 2. Low Involvement (Conditions 2 &amp; 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thank you for signing up for the experiment. You are among a very small and select group chosen to participate in the study, and your responses are very important to us. The purpose of this study is to collect your opinions about camera products to finalize the development of a new camera product that will be marketed in the southern California area soon. Your names will be entered into a lottery for a free offer of the new product or a gift certificate of equal value.</td>
<td>Thank you for signing up for the experiment. This study is being conducted in several cities in the United States, and you are among 10,000 respondents participating in the study. The purpose of the study is to obtain your opinions about brands.</td>
</tr>
</tbody>
</table>

The session proceeded as in Study 1 except for an additional paper questionnaire and a change in task duration. I added a pre-experiment questionnaire to measure participants’ engagement levels, involvement levels, and previous experience with camera products before the manipulation. Because of the additional questionnaire, I reduced the time of web browsing from ten minutes to eight minutes, in order to maintain the entire session time consistent to Study 1.
**Material 1: Website.** This study used the same camera website developed for Study 1. The website displayed the same twelve point-and-shoot cameras from the same three brands (Sony, Canon, and Olympus), and participants browsed the website in full-screen mode, as in Study 1, to block the clock at the bottom of the screen.

**Material 2: Questionnaires.** This study used the pre-experiment questionnaire along with the post-experiment questionnaire. Prior to browsing the website, participants completed a short paper questionnaire to assess their engagement level, involvement level, interest in cameras, and previous camera shopping experiences. By measuring these, the study aimed to investigate how these pre-experiment measures might change after each participant browsed the website. After browsing the website, participants completed the post-experiment questionnaire, which was very similar to that used in Study 1 except for a few minor changes discussed below.

**Product-information recall.** As in Study 1, I measured both unaided information recall and aided recall (i.e., recognition) using the same questions from the Study 1 except for a few changes. On the open-ended question for unaided recall, I added one more information item, favorite product features, to the original four items and changed the price information from asking for the “price” to asking for the “price range” of the product. Among the recognition (aided-recall) questions, I added a new question that measured visual information recall, displaying product pictures as visual aids.

**Engagement.** The pre-experiment questions about engagement asked about how motivated and excited the participants were about the assigned shopping task (e.g., “I feel motivated to take part in the shopping task.”) on a seven-point scale ranging from 1
(Strongly Disagree) to 7 (Strongly Agree). The post-experiment questionnaire consisted of a condensed version of the original engagement scale from Study 1, keeping only twelve items from the “User Engagement Scale” (O’Brien, 2010), while removing other engagement questions that overlapped with the usability questions (i.e., visual aesthetics, speed, or usability of the website). I used the same ten questions to determine the engagement average, using the questions from FA and FI and used other questions to determine involvement levels as well as perceived shopping experiences. To be consistent with other scales in Study 2’s questionnaires, I measured all the questions from the scale on a seven-point scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree) instead of keeping the original scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), and 6 (Not Applicable) (α = .87).

**Involvement.** I measured involvement levels both before and after the manipulation. The pre-manipulation measure was used to compare the pre-involvement levels with the post-manipulation involvement, and investigate any pre-existing factors related to the participants’ involvement or motivation toward the shopping task. In the pre-experiment measure, the participants answered five questions before reading one of the involvement scenarios. The questions asked participants about their current motivation and interest in the shopping task on a seven-point scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). Specifically, I measured personal relevance and interest in cameras and ten other randomly selected product categories (e.g., automobiles, laptops, books, furniture, etc.) on a seven-point scale ranging from 1 (Very Unlikely) to 7 (Very Likely). The additional products were included to ensure participants
were not aware that they would be shopping for cameras and to keep the purpose of the study from strongly impacting participants’ opinions. For the post-experiment questionnaire, I included the same question that I used for the involvement manipulation check in Study 1 (a seven-point scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree)).

**Purchase Intentions.** I used the same set of questions to measure purchase intention as measured in Study 1, with a seven-point scale ranging from 1 (Extremely Unlikely) to 7 (Extremely Likely; \( \alpha = .76 \)).

**Other variables.** I used the same seven questions from Study 1 to measure perceived usability. As explained, these questions measured overall perceived website usability in terms of participants’ satisfaction with overall experiences on a seven-point scale ranging from 1 (Completely Dissatisfied) to 7 (Completely Satisfied) (\( \alpha = .82 \)). In addition to perceived usability, two questions measured the participants’ current mood on a seven-point scale ranging from 1 (Very Negative) to 7 (Very Positive) (\( \alpha = .78 \))

At the end of the post-experiment questionnaire, a new question asked participants to report on their average online shopping patterns, such as the type of information (e.g., product descriptions vs. other customers’ product reviews) they tend to focus on and the amount of time they usually spend when reviewing product options. I designed this question to examine whether individual differences in shopping patterns influenced the experimental results.

**Control variables.** All control variables were kept the same as in Study 1 except for the duration of the browsing session and minor changes in the shopping scenario. The
shopping scenario included additional instructions for participants to pay attention to product attributes and brand names, in order to make the objective of the task clearer than in Study 1.

**Results**

Overall, most results from Study 2 replicated the findings of Study 1. Brand-name recall was less accurate among touch-interface users than mouse users, and this effect was significant in high-involvement conditions. In low-involvement conditions, touch-interface users were more engaged with shopping than mouse users. There were several additional findings as well. Touch-interface users showed higher purchase intentions than mouse users in low-involvement conditions, and this association was mediated by shopper engagement.

Furthermore, the manipulation of involvement was successful. The involvement level of high-involvement groups ($M = 5.08, SE = .17$) was marginally higher than that of low-involvement groups ($M = 4.70, SE = .16; F(1, 133) = 3.27, p = .07$), which indicates the participants were manipulated to have either high or low involvement as intended by the two scenarios. Participants’ pre-experiment involvement levels did not have a significant effect on their post-experiment involvement levels ($F(1, 133) = 2.01, p = .16$). This suggests no significant confounding effects from pre-existing individual differences in motivation toward the shopping task.

**Product-information recall.** Similar to Study 1, computer device type and involvement level had a significant interaction effect on brand-name recall ($F(1, 131) = 4.55, p < .04$). In high-involvement conditions only, participants who browsed the
website using a touch interface ($M = .67$, $SE = .08$) recalled brand names less accurately than participants who used a mouse ($M = .94$, $SE = .08$; $F(1, 131) = 6.65$, $p = .01$), supporting H6. In addition, in Study 2, there was no main effect of device type on brand-name recall. However, unlike Study 1, there was a significant main effect of device type on price-information recall ($F(1, 131) = 4.50$, $p = .04$) and a significant device type by involvement interaction effect ($F(1, 131) = 11.83$, $p = .001$). Touch-interface users recalled camera price information significantly less accurately ($M = .49$, $SE = .06$) than mouse users ($M = .67$, $SE = .06$; $p = .04$). The negative effect of device type was significant in the high-involvement condition (touch ($M = .36$, $SE = .08$) < mouse ($M = .82$, $SE = .08$), $F(1, 131) = 15.31$, $p = .0002$) and was not significant in the low-involvement condition (touch ($M = .63$, $SE = .08$) > mouse ($M = .52$, $SE = .09$); $p = .35$). Thus, the results in Study 2 support H1 and H6 on brand-name recall only. Since most direct effects are not significant, H5 is not supported as there is no statistically significant mediation effect of engagement on information recall.

Apart from brand name and price information, participants reported no significant differences between the two device types in recalling other types of information, such as product color ($F(1, 131) = .48$, $p = .49$), favorite product feature ($F(1, 131) = .51$, $p = .48$), or product name ($F(1, 131) = 1.53$, $p = .22$).
Table 6. Product-Information Recall (Study 2)

<table>
<thead>
<tr>
<th>Type of Information</th>
<th>Information Recall (High-Involvement)</th>
<th>Information Recall (Low-Involvement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Touch</td>
<td>Mouse</td>
</tr>
<tr>
<td>Brand Name</td>
<td>.67 (SE = .08)</td>
<td>.94 (SE = .08)</td>
</tr>
<tr>
<td>Color</td>
<td>.67 (SE = .08)</td>
<td>.84 (SE = .08)</td>
</tr>
<tr>
<td>Product Name</td>
<td>.16 (SE = .06)</td>
<td>.31 (SE = .06)</td>
</tr>
<tr>
<td>Price</td>
<td>.36 (SE = .08)</td>
<td>.82 (SE = .08)</td>
</tr>
<tr>
<td>Favorite Product Feature</td>
<td>.58 (SE = .09)</td>
<td>.72 (SE = .09)</td>
</tr>
</tbody>
</table>

*The mean differences between touch and mouse are statistically significant at \(p < .05\)

**The mean differences between touch and mouse are statistically significant at \(p < .01\)

\(a.\) Simple effect analysis
**Engagement.** Study 2’s findings on shopper engagement were also consistent with Study 1, supporting H2 again. As predicted in H2, touch interfaces resulted in higher engagement than mouse devices. However, in Study 2, there was a significant main effect of device type ($F(1, 131) = 6.14, p < .02$), which was not significant in Study 1. The participants who used a touch interface to shop were more engaged with their shopping experiences ($M = 4.50, SE = .11$) than those who used a mouse device ($M = 4.09, SE = .12$). Consistent with Study 1, involvement level had a significant main effect on engagement ($F(1, 131) = 4.65, p = .03$), and there was also a significant interaction effect between device type and involvement level ($F(1, 131) = 4.12, p = .04$). According to the simple effect analysis, the result is consistent with Study 1 in that touch-interface users were more engaged with their shopping experiences than mouse users, but only in the low-involvement condition (touch ($M = 4.49, SE = .15$) > mouse ($M = 3.74, SE = .18$)); $F(1, 131) = 10.25, p = .002$.

Among the two sub-components of engagement, focused attention (FA) and felt involvement (FI) of the user engagement scale (O’Brien, 2010), both device type ($F(1, 131) = 3.97, p < .05$) and involvement level ($F(1, 131) = 5.84, p = .02$) influenced participants’ FA with a significant interaction effect between device types and involvement levels ($F(1, 131) = 5.08, p = .03$). On the other hand, there was only a main effect of device type on participants’ FI ($F(1, 131) = 6.51, p = .01$), suggesting a stronger impact on the FA questions.
In terms of outcomes of engagement, shoppers’ engagement level predicted product-information recall of product names ($\beta = .18, t = 2.10, p = .04$), but it did not predict product-information recall for all other information types (i.e., brand name, product color, favorite product feature, and price range; $p > .05$). In addition, shoppers with higher engagement displayed higher purchase intentions ($\beta = .27, t = 3.33, p < .002$).

**Purchase intentions.** The present study found a significant impact of device types on purchase intentions as in Study 1, thereby supporting H3. In addition, this second study also found a mediation effect of engagement on purchase intentions, which Study 1 did not find. There was a significant main effect of device type on participants’ purchase intentions toward the products they browsed during the session ($F(1, 131) = 10.45, p = .002$), while having no interaction effect with involvement level ($F(1, 131) = .37, p > .05$), providing no support for H8. Touch-interface users reported significantly
higher purchase intentions \((M = 5.50, SE = .16)\) toward the product than mouse users \((M = 4.72, SE = .18, p = .002; F(1, 131) = 10.45, p = .002)\). In each involvement condition, purchase intentions were significantly higher among touch-interface users than with mouse users \((p < .05)\). Hayes’ INDIRECT and PROCESS macros (with a bootstrap estimation with 1,000 samples) evaluated the mediating effect on purchase intentions. Engagement had a significant indirect effect on purchase intentions \((b = .17, 95\% \text{ CI} [.04, .38])\); however, there was no significant moderated mediated effect in purchase intentions for involvement and engagement.

**Figure 3. Purchase Intentions (Study 2)**

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**Supplemental analyses.** As expected, all of the control factors were successfully implemented. The website design \((r = .14, p = .11)\), site structure/speed \((r = .03, p = .70)\), and ease of the site \((r = -.04, p = .69)\) were not significantly correlated with shoppers’ engagement levels, suggesting no significant impact of the website on engagement. As in
Study 1, device type had no main effect on participants’ perceived mood ($F(1, 130) = .37, p = .55$); however, involvement level did have a significant main effect on mood ($F(1, 130) = .49, p = .03$) with no significant interaction between mood and device type ($F(1, 130) = .70, p = .41$). Low involvement level led to positive moods ($\beta = -.24, t = -3.02, p = .003$), and high engagement levels also led to positive moods ($\beta = .36, t = 4.47, p < .0001$). This implies a potential impact of cognitive load on shoppers’ moods induced by involvement level. Information processing styles did not display any significant associations with device type, involvement level, and the dependent variables ($p > .05$).

**Discussion**

Most findings of Study 2 are consistent with those of Study 1. The replication of findings between the two studies supports my predictions that touch-interface environments do influence shoppers’ decision-making process both positively and negatively depending on users’ involvement level. The positive effects that this study has found are regarding shopper engagement and purchase intentions. Online shoppers are likely to be more engaged with their shopping experiences when using a touch interface to browse products than when using a mouse, which is consistent with the findings in the education and other non-marketing literature as discussed earlier. Also, as in the marketing literature on engagement, the touch-interface users who were highly engaged were more willing to purchase the products than mouse users. Touch interfaces had a negative impact on product-information recall although some limitations exist. Touch interfaces may have a negative influence on shoppers’ cognitive performance at least for brand-name recall, especially in the high-involvement condition. However, touch
interfaces have a positive impact on engagement in the low-involvement condition. It is possible that using a touch interface in the high-involvement condition creates a *sensory overload* because a high level of involvement requires additional information to process and add more cognitive demands than a low-involvement level does.

However, the findings regarding information recall are limited to brand-name recall and are insufficient to generalize to other types of product information. In addition, it is unclear why recalling other types of information such as product colors or favorite features did not differ by device types. Perhaps, it is because of specific types of information which shoppers are likely to attend to. For example, when browsing multiple products, it is likely that some shoppers focus more on product colors while others focus more on brand names. These different tendencies to focus on certain information criteria may matter. Participants’ different information-processing styles may also affect information recall. Though the random assignment of subjects ruled out any issues from such individual differences, it will be worthwhile to explore if preferred information type or different information processing styles influence results in the different device environments. Another limitation of this study, which requires further investigation, is that the results are not sufficient to explain whether or not vision and touch conflict or hand movements caused the negative impact of device types on recall.

Nevertheless, it is important to note that using a touch interface may not always be negative regarding information recall if the involvement level is low. In both Studies 1 and 2, touch-interface users in the low-involvement condition recalled brand names more accurately than mouse users, although the difference was not statistically significant.
Possibly, because touch interfaces are generally used more often in casual computing devices, such as smartphones or tablet PC, people may perceive their touch-interface environments to be more fun or less task-oriented than those in mouse environments do. Thus, if the involvement level is low, using a touch interface, which tends to be cognitively challenging, yet fun to operate, may not be as cognitively overwhelming as expected because the fun and casual characteristic of touch interfaces balances the perceived cognitive threshold. However, if the involvement level is high, the fun and casual nature of touch interfaces may not be sufficient to control the perceived cognitive threshold, resulting in cognitive overload.

Despite the limitations of these two studies, they indicate that there are several positive outcomes of using a touch interface, with effects that are very consistent in both studies and with the literature. Touch-interface users’ higher engagement and higher purchase intentions (vs. mouse users) were stronger in the low-involvement conditions, indicating the important role that involvement levels play in engagement and purchase intentions. When people are less involved, they become less motivated to shop or perceive lower personal relevance toward the shopping task. As a result, they become less likely to cognitively process much of the product information details, experiencing lower cognitive load. According to the Elaboration Likelihood Model (ELM; Petty, Cacioppo, & Schumann, 1983; San Martin, Camarero, & San José, 2011), when people are less involved with the product, they become less motivated to process product information details and tend to rely more on feelings or affective cues (e.g., store atmosphere) during the decision making process than on cognitive cues (e.g., information
about product specifications). Perhaps, in this research, high engagement and even higher purchase intentions amongst the low-involvement shoppers might have been due to the nature of the low-involvement condition, which lowers motivation to process relevant information, triggering affect-driven information processing. If shoppers rely more on affective cues, as affective-cognitive models (Shiv & Fedorikhin, 1999) suggest, it is also possible these affect-driven shoppers choose products that are stronger in hedonic attributes than utilitarian attributes and result in more immediate and less deliberate decisions.

**General Discussion**

Both Studies 1 and 2 have provided insight into the impact of touch interfaces on information recall, engagement, and purchase intentions. In summary, touch interfaces are likely to negatively affect online shoppers’ brand-name recall if shoppers are highly involved. However, in terms of shopper engagement and purchase intentions, touch interfaces play a positive role among less involved shoppers. The key message from these findings is that input device environments, such as touch interfaces, are likely to have a significant impact on online shoppers’ purchase decision processes, and this influence may vary not only by the type of device used but also by shoppers’ level of involvement. Moreover, level of users’ engagement during their online shopping experiences seems to mediate the effects of device type on purchase intentions. Although a further investigation is necessary to understand the role of devices in terms of the entire online purchasing process, this first essay makes several important contributions to current
online retail research as well as online retail practices. The following sections explain the key contributions of this study, its limitations, and suggested future research.

**Contributions**

The findings of these series of studies make meaningful contributions to the literature on online retailing and online user experiences. First, they fill the gap in traditional sensory marketing literature by elaborating on how touch functions in online retail environments and how it differs from offline touch (i.e., touching products directly). In particular, the results of this investigation are consistent with findings on tactile cues and tactile perception with movements. Previous studies of offline touch (Warren & Rossano, 1991) have suggested that people experience vision and touch conflicts if visual information and tactile information do not match. Extending the concept of vision and touch conflicts to touch-interface user environments, interface-touch gestures may cause such conflicts between vision and touch because visual information about users’ navigation activities does not come with differentiated tactile responses beyond the perception of the screen surface. Moreover, because it is expected that body movements decrease the performance of tactile perception, interface touch gestures that involve active hand movements may facilitate the distractive nature of touch interfaces even further. As expected, this study found strong evidence in two separate experiments that touch-interface environments negatively affect users’ cognitive performance on tasks such as information recall, compared to mouse environments.

Second, the findings of this study call for an expansion of the definition of online retail environmental cues by introducing computer device type as a new cue that goes
beyond more traditional cues, such as website design or web content. Adding device type is timely because most shoppers today use multiple types of computer devices when shopping online rather than a single device. It is important to look at online retail environments with a view that includes computer device types as one of the factors that influence shopping experiences. Brasel and Gips (2014) suggested that it would be necessary for future computer-based research to indicate device types in their specified protocols. In support of Brasel and Gips’ suggestion, this study provides evidence that directly relates device type to information recall, shopper engagement, and purchase intentions, all of which are part of the key concerns of online retailers.

Third, this study is also the first to report the mediating role of user engagement in relation to computer device types, purchase intentions, and involvement. Supporting previous literature on engagement in gaming (Thompson et al., 2012) and education (Enriquez, 2010; Neumann, 2014), the present investigation found a positive role of using a touch interface in increasing shopper engagement, leading to higher purchase intentions. The association of higher engagement with low involvement also supports the idea that involvement and engagement differ, and that involvement representing personal relevance or motivation to shop is often an antecedent of shopper engagement as suggested by the Stimulus-Organism-Response framework (Eroglu et al., 2001).

Fourth, this program of research is the first to report the negative impact of touch interfaces on online shoppers’ information recall. In high-involvement conditions, shoppers who used a touch interface recalled brand names and price information less accurately than those who used a mouse. This finding also supports my argument for the
distractive nature of touch interfaces that occurs due to vision and touch conflict and active hand movements. Different user experiences that arise from the device types provide many practical implications as well, discussed in the next section.

Finally, the findings contribute to establishing a foundation for researchers’ future investigations of “interface touch” (Brasel & Gips 2014). Contributing to the initial development of this field is important because future touch-screen technology will eventually transmit realistic tactile cues of the displayed content, which will make tactile perception in online retail environments more similar to that of offline environments. These advanced tactile technologies that transmit realistic tactile cues will benefit not only general consumers but also consumers who have lost tactile perception (i.e., those who have lost their fingers or feet), as well as those consumers who have difficulty visiting offline stores.

**Managerial Implications**

According to the findings, online shoppers who used a touch interface to browse for high-involvement products experienced difficulty recalling brand names and price information accurately, which would eventually influence their purchasing decisions. This result suggests an important upgrade to retailers’ and marketers’ websites. Currently, upon consumers accessing a website, they encounter a push from retailers and marketers to use a PC or mobile version of their website, depending on consumers’ device type. Most mobile and some PC versions are designed to be easy to use in both touch and non-touch interfaces, but most retailers and marketers do not identify specific input device environments beyond the simple distinction between PC and mobile. They
assume mobile devices are more likely to be touch screens while PC types are more likely to be non touch-screens. However, classifying such diverse device environments into only two categories is no longer sufficient. Such classification (i.e., PC and mobile) is too broad considering that we now have multiple options of each. For example, mobile devices range from smartphones to tablets in various sizes. Therefore, in order to create more optimal shopping conditions, it is necessary to use more sophisticated tools to detect customers’ device environments.

More optimized shopping environments do not require business practitioners to prepare additional versions of their websites for all existing device types. This also does not imply making the websites more user friendly. Rather, using the current classification, businesses need to implement additional tools to customize the current content depending on the specific input-device condition. For example, webroomers (i.e., shoppers who browse multiple product options online before purchasing one of them at a brick-and-mortar store), who used a touch interface to extensively browse for multiple high-involvement products, may not recognize brand names when they arrive at the offline store. People who shop solely online using a touch interface may also experience difficulty recalling brand names by the time they need to make a final purchasing decision. Therefore, when presenting complex product information or high-involvement product categories, online retailers need to simplify their web content in order to reduce shoppers’ cognitive load, and in turn, helping to improve their information recall. Even more helpful would be if product information stored on the web could be easily transferred to shoppers’ smartphones via text messages, e-mail, or other apps, allowing
shoppers to easily locate previously accessed product information whenever and wherever they resume their shopping, whether online or offline.

In terms of engagement, online retailers may want to increase shoppers’ engagement and purchase intentions of low-involvement product if they use a mouse. If shoppers with low-involvement use a mouse device, they tend to be less engaged with the shopping experience and tend to have lower purchase intentions than when using a touch interface. To prevent them from losing interest in retailers’ sites and to avoid losing them to competitors, retailers need to find better ways to increase customer engagement and customers’ time spent on the sites. They may need to render their online shopping environments more appealing and optimize user experiences. Retailers may also wish to use additional promotional strategies such as special promotional offers or discount offers on the website in order to motivate shoppers and keep them engaged. On the other hand, if low-involvement shoppers use a touch interface, retailers may need to program their site to encourage these shoppers to make larger purchases (i.e., bundles) as low-involvement shoppers are more engaged and are more likely to purchase the products.

In addition to retailers, online media and advertisers may benefit by identifying input devices. Online media such as Facebook and Google have been collecting a vast amount of user data ranging from basic demographic information to detailed usage patterns. Advertisers have been utilizing such data to identify their target consumers and deliver ads to those potential consumers as accurately as possible. These data may be further refined by adding input device types and device usage patterns of individual target
consumers (e.g., using touch-screen devices for Facebook, but mouse devices for web searching).

Besides website optimization, the findings also suggest a potential influence of other environmental cues on online shopping. The fact that device type affects shopper engagement and product-information recall itself suggests that other sensory cues in shoppers’ physical environments, such as location, lighting, scents, or background noise, may also play a role. Therefore, anyone providing websites or interactive content that is transmitted through computers should make an attempt to better understand the overall nature of such sensory experiences in these various physical environments. Although cues outside websites may be beyond the practitioners’ control, they may still provide content and services that better fit certain physical environments utilizing existing tools. For example, people who are shopping online from a coffee shop may be affected by coffee scents or background music and may therefore feel more casual, while those who are online shopping in their offices may be in a rush to make a purchasing choice before their next meeting. Most retailers’ websites are capable of estimating location and region for most of their shoppers in real time (i.e., those with enabled location settings); thus, there may be more opportunities for retailers to customize their content or at least their one-off promotional offers.

**Limitations and Future Research Directions**

As one of the first studies exploring how touch interface influences online shopping experiences, this study explored a few of the common variables that most concern retailers and marketers. The results provide a broad overview of both the positive
and negative effects of different devices. However, these findings may be qualified by a few limitations. First, since this study focused on measuring variables during the shopping process, future studies may need to verify the outcomes of the shopping experience (e.g., products shoppers eventually choose) in order to have a more comprehensive view of the influence of device types.

Secondly, to maximize the generalizability of the findings, my design implemented one of the most common computer environments (desktop PCs) that most shoppers are familiar with. However, some of the findings may vary slightly if the monitor sizes are significantly larger or smaller than the test equipment I used in these experiments. The influence of screen sizes may either enhance or reduce some of the effects found in this investigation. For example, 55-inch LED touch-screen advertisements at airports may produce slightly different effects because of their size as well as the simpler message in contrast to reading a webpage full of product details. Thus, future research need to explore the potential effects of monitor sizes, for example between smartphones and mega touch-screens for outdoor advertisements.

Third, this study did not control for types of touch gestures or mouse interactions in order to keep the shopping experiences as natural as possible. It would be helpful to ascertain whether different navigation activities (e.g., tapping, swiping) or different viewing directions (e.g., swiping horizontally or vertically) influence online shopping experiences and shoppers’ cognitive and sensory processing during the purchasing process.
Fourth, an additional concern is the chosen product types. In this research, I selected camera and sweatshirt product categories based on the pilot study results. The results from the pilot study showed that electronics (e.g., cameras) as well as clothing items (e.g., sweatshirts) are the most popular online products among college students. Electronics were more likely to increase the students’ involvement levels while basic clothing items such as sweatshirts were not. Despite this effort, there may be confounding effects of product categories with involvement levels because individual differences in shoppers’ perception of the test product categories depend on the objective of their shopping (e.g., shopping for someone else vs. yourself). Therefore, some of the present findings are bound to the shopping occasions and product categories that are similar to those tested in these experiments. Moreover, based on the pilot study results, I did not test products that most people purchase without much browsing (e.g., required textbooks). The influence of devices may not be significant when shopping for such purchase-only products because shoppers may not be exposed to the device environments long enough.

Lastly, as discussed in both studies, the results on information recall are limited to brand names only, which narrow the generalizability of the findings. In future research on device environments, testing cognitive performance, such as product information recall, needs additional measures to capture individual differences in preferred information criteria (e.g., price).
Conclusion

Online shopping environments have evolved rapidly over the last several years with the diversification of computing device types. As one of the first studies to examine the impact of touch interfaces on shopping, this study examined the tactile sensations of online shoppers by comparing two input devices (i.e., touch interface and mouse). The findings revealed both positive and negative aspects of touch interfaces and mouse devices. Touch interfaces (vs. mouse devices) are more likely to increase shopper engagement, which leads to higher purchase intentions, but less likely to benefit in recalling brand names. Further research might clarify the remaining questions regarding the impact of device type on online shoppers’ eventual final decisions. Essay 2, therefore, examines if the final purchase decisions actually differ by the type of input device beyond simply measuring levels of purchase intentions.
References


Chapter 3.

Essay 2: The Impact of Touch Interfaces on Online Shoppers’ Product Choices
Introduction

Background

In Essay 1, I examined the effects of touch interfaces on online shopping in comparison to the impact of mouse devices. I discovered both positive and negative effects of touch interfaces on the online shoppers, with the following three key findings: (a) using a touch interface when browsing products online led to lower brand-name recall (for high-involvement only), suggesting that touch interfaces have a negative effect on high-involvement shoppers’ cognitive performance compared to mouse devices; (b) using a touch interface led to higher engagement among low-involvement shoppers, resulting in higher purchase intentions; and (c) shoppers’ involvement levels moderated the impact of touch interfaces on information recall and engagement while displaying no significant moderating effect on purchase intentions.

Although these findings provide new evidence that device types play an important role in managing online shoppers’ purchase intentions, it is still unknown whether the effects of different device types translate to shoppers’ final product choices, which are also critical for business planning. Because I controlled for the product types to be the same (e.g., point-and-shoot-cameras) in Essay 1, the measurement of purchase intentions alone could not specify whether device types lead to choosing a product that is more salient in a specific product attribute (e.g., hedonic vs. utilitarian) than other products. Because purchase intention measures are to determine willingness to purchase products, these measures do not reflect shoppers’ final purchase decisions. Thus, to understand
shoppers’ final purchase decisions, it is necessary to specifically ask for choices among different product options.

Furthermore, besides the findings regarding information recall, engagement, and purchase intentions, it is still unclear which characteristics of the different input devices specifically lead to such outcomes. As touch interfaces are more cognitively challenging than other devices, such challenges may lead touch-interface users to rely more on certain types of cues (e.g., affective cues) during the shopping experience, and to choose a certain type of product (e.g., hedonic product). Likewise, as touch interfaces in low-involvement conditions tend to result in higher engagement, it is possible that such engaging experiences may cause shoppers to rely more on certain types of cues (e.g., affective cues) from products or the shopping atmosphere. Therefore, in Essay 2, I examine why and how using a touch interface affects final purchase decisions by analyzing the key characteristics of touch interface user experiences.

**Touch and Emotion**

Previous research has shown that touch communicates the positive and negative valence of emotions, as well as their intensities (Jones & Yarbrough 1985; Knapp & Hall, 1997). Touch tends to enhance the intensity of emotion displayed on people’s faces and in their voices (Knapp & Hall, 2010) and clearly delivers distinct emotions (Hertenstein, Holmes, McCullough, & Keltner 2009). Examples of touch cues include a firm handshake versus a light handshake, or a gentle pat versus a strong pat. For example, touching a certain part of the body conveys the valence of an emotion and its intensity. People may communicate various emotions by touching just a stranger’s arm. Even
within restricted conditions of touch, people can communicate emotions such as anger, fear, disgust, love, gratitude, sympathy, happiness, and sadness as accurately as they can with facial or vocal expression (Van Erp & Toet, 2013).

The existing literature in human-computer interactions (HCI) suggests the possibility that computer-mediated touch may be a tool capable of communicating emotions (Van Erp & Toet, 2013; Gao, Bianchi-Berthouze, & Meng, 2012). Much research in HCI has examined touch screens as tools to communicate or detect emotions by comparing various user interactions, including different keystroke behaviors (Gao et al., 2012; Khanna & Sasikumar, 2010; Lv, Lin, Yin, & Dong, 2008) and tactile gestures (e.g., squeezing, patting; Hertenstein et al., 2009). Although psychology research suggests that there may be some limitations in detecting emotions by using touch alone because multiple emotions may be present in the same type of tactile gesture (Herstenstein et al., 2006; Herstenstein et al., 2009), such distinction may be possible when using a modern touch-interface device. A study (Gao et al., 2012) concerning iPods suggests that touch technology can discriminate between four emotional states (i.e., excited, relaxed, frustrated, and bored) and two levels of arousal by measuring finger strokes. How often computer users press certain keys may be determined by the emotional states of computer users. For instance, users who are angry display stronger finger strokes (Gao et al., 2012). When users are in a positive mood, their typing speed is likely to increase, while it is likely to decrease when users are in a negative mood (Khanna & Sasikumar, 2010).
The Affect-Driven Nature of Touch Interfaces

These days, most touch interfaces are available on smartphones and tablet PCs that are designed for more casual or simpler computing activities such as quick information browsing (e.g., price checks for product options) and instant communication (e.g., text messaging), as opposed to ordinary desktops and laptops, which remain more popular for complicated, work-related tasks (e.g., creating a budget chart using Excel). Due to the touch interfaces’ casual and fun nature, it is possible that shoppers perceive a touch interface to be more engaging and enjoyable to use. As a result, shoppers using a touch interface (vs. using a mouse) may rely more on affective cues, which leads them to make faster purchase decisions. In other words, the higher purchase intentions of touch-interface users found in Essay 1 might be a reflection of shoppers making faster purchase decisions due to the affective nature of the device environment. Indeed, research on educational software and games has shown that using a touch screen leads to higher user engagement and satisfaction (Enriquez, 2010), suggesting that touch-interface user experiences are potentially more affective or fun. The findings in Essay 1 are also in line with the existing literature that touch-interface users are more likely to engage with their user experiences (Enriquez, 2010; Neumann, 2014; Thompson, Nordin, & Cairns, 2012). Therefore, touch-interface user experiences are similar to affect-driven information processing, which relies more on affective/hedonic cues than on cognitive/utilitarian cues.

In addition to the casual nature, the negative impact of touch interfaces on memory, as discussed in Essay 1, may increase shoppers’ reliance on affective cues.
According to the affective-cognitive model, when people perform complex tasks that are likely to deplete their cognitive resources, they tend to process information by relying more on emotional and affective cues than on logical and cognitive cues (Shiv & Fedorikhin, 1999). As touch interfaces tend to be more cognitively challenging to operate (Negulescu, Ruiz, Li, & Lank 2012; De Waard, Lewis-Evans, Jelijs, Tucha, & Brookhuis, 2014), it is likely that using a touch interface results in resource depletion, leading to a stronger reliance on affective cues. When people become more reliant on affective cues, they tend to make decisions faster because they browse alternatives that are easier to compare and require less cognitive effort than when relying on cognitive cues, which tends to lead to more deliberate, memory-based decisions. As a result, people relying on cognitive cues experience resource depletion and may choose products with stronger hedonic attributes than utilitarian attributes (Shiv & Fedorikhin, 1999). Thus, touch interface users are likely to make their purchase decisions more quickly than non-touch interface users and are more likely to choose hedonic product options.

In summary, due to the affect-driven nature of touch interfaces, touch-interface users are likely to make faster purchase decisions and are likely to choose products that are more salient in their hedonic or affective attributes. However, the marketing literature has not yet examined the association and applicability of affective-cognitive theories for explaining the user experiences of touch interfaces. In Essay 2, I assess whether affective-cognitive theories are applicable and determine the characteristics of touch-interface user experiences by examining the impact of touch interfaces on online shoppers’ purchase decision patterns.
**Literature Review**

**Affective Information Processing and Immediate Purchase Decisions**

In the marketing literature, one of the most commonly discussed topics is whether consumers reach a product selection on the basis of affective cues or on the basis of cognitive cues such as detailed product information (e.g., Chang & Pham, 2013; Nenkov & Scott, 2014; Okada, 2005; Schmitt, Brakus, & Zarantonello, 2015; Shiv & Fedorikhin, 1999). Shiv and Fedorikhin (1999) suggest that consumers choose products that elicit positive affect while rejecting those that elicit negative affect. They argue that people tend to make decisions almost *immediately* or *automatically* when they rely on affective cues, while tending to go through a more *deliberate* decision-making process when focusing more on cognitive cues.

These arguments about automatic and deliberate processes are consistent with several other theories on information processing (e.g., Epstein, 1993; Hoch & Loewenstein, 1991; Leventhal, 1984, 1993; Zajonc, 1980). For instance, Epstein’s (1993) Cognitive-Experiential Self Theory (CEST) proposes two systems: an affective system, which processes information rapidly, and a rational system, which processes information in a more deliberative and refined manner. Hoch and Loewenstein (1991) and Zajonc (1980) suggest that affect is associated with rapid information processing whereas cognition is more closely associated with deliberative information processing. Leventhal’s (1984, 1993) theory is also similar, in that affective reactions arise from an innate route, which involves sensory-motor processes. Chang and Pham’s recent study (2013) also supports the connection between affective cues and judgments. Their findings
suggest that people tend to rely more on affective feelings in judgments when their outcomes are set in the near future than when the outcomes are set in the more distant future. In particular, temporal proximity enhances the relative preference for affectively superior product options and increases the impacts of affect on product evaluations (Chang & Pham, 2013).

**Product Choices: Hedonic versus Utilitarian**

Following the information-processing models presented above, the literature on hedonic consumption has demonstrated that consumers more strongly rely on affective or emotional criteria (e.g., fun, excitement, pleasure) when their goal is to seek pleasure from the process of purchasing a product or from the product itself. This often results in choosing a product with stronger in such hedonic criteria.

Hirschman and Holbrook (1982) define hedonic consumption as the type of consumer behavior that depends on affective and pleasure-seeking criteria, such as the “multisensory, fantasy and emotive aspects of one’s experience with products” (p. 92). Singer (1966) holds a similar view of hedonic consumption behavior and suggests that this is related to imaginative dimensions of reality. Hagtvedt and Patrick (2009) also suggest that affect-based information processing is “feelings-based,” whereas cognition-based information processing is “reasons-based,” which depends more on relevant explanations (p. 610). In other words, pleasant or fun experiences (vs. work) lead consumers to rely more strongly on affective cues, resulting in hedonic product choices (Laran & Janiszewski, 2011). For brand evaluations, emotions also play an important role
that brand-elicited emotions tend to influence consumer evaluations of brand extensions (Yeung & Wyer, 2005).

Many other studies (e.g., Dubois & Paternault, 1995; Okada, 2005; Pham, 1998) are also in line with the literature outlined above regarding the nature of hedonic and utilitarian consumption. In summary, research has commonly found that consumers evaluate “feelings-based” products spontaneously on the basis of the emotions and feelings that the products evoke (Schwarz & Clore, 1983), while their evaluation of “reasons-based” products relies more on objective rationality.

**The Hedonic Nature of Touch Interfaces**

Considering the casual device usage patterns, touch interfaces are likely to strengthen the affect-driven and hedonic nature of touch-screen user experiences. Because people tend to use touch screens more often for casual or easier tasks, they may perceive the atmosphere of online shopping experience to be more engaging or fun. Consequently, such casual user experiences may highlight the more affective, emotional, or hedonic aspects of shopping experiences, which may lead to product choices that resemble those of shoppers who rely on affective cues to process information.

In addition to the casual usage, the cognitively demanding user experience may amplify the affective nature of touch interfaces. The extant literature suggests that the consumers’ status of cognitive resource-depletion leads them to depend on affective or cognitive cues that therefore lead to hedonic or utilitarian choices, respectively (e.g., Chang & Pham, 2013; Moore & Konrath, 2014; Petty & Cacioppo, 1979, 1986; Petty, Cacioppo, & Schumann, 1983; San Martin & San José, 2011; Shiv & Fedorikhin, 1999).
When consumers have sufficient resources to process information, they tend to choose products based more on cognition than on affect. For example, when choosing food while not cognitively depleted, consumers are more likely to choose a healthier option such as fruits (utilitarian choice) instead of chocolate cookies (hedonic choice), while tending to choose the opposite if their cognitive resources are insufficient (Salmon, Fennis, De Ridder, Adriaanse, & De Vet, 2014). Based on the findings of Essay 1, touch-interface users’ information-processing patterns seem to be closer to affect-driven, lower-order processing. In Essay 1, touch-interface users (vs. mouse users) displayed lower information-recall in high-involvement conditions while displaying higher engagement and higher purchase intentions in low-involvement conditions, implying the affective characteristics of touch-interface experiences. In other words, touch interfaces (vs. mouse devices) are more likely to strengthen affect-based processes whereas mouse devices (vs. touch interfaces) are more likely to trigger cognition-based information processing.

Considering the previous literature and Essay 1 findings, I hypothesize that online shoppers using a touch interface to browse products are more likely to be engaged in affect-based information processing and are more likely to choose hedonic products than are shoppers using a mouse to browse such products. Moreover, because affect-driven decisions tend to be made faster than are cognition or memory-based decisions, it is likely that touch-interface users make their purchase decisions more immediately and are less likely to prolong making decisions than are mouse users:

**H1.** Online shoppers using a touch interface to browse products display a higher likelihood of choosing a hedonic product than those using a mouse.
**H2.** Online shoppers using a touch interface to browse products display a higher likelihood of making an immediate purchase decision than those using a mouse.

**The Moderating Role of Task Complexity**

Beyond the resource depletion and the casual usage associated with touch interfaces, performing a complex task also results in reduced attention and worse information processing, implying an affect-driven effect. For instance, in-store shoppers pay less attention to the visual details of their product choices during a subsequent shopping task if the decision heuristics of the first task were too complex because the task complexity depletes cognitive resources. When shopping goals are not specific (e.g., find a jacket you like), it is likely to be more demanding on shoppers’ cognitive resources because they tend to look at more items before making a decision. This first task in turn leads to customers browsing fewer items before making their final decision in the subsequent shopping task (Wästlund, Otterbring, Gustafsson, & Shams, 2015).

Task complexity moderates the impact of the environment on product choice. Shoppers tend to reduce the difficulty level of tasks or choose options that are less complex and easier to justify when faced with decision-making tasks that are either difficult or easy to assess. For example, if resources for time and cognitive capacity are depleted, it is less likely that people engage in effortful trade-off comparisons, resulting in final choices that better reflect their intuition (Bettman, Luce, and Payne 1998; Dhar and Nowlis 1999). When making a complex decision, people tend to simplify the decision-making process by eliminating certain criteria in order to reduce the load of
information (Payne, 1976). For instance, when consumers perceive the high temperature in the room (i.e., added task-complexity), their cognitive performance becomes poorer and become less likely to make difficult product choices than those who did not experience a higher temperature during the completion of the task. On the other hand, consumers who did not have the temperature stress are more likely to choose easier options, because these do not require complex analyses of product attributes as required when making difficult product choices (Cheema & Patrick, 2012). Likewise, when people experience low resources for self-control, they tend to make quick and simple decisions because they are able to exclude some of the product information and save cognitive resources (Gigerenzer & Gaissmaier, 2011; Shah & Oppenheimer, 2008).

The literature on compromise and attraction effect also supports the notion that consumers tend to make easier choices when they have insufficient cognitive resources. The attraction effect refers to a situation in which the introduction of a relatively inferior alternative increases the attractiveness of the dominating alternative (Huber, Payne, & Puto, 1982; Huber & Puto, 1983; Ratneshwar, Shocker, & Stewart, 1987; Simonson, 1989). In contrast, compromise effects occur when consumers review detailed attributes or functional specifications of products and decide on a safe or compromise option that lies in between two other options (Huber & Puto, 1983). When consumers have to make a complex purchase-related decision by considering not only product attributes but also non-product attributes, such as other people’s evaluations of their product choice (e.g., gifts; Simonson, 1989), they tend to experience resource depletion, which in turn,
increases the attraction effect and decreases the compromise effect (Pocheptosava, Amir, Dhar, & Baumeister, 2009).

In summary, a high level of depleted cognitive-resources is likely to influence consumers such that they lean more toward easier options, which are hedonic choices. When consumers encounter a high amount of product information to process, they must use up their cognitive resources to process it. This high cognitive load (vs. low cognitive load) increases consumers’ reliance on affective cues and results in consumers making more hedonic choices and faster decisions that may reflect impulsive responses. In other words, task complexity is likely to moderate the impact of resource depletion on consumers’ final decisions.

As explained previously, touch-interface experiences are likely to encourage such affect-driven information-processing patterns, and task complexity may moderate the impact of touch interfaces. Thus, I propose that higher task complexity positively impacts the effect of touch interfaces on choices (H1) and positively impacts the effects of touch interfaces on the likelihood of making immediate purchase decisions (H2), as task complexity tends to deplete the cognitive resources that consumers need during their purchase decision-making processes. In addition, I propose, as in Essay 1, that engagement mediates the impacts of device type on the dependent variables, which in this case are product choices and the likelihood of making immediate purchase decisions:
**H3a.** Task complexity moderates the impact of touch interfaces on choices such that touch-interface users (vs. mouse users) who experience higher task-complexity have a higher likelihood of making hedonic choices.

**H3b.** Task complexity moderates the impact of touch interfaces on immediate purchase decisions such that touch-interface users (vs. mouse users) who experience higher task-complexity display a higher likelihood of making immediate purchase decisions.

**H4a.** Shopper engagement mediates the impact of touch interfaces on the likelihood of making hedonic choices.

**H4b.** Shopper engagement mediates the impact of touch interfaces on the likelihood of making immediate purchase decisions.

Figure 4. Essay 2 Conceptual Framework

![Diagram](image)

As an extension of Essay 1, which focused on measuring purchase-related evaluation criteria, Essay 2 explores additional characteristics of touch-interface environments in order to understand shoppers’ final product choices. I examine the final product choices and immediate purchase decisions of online shoppers as indicators of
reliance on affective cues. In the following experiment, I investigate the types of products that shoppers choose (e.g., hedonic vs. utilitarian) and how these choices differ by input-device type. In order to investigate the potential moderating effects of task complexity, I examine whether task complexity has any influence on the process of choosing products as suggested in the literature (Cheema & Patrick, 2012). I also examine an additional indicator of product choice by measuring the likelihood of immediate purchase decisions, in which the higher (vs. lower) levels tend to indicate a hedonic (vs. utilitarian) nature of purchase decisions.

Method

Design

I recruited 119 participants via e-mail announcements to several target groups. These groups included students at a large west coast university, former students at the same university who were registered in the lab database, and all current students who opted-in for promotional mail. Sixty-four percent of the participants were women. Most participants were between 18 and 23 years old (18–23 (80.7%) > 24–29 (10.1%) > 30 or above (5.0%; 4.2% with no answer)). Ninety-five percent of participants were students, with 2.5% full-time/part-time professionals and 2.5% reported other occupations. The experiment was a 2 × 2 between-subjects design (device (touch interface and mouse) × task complexity (high and low)) conducted using a desktop computer with a 22-inch touch-screen monitor, a mouse, and a keyboard. Participants in touch-interface conditions used only the monitor and were instructed to use their fingers to browse the content.
displayed on the screen. Non touch-screen participants used the same monitor; however, they used a mouse and a keyboard to browse the content instead of a touch interface.

Table 7. Experiment Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Device</th>
<th>Task Difficulty</th>
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</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>Touch Interface</td>
<td>High</td>
</tr>
<tr>
<td>Condition 2</td>
<td>Touch Interface</td>
<td>Low</td>
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<tr>
<td>Condition 3</td>
<td>Mouse</td>
<td>High</td>
</tr>
<tr>
<td>Condition 4</td>
<td>Mouse</td>
<td>Low</td>
</tr>
</tbody>
</table>

During the experiment, each participant was seated at an individual desk to prevent other participants from disturbing him or her. Participants were randomly assigned to four conditions. Each group comprised between twenty-eight and thirty-one subjects. To manipulate task complexity, I used two versions of a fictitious Bluetooth speaker e-commerce site, one of which was a full website with lengthier product descriptions than the other. Keeping product images and the website design the same, I shortened the textual product descriptions from the full site to create the low task-complexity website (see “Material 1. Websites” for details). High task-complexity groups browsed the full-version site using either a touch interface or a mouse, respectively. Low task-complexity groups browsed the simpler version of the website also using either a touch interface or a mouse.
Procedure

Participants first completed a pre-experiment questionnaire that measured their levels of involvement, which indicate their personally perceived relevance and motivation toward the shopping task and product category. After completing the pre-experiment questionnaire on paper, the participants read the following shopping scenario, along with instructions about how to operate the computer:

During the experiment, imagine that you just moved into a newly opened apartment with your best friend. You are excited about your new place and are interested in purchasing a new Bluetooth speaker with which you can enjoy listening to music. A $200 gift card has been given to you to buy a Bluetooth speaker. While navigating the site, please pay close attention to attributes and brand names of products because you need to evaluate them when you’d like to make a choice.

Until they finished reading the above instructions, the computer monitors were turned off, and the participants were not allowed to use the computers. After all of the participants read the instructions, they were allowed to navigate one of the websites. Each website displayed nine Bluetooth speakers from three brands (i.e., three speakers each from Bose, Sony, and Logitech). After browsing the site for six minutes, the participants were asked to stop browsing, turn off their monitors, and complete a post-experiment paper questionnaire that measured the dependent variables (i.e., final product choice and immediate purchase decisions); the mediator variable (i.e., engagement); and the moderator variable (i.e., perceived task-complexity).
Material 1. Websites

The design of the test website, similar to most e-commerce websites, consisted of a landing page displaying images of all nine products, each linking to an individual product page. Each product page displayed three-to-five images and text descriptions of the product, including price. Both the images and product descriptions were taken from Amazon.com as of October 5, 2015. To make the website look as realistic as possible, I varied the number of product images but kept the varying range to be between three and five images. To manipulate task complexity, I created two versions of the test website. For high task-complexity, I used the site that displayed the full product text descriptions from Amazon.com, while for low task-complexity, I shortened the text descriptions to less than half the length of the full descriptions. Prices and product images remained the same for both websites. The prices of the products on the website ranged from $75.00 to $333.00 in both high and low task-complexity conditions. In order to control the fictitious online retail environment, both websites displayed neither other consumers’ product reviews nor online advertisements in order to better control the fictitious online retail environment. The websites used the same design template as in Essay 1, and both high task-complexity and low task-complexity sites were hosted concurrently by a third-party hosting service. During the experimental sessions, participants browsed the website using Internet Explorer in full-screen mode which hides the URL, the menu bar, and the entire Windows taskbar, including the clock.
Material 2. Questionnaires

As explained above, I measured the variables using two paper questionnaires, one each for pre-experiment and post-experiment. This involvement measure was designed to understand whether individual participants’ different levels of involvement prior to shopping affected their levels of engagement during the shopping experience because involvement is often an antecedent of engagement (Eroglu, Machleit, & Davis, 2001). The same questionnaire also measured previous experience with shopping for Bluetooth speakers in order to understand whether previous exposure to the product may have influenced participants’ responses. Multiple questions referred to individual participants’ shopping experiences with many items, including Bluetooth speakers, so that the participants were not made aware of the product that was used for the shopping experiment. In addition to involvement and previous shopping experience, the pre-experiment questionnaire measured Need for Cognition (NFC) in order to assess if individually different interest in cognitive information influenced individuals’ responses.

The post-experiment questionnaire measured final product choice (i.e., hedonic vs. utilitarian), immediate purchase decisions, immediate/general purchase intentions, engagement, and perceived task-complexity. In addition to these key variables, I assessed other factors, including usability of the website, demographic profile, preferred online-shopping patterns, and device-usage patterns. I measured all items on a seven-point scale, except for product choice and a few items described below.

Product choice. On the post-experiment questionnaire, the participants chose one Bluetooth speaker from two options, A and B. Option A was introduced as a Bluetooth
speaker that is ideal for work (hedonic choice), while option B was described as ideal for parties and entertainment (utilitarian choice). For both A and B, I set the price at “$100” and colors as “black or gray.”

**Immediate Purchase Decisions.** For the likelihood of making immediate purchase decisions, I used two measures, ranging from 1 (Extremely Unlikely) to 7 (Extremely Likely): I asked (a) which product (A, B, or nothing) the participants would purchase immediately; and (b) concerning how likely participants were to purchase at least one of the Bluetooth speakers on the website “in the near future” instead of “immediately,” without asking for any other details on specific purchase timing. These two questions were designed to understand participants’ tendency towards an immediate purchase decision. These measures also explain the likelihood of choice deferral because participants who are faster in making a purchase decision would be less likely to defer their decision.

To understand whether the likelihood of immediate purchase decisions differed from general, non-immediate purchase intentions, I asked participants about the overall likelihood that they would purchase at least one of the speakers that they had browsed on the test website. I also tested indirect measures of general purchase intentions by asking six questions on a seven-point scale (1 = Very Unlikely to 7 = Very Likely): (a) likelihood to visit stores or websites to learn more about the products; (b) likelihood to look for more information online; (c) likelihood to sign up online for e-mails, catalogues, and other promotional materials; (d) likelihood to seek other people’s opinions about the
products; (e) likelihood to read online product reviews; and (f) likelihood to purchase the products.

In addition to immediate and general purchase intentions, I measured participants’ willingness to pay (WTP) by asking two questions: (a) a multiple choice question regarding the preferred price that participants are willing to pay compared to the average price on a seven-point scale ranging from 1(Nothing) to 7 (A Lot More than Average), and (b) an open-ended question asking for the approximate price they would prefer to pay (“Among the Bluetooth speakers you browsed today, approximately how much are you willing to pay for the one that you like the most?”).

**Engagement.** The questions for engagement were taken from the “User Engagement Scale,” which was designed specifically to measure user engagement in online shopping and other types of interactive content (O’Brien, 2010; O’Brien & Toms, 2008, 2010). To determine engagement levels, I used the average of the same ten questions from the scale that I used in Essay 1. Also, as in Study 2 of Essay 1, I adjusted the scale to include seven points (1 = Extremely Unlikely to 7 = Extremely Likely) instead of the original six (1 = Extremely Unlikely to 5 = Extremely Likely; 6 = Not Applicable), in order to maintain consistency with the other scales used in this study. (α = .89)

**Perceived task-complexity.** I measured participants’ average perceived task complexity as a manipulation check. The same post-experiment questionnaire included four questions, regarding: (a) how effortful it was for participants to understand the product information on the test website (1= A Lot Less than I Expected to 7 = A Lot More than I Expected); (b) how lengthy was the information (1= Not at All to 7 = A Lot More
than I Expected); (c) how easy was the information to understand (1 = Very Easy to 7 = Very Difficult); and (d) how easy it was to operate the device (1 = Very Easy to 7 = Very Difficult). I used the average score of the first three questions (a, b, and c) to run the task-complexity manipulation and used (d) to determine perceived task complexity of device operation (α = .61).

**Other variables.** Using a seven-point scale, the post-experiment questionnaire also inquired about the participants’ mood, website usability, product-information recall, demographic information, preferred online-shopping patterns, and device-usage patterns. Three questions asked about participants’ current feeling, with response ranging from 1 to 7: (a) *Very Negative* to *Very Positive*; (b) *Very Sad* to *Very Happy*; and (c) *Very Depressed* to *Very Excited. (α = .84).* I measured website usability using the same measures used in Essay 1 (α = .81).

In order to measure product-information recall, I used the same unaided-recall question from Study 2 of Essay 1. The participants wrote four types of information about their one favorite product: (a) its brand name; (b) product color; (c) features; and (d) price range. I scored the participants’ answers into five categories evaluated from 0 to 1 point, as follows: (a) answers that were correct (1 point; e.g., “Bose”); (b) answers that were mostly correct, with minor typos (0.75–0.8 point; e.g., “Boise” instead of “Bose”); (c) answers that were half correct (0.5–0.55 point; e.g., “White/Grey” instead of “White”); (d) answers of which less than half were similar to the correct answer (0.25–0.3 point; e.g., “Logui” instead of “Logitech”); and (e) completely incorrect answers or no answers (0 points). In addition, when categorizing answers, I considered how helpful recalled
information might have been if the participants actually attempted to find their favorite product again by going to a store or visiting a real website. Thus, average points higher than 0.5 meant that participants remembered 50% of product information correctly, which would be relatively more helpful than remembering less than 50% when attempting to locate the product again at a different retail location.

At the end of the questionnaire, the participants provided their demographic information, including their gender, age, occupation, and average income, in addition to previous experience with touch interfaces and preferred online-shopping patterns. After completion, the participants received a cash payment ($5.00), and those who referred an eligible subject to the experiment received an additional referral fee ($1.00).

Other Experimental Procedures

As in Essay 1, the experiment controlled several additional factors to reduce possible confounding effects. As mentioned above, I prevented access to time information so that the participants remained unaware of how much time had passed during the session. In addition, I did not let participants use watches or electronic devices that they could have used to check the time. When measuring product-information recall, I blocked access to product information by turning off the monitors before and after the shopping sessions. Moreover, I kept the equipment conditions compatible by using the same size monitor for both touch-interface and mouse conditions. Finally, based on the Essay 1 pilot study, I designed the website to resemble a neutral e-commerce website in order to minimize the confounding effects of website design that might result from visual
aesthetics, speed, or usability (ease of navigation), all of which influence engagement (O’Brien & Toms, 2008, 2010).

**Results**

By varying the length of product descriptions, manipulation of task complexity was successful; perceived task-complexity was significantly higher in the high task-complexity condition than in the low task-complexity condition (High ($M = 3.81, SE = .12$) > Low ($M = 3.12, SE = .12$); $F(1, 115) = 16.03, p < .0001$). Pre- and post-experiment involvement levels did not show a significant association ($r = .18, p > .05$), and pre-experiment involvement did not predict post-experiment involvement levels ($\beta = .18, t = 1.97, p > .05$), suggesting no significant issues in involvement.

**Product Choices**

As predicted (H1), device type was likely to be a significant predictor of product choices ($b = 1.19$, Wald $\chi^2(1) = 6.17, p = .01$). Touch-interface users were more likely to choose a Bluetooth speaker that had a hedonic attribute (i.e., ideal for parties and entertainment) than mouse users. Among those who chose the hedonic option, touch-interface users were more likely to choose the hedonic option (56%) than mouse users (44%; $\chi^2(1, N = 119) = 6.47, p = .01$). Amongst those who chose the utilitarian option (i.e., ideal for work), 71.4% were mouse users while only 28.6% were touch-interface users. In the touch-interface conditions, 86.4% of touch-interface users chose the hedonic option while only 13.6% of them chose the utilitarian option. In the mouse conditions, the proportion of utilitarian choice (33.3%) was much larger than that of touch-interface users in mouse conditions. This overall tendency toward the hedonic option was expected.
regardless of device type because the most common usage of Bluetooth speakers is for entertainment activities such as listening to music rather than for work-related tasks. Despite the concern, the device effect was fairly strong in that touch interface users (vs. mouse users) were significantly more likely to choose the hedonic option. Task-complexity, however, did not account for the choices \( (b = -.35, \text{Wald } x^2(1) = .55, p = .46) \) and showed no significant interaction effect with device type \( (b = -.71, \text{Wald } x^2(1) = .55, p = .46) \).

Figure 5. Product Choices

In summary, touch interfaces (vs. mouse devices) were likely to attract consumers to more hedonic (vs. utilitarian) products; however, the complexity of product information neither amplified nor reduced this device effect and had no significant influence on the product choice. It is possible that manipulating task-complexity solely by varying information length was too weak to influence the participants’ decisions even...
though the manipulation check displayed no significant issues. In addition to
manipulating the content length, it may be necessary to manipulate vocabulary or
wording of the product information as well as page layout. It is also possible that task
complexity moderates the impact of device type on subsequent choice tasks, not on the
initial choice task.

Immediate Purchase Decisions

H2 proposed that touch-interface users are more likely to make an immediate
purchase decision and less likely to defer their decisions than are mouse users. As
described earlier, the participants answered two questions about immediate purchase
intentions.

Immediate purchase decisions. Higher immediate purchase intention implies
that shoppers make a purchase decision more immediately and are less likely to defer
their choices. In this experiment, when participants made their choice of products to
purchase immediately, between the hedonic (i.e., option A: ideal for parties and
entertainment) and utilitarian (i.e., option B: ideal for work) speaker options, touch-
interface users (55.8%) were more likely to choose the hedonic option than were mouse
users (44.2%; $x^2(2, N = 119) = 6.04, p < .05$). However, in both device conditions, the
majority of participants chose the hedonic option over the utilitarian one. In the touch-
interface conditions, most participants (72.9%) chose the hedonic option, followed by the
no product choice (18.6%), and finally the utilitarian option (8.5%). In the mouse
conditions, more participants also chose the hedonic option (56.7%) than chose the
utilitarian option (25%) or the no product choice (18.3%). Overall, the results were
similar to the product choice patterns. Touch-interface users were more willing to purchase the hedonic option immediately than mouse users, but the hedonic choices were higher than the utilitarian choices in both device conditions due to the affective usage patterns of Bluetooth speakers.

When asked for a favorite item on the website, without describing the hedonic and utilitarian attributes, device type had a marginally significant impact on immediate purchase intentions toward a favorite speaker \(F(1, 115) = 3.74, p = .06\). Contrary to my expectation, mouse users \((M = 4.53, SE = .24)\) displayed higher immediate purchase intentions towards favorite items than did touch interface users \((M = 3.87, SE = .254)\), suggesting that mouse users are more likely to make faster purchase decisions. The device conditions, however, had no interaction effect with task complexity \(F(1, 115) = .63, p = .43\).

Figure 6. Immediate Purchase Intentions
Therefore, the results support H2 which states that touch-interface users are more likely to make immediate purchase decisions than are mouse users, suggesting that touch-interface users process information driven by affect. However, when products have no clear distinctions between hedonic and utilitarian attributes, the opposite conclusion may be possible.

**General purchase intentions.** I also measured general purchase intentions toward the speakers in order to gain a comprehensive understanding of the participants’ overall likelihood to purchase. The results suggest that touch-interface users ($M = 4.97$, $SE = .22$) were more likely to purchase a product that they browsed on the website than were mouse users ($M = 4.27$, $SE = .22$; $F(1, 115) = 5.35$, $p = .02$).

Figure 7. General Purchase Intentions
Although touch-interface users were less likely to make immediate decisions, their general purchase intentions, regardless of purchase timing, tended to be higher than mouse users’, supporting the findings from Essay 1. Indirect general purchase intentions (e.g., likelihood to browse online product reviews) did not significantly differ by device type \((F(1, 115) = 1.94, p = .17)\).

**Willingness to pay (WTP) and need for cognition (NFC).** I assessed WTP and NFC as additional measures of the hedonic and utilitarian nature of device types. The responses on WTP show that participants were more likely to pay higher prices in the low task-complexity conditions \((M = 156.13, SE = 8.20; F(1, 114) = 6.31, p = .01)\) than in the high task-complexity conditions \((M = 127.51, SE = 7.92)\), and this effect did not significantly differ by device type \((F(1, 114) = .002, p = .97)\). This result is not consistent with the affective-cognitive model that when people experience resource depletion (i.e., high cognitive load), they tend to display more impulsive behavior, including instant purchase decisions, and unplanned spending. NFC, as a covariate, did not have a significant effect \((p > .05)\) on all the measures regarding choices, immediate purchase decisions, purchase intentions, and WTP and displayed no interaction effect \((p > .05)\) with devices and task complexity on the same dependent variables.

**Task Complexity**

In H3, I hypothesized that higher task-complexity moderates the impact of touch interfaces on hedonic choices (H3a) and on higher immediate purchase intentions (H3b). I manipulated task-complexity levels by varying the length of product descriptions. As explained earlier, the manipulation of the task-complexity treatment was successful,
showing that perceived task-complexity was significantly higher in high task-complexity conditions \((M = 3.81, SE = .12)\) than in low task-complexity conditions \((M = 3.12, SE = .12; F(1, 115) = 16.30, p < .0001)\). In addition to the manipulation check on task-complexity, I also measured perceived complexity regarding device operation, which did not differ by the device types, suggesting that participants perceived operating a touch interface was no more difficult than operating a mouse \((F(1, 115) = .001, p = .98)\).

There was no significant moderating effect of task-complexity on choices \((F(1, 115) = .28, p = .60)\), immediate purchase intentions \((F(1, 115) = .63, p = .43)\), or general purchase intentions \((F(1, 115) = .11, p = .74)\), suggesting no interaction between device type and task-complexity. In other words, what really influenced perceived task-complexity was the complexity of the web content (e.g., lengthier information), not the more- or less-challenging device environment. In summary, there was no significant moderating effect of task complexity on any dependent variables; the results do not support H3a and H3b.

NFC was a significant covariate for perceived task-complexity \((F(1, 114) = 15.39, p < .001)\). As in the outcome without NFC, no interaction effect existed between device type and task complexity levels \((F(1, 114) = 2.50, p = .12)\). Task-complexity levels had a significant main effect on perceived task-complexity \((F(1, 114) = 16.68, p < .001)\), suggesting the successful manipulation, but the result showed no significant main effect of device type \((F(1, 114) = .70, p = .40)\). Contrary to the NFC theory, if participants were high in their NFC, they perceived the complexity of processing the product information as being more difficult \((M = 3.33, SE = .10)\) than did those with low NFC \((M = 2.73, SE = .10)\).
= .10; $F (1, 114) = 16.68, p < .001$). Overall, NFC has no significant association with device type and has no significant influence on perceived task-complexity.

**Engagement.** Participants who shopped using a touch interface ($M = 4.59, SE = .12$) felt more engaged with shopping than those who used a mouse ($M = 4.11, SE = .12; F (1, 115) = 7.51, p < .01$). In addition, the difference between device types was stronger in low task-complexity conditions (Touch ($M = 4.63, SE = .18$) > Mouse ($M = 4.10, SE = .17$), $p = .04$) than in high task-complexity conditions (Touch ($M = 4.55, SE = .17$) > Mouse ($M = 4.12, SE = .17$), $p = .08$). However, there was no significant interaction effect between devices and task-complexity ($F(1, 115) = .07, p = .87$), suggesting that task-complexity does not significantly moderate device’s impact on engagement. In addition, these results indicate that there is no significant indirect effect of task-complexity on choices or immediate purchase intentions.

With regard to the mediation effect of engagement, proposed in H4a and H4b, although the association between touch interfaces and engagement was significant, engagement was not a significant mediator between touch interfaces and either choice or purchase intentions. Engagement had no significant impact on either choice ($b = -.38$, Wald $x^2(1) = .16, p = .69$) or on immediate purchase intentions toward hedonic/utilitarian choices (hedonic: $b = .18$, Wald $x^2(1) = .53, p = .47$; utilitarian: $b = -.13$, Wald $x^2(1) = .16, p = .69$). However, the touch-interface users ($M = 3.90, SE = .25$) reported lower immediate purchase intentions toward the Bluetooth speakers than did the mouse users ($M = 4.53, SE = .24$), though the difference was marginally significant ($\beta = .18, t = 1.93$, Wald $x^2(1) = 3.66, p = .05$).
As only partial effects exist, the conditions for the mediation effect are not supported; thus, H4a and H4b are rejected.

**Other variables.** As in the first essay, participants who shopped using a touch interface ($M = .54, SE = .04$) recalled product information less accurately than did mouse users ($M = .67, SE = .04; F(1, 115) = 4.61, p = .03$). For specific types of product information, touch-interface users ($M = .69, SE = .05$) recalled brand names less accurately than did mouse users ($M = .93, SE = .05; F(1, 115) = 11.17, p < .01$); however, there was no significant impact of device type for recalling product color ($F(1, 115) = 1.50, p = .22$), product features ($F(1, 115) = .51, p = .48$), or price range ($F(1, 115) = 3.50, p = .06$). NFC was not a significant covariate for product information recall ($F(1, 114) = .47, p = .50$).

Perceived website usability was positively correlated with engagement levels ($r = .43, p < .001$), suggesting an influence of website content on engagement. However, task-complexity levels did not have a significant main effect on perceived website usability ($F(1, 115) = 3.05, p = .08$), indicating that the website design and content were successfully controlled for task-complexity or perceived ease of use. Device type had a significant main effect on perceived website usability ($F(1, 115) = 4.97, p = .03$) as well as an interaction effect with task complexity ($F(1, 115) = 5.98, p = .02$). Using a touch interface ($M = 5.53, SE = .16$) led to higher satisfaction with website usability than using a mouse ($M = 5.03, SE = 1.6; p < .03$) although this difference was only significant in the low task-complexity (TC) conditions ($F(1, 115) = 10.66, p = .001$). In other words, touch-interface users...
who encountered the low task-complexity website experienced less resource depletion, tended to be more positive when evaluating the website content, and were more satisfied with the overall information available on the site than participants who encountered the high task-complexity site. This interaction effect between device type and task complexity implies a positive impact of touch interfaces on shoppers’ evaluation of product information and website design. That is, if product descriptions are written concisely, it is likely that shoppers who use a touch interface to browse products and evaluate their website experiences more positively than those using a mouse.

As in Essay 1, participants’ mood was positively correlated with their engagement levels. When the participants felt more positive, they were more likely to be engaged with their shopping ($r = .53$, $p < .001$). In addition, and touch-interface users ($M = 4.95$) reported feeling more positive (i.e., feeling positive, happy, and excited) than mouse users ($M = 4.57$; $F(1, 115) = 6.30$, $p = .01$).

**General Discussion**

The results presented here suggest several meaningful implications. As hypothesized, touch-interface users are likely to attend to affective cues, which lead them to make hedonic choices, and touch-interface users are more likely to make immediate purchase decisions when the distinction between hedonic and utilitarian attributes is clear. For WTP, the result did not support the existing literature on impulsive response such that shoppers in the low task-complexity conditions were willing to pay significantly higher prices for a Bluetooth speaker than those in the high task-complexity condition.
NFC also does not seem to play a significant role in both touch interface and mouse conditions, except for its negative association with perceived task-complexity.

Overall, most results are in line with the literature regarding the affective-cognitive model and information-processing styles, while some results need further exploration in order to accurately define the affect-driven nature of the touch interface.

As predicted, the process of using a touch interface to shop clearly resembles the findings suggested by affect-driven information processing: That is, touch-interface users are more likely to choose a hedonic product option and have higher immediate purchase intentions for the hedonic option than mouse users. However, task complexity, known to moderate affect-driven decisions, does not seem to enhance hedonic aspects of user experiences as related to device type. Combining these mixed results, it is possible that the affective nature of touch-interface environments does not exactly relate to the same affect-driven processes found in previous research although this study found many similarities. There may be other components that explain the unanswered part of the affective nature, which requires additional exploration.

In further investigating the affective aspects of touch interfaces, an important point of departure may lay in the reason behind why touch-interface users did not perceive the shopping task as more difficult than did mouse users, as had been expected. Although information-recall was lower among touch-interface users than among mouse users, touch-interface did not show higher perceived task-complexity than mouse users. A possible explanation for such mixed results may be associated with engagement levels. Despite the negative effects on information recall, touch-interface users were more
engaged with shopping than were mouse users. Thus, it is possible that higher engagement of touch-interface users might have attenuated their perceived task-complexity, making them less sensitive to task difficulty.

Notably, high engagement displayed a strong correlation with positive mood \( (r = .53, p < .01) \), and touch-interface users felt more positive, happier, and more excited than did mouse users. This correlation is also consistent with the findings reported in Essay 1, implying a strong overall association between engagement and mood in touch-interface environments. In addition, touch-interface users evaluated their shopping experiences and the website usability more positively than did mouse users. Therefore, it is very likely that higher engagement might have made participants feel more positive, and this positive valence might have helped them evaluate the shopping task as being easier than it really was. If this positive impact of engagement and mood holds, the reason why touch-interfaces lead to choosing hedonic products may be due to a pleasure-seeking motivation or the fun/casual user experience induced by the affective nature of touch interfaces rather than from cognitive-resource depletion as a result of a more challenging user experience.

**Contributions**

As an extension of Essay 1, Essay 2 contributes to marketing research by expanding the previous overview of the impact of device types on online shopping. The findings here remind researchers and practitioners of the important role of a variety of computer-device environments by further defining the hedonic/utilitarian characteristics of device types. This study also highlights the association between device type and
product choices and suggests that touch-interface users are more likely to choose hedonic products over utilitarian options. Understanding which kinds of products (e.g., hedonic vs. utilitarian) may sell better under certain device conditions helps marketing practitioners make better business projections and lets them prepare more appropriate marketing strategies and better content design.

In addition, this essay discovered that touch interfaces have interesting connections with engagement, mood, and satisfaction, implying the hedonic characteristics of touch interfaces. It is likely that touch interfaces induce a more positive mood and higher engagement, which results in a more positive evaluation of the website. These associations imply that shoppers’ moods may potentially impact their overall evaluation of online-shopping experiences. Shoppers’ moods could be one important factor that explains the likelihood to report positive online-shopping experiences (e.g., higher satisfaction with the website) and display more approach behavior (e.g., higher engagement, higher purchase intentions, and a longer stay at stores), of which both could eventually convert into more purchases.

Managerial Implications

This study provides several meaningful implications for marketing practitioners. First, touch-screen environments seem ideal for selling hedonic products or services, especially, those designed for people who tend to rely on affective cues during their shopping experiences. Affective cues in online shopping range from emotional aspects of the products themselves, such as brand images, to the pleasantness of the shopping
website. Retailers and marketers may observe better results if they manipulate their website content to display more hedonic items to touch-interface users.

Second, as touch-interface users may choose more hedonic options and are more willing to purchase the product immediately, retail and marketing practitioners may want to consider providing more products that are stronger in hedonic attributes than in utilitarian attributes or highlight more hedonic attributes in the product information.

Third, as in Essay 1, these results remind practitioners of the importance of identifying online customers’ input-device environment beyond just tracking PC versus mobile devices. Currently, retailers and marketers can typically capture and track many types of customer activity on their websites, including average visits, unique visitors, and average visit duration. They can also identify whether their online customers use a PC or a mobile device to use to access the websites. However, as device environments have become more diverse than ever, this device identification should be more sophisticated and even detect input device type (e.g., a touch interface) so that it eventually helps retailers and marketers improve their current data-driven marketing to be more effective.

Lastly, marketing practitioners may want to consider using a touch interface in special occasions where they want to encourage affective decisions or hedonic choices. Examples of such occasions might be during fundraising or charity events or situations where creating consensus is important. For example, participants might be more willing to donate to a charity action if they are able to use a touch-screen device installed at the event to read information about donations and make a donation electronically. But, practitioners should also be careful not to be overly aggressive when marketing to
customers using a touch interface because customers have less control over their purchasing decisions when using a touch interface than when using a non-touch device.

**Limitations and Future Research Directions**

Although this essay provides several meaningful findings that help defining characteristics of touch interfaces, the study presented here also has its limitations. First, I did not conduct a separate manipulation check for the hedonic/utilitarian options, and the affective nature of Bluetooth speakers might have affected the distinction between hedonic and utilitarian attributes. Secondly, the results presented here may depend on age and device fluency. In particular, the generalizability of the results may be limited to relatively younger age groups because participants were mostly university students in their 20s, with a similar level of familiarity with touch interfaces and mouse devices. Younger or older age groups may display different outcomes because some age groups are less comfortable operating touch interfaces than others. Third, the definition of high and low task-complexity might have caused potential confounds because the task complexity differed only by the length of product descriptions. Some participants might prefer more in-depth information because understanding more details usually helps them determine the best possible product, whereas less information can be too limited, increasing the difficulty of their decision-making process.

As this study has found several key indicators (e.g., product choice) of online-shopping experiences using different devices, future research should continue to explore additional factors that explain shoppers’ device experiences further within a greater variety of shopping occasions. It is necessary to continue investigating newer touch-
screen technologies as well as other advanced computer-device environments. In
addition, future research should explore more specific interactions within touch interface
environments in connection with the hedonic aspects of touch interfaces. For example,
technologies such as air touch (e.g., Nintendo Wii), force touch, or even different touch
gestures, such as swiping or tapping, may affect the behavior of online shoppers. It would
also be interesting to investigate the degree to which the findings of this study might
change when combined with other sensory cues. Online-shopping experiences may often
involve sensory cues, whether these are olfactory (e.g., air freshener), auditory (e.g.,
background music), or taste (e.g., coffee) sensations.

Conclusion

Taken together with Essay 1, the findings presented here provide a comprehensive
overview of the characteristics of touch interfaces in comparison with mouse devices in
online shopping. One of the key findings here is that touch interfaces are more likely to
strengthen shoppers’ reliance on affective cues, leading them to choose hedonic products
and make immediate decisions. This result supports the existing literature on the
affective-cognitive model, hedonic shopping motivations, and resource depletion.
However, other results suggest a need to adjust these existing theories on
affective/cognitive information processing, which were mostly developed around offline
environments, to better capture the potential mechanisms involved in computer-device
environments. The present investigation is one of the first studies regarding product
choice patterns in touch-interface environments. Using the findings of this study as a
foundation, researchers should explore additional aspects of device environments and
should continue to provide advanced understanding of current online-retail environments.
References


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Chapter 4.

Conclusions
General Discussion

The Hedonic Nature of Touch Interfaces

In this investigation, the effects of using a touch interface are in line with the suggestions of affective-cognitive theories. According to the findings, touch-interface user experiences resemble the process that occurs when people rely on affective information or hedonic cues for making a decision. Using a touch interface to shop leads to higher engagement with shopping, resulting in higher purchase intentions than when using a mouse. When it comes to final purchase decisions, shoppers who use a touch interface are likely to choose a product option with stronger hedonic attributes and are more likely to make immediate purchase decisions than mouse users. These findings support the existing theories that people’s reliance on affective information cues results in hedonic product choices, high purchase intentions, and immediate decisions (e.g., Shiv & Fedorikhin, 1999; Hirschman & Holbrook, 1982; Hagvedt & Patrick, 2009), suggesting the hedonic/affective nature of touch-interface environments.

Different Role of Task Complexity

Although most of the present findings support the literature on affect-driven information processing, some results indicate that the effects of such affect-dependent environment in touch interfaces may differ from the effects that the literature suggests. According to the literature, performing a complex task is likely to result in cognitive resource depletion, which amplifies dependency on affective information (e.g., Cheema & Patrick, 2012; Shiv & Fedorikhin, 1999). However, task complexity in this research
did not have a main effect on product choice and did not significantly moderate the impact of touch interfaces on choice and immediate purchase intentions. Moreover, device type did not have a significant main effect on perceived task-complexity such that touch-interface users did not necessarily perceive a shopping task to be more difficult than mouse users. Thus, unlike the literature, task complexity in this research was not a significant moderator for product choice. However, as discussed earlier in the results section, it is possible that the task-complexity manipulation (i.e., length of product information only) was not strong enough to induce the expected effects. It may be necessary to vary the quality of the content by manipulating vocabulary, wording, or page layout, in addition to content length. Also, performing multiple shopping tasks instead of a single shopping session may strengthen the effects of task complexity.

Nevertheless, the issue on task complexity alone is not sufficient to completely reject the proposed assumption that cognitively challenging touch-interface environments causes a stronger reliance on affective cues. Multiple findings in this research support at least partially that touch interface users are likely to recall product information less accurately than mouse users. Although the findings on information recall are limited to brand-name recall only, they were consistent in multiple studies of this research. Such consistency implies that some cognitive challenges may exist in touch-interface environments, and these may cause resource depletion, which negatively influences shoppers’ cognitive performance (e.g., brand-name recall).

Touch-interface users’ poorer information-recall may be associated with their involvement levels because the related-results in this research were significant in the
high-involvement conditions only. When shoppers are highly involved, they tend to process more detailed product information than those who are less involved. On the contrary, shoppers who are less involved or less motivate to shop tend to be more interested in non-product relevant, experiential or affective cues (e.g., pleasantness of the store). Thus, it is likely that higher involvement in this research added more cognitive challenges to touch-interface users, who would already experience more challenges than mouse users due to the vision-touch conflict and active hand movements. In addition, shoppers’ tendency to focus on certain types of product information depending on their involvement levels or shopping occasions might have led to no significant effects on other types of information such as prices, product colors, and product features. Therefore, it is still necessary to find a clearer explanation about the cognitively challenging nature of touch-interfaces. Future research needs to explore the associations between cognitive load and involvement levels further, in addition to testing stronger task-complexity manipulations.

**The Casual Nature of Touch Interfaces and Mood**

In addition to the cognitively challenging nature of touch interfaces, it is also possible that the casual attributes of touch interfaces themselves might amplify the reliance on affective cues, resulting in a hedonic choice. Touch interfaces (vs. non-touch interfaces) are considered to be more casual and less serious because of the simpler types of tasks that are often performed on these devices. Touch screens are more widely available through smaller mobile devices such as smartphones and tablet PCs, whereas regular PCs, such as desktops or laptops, are more often considered for work-related
tasks. Thus, it is likely that people perceive touch-interface user environments to be more casual and fun than non-touch environments. In this research, the casual nature of touch interfaces might have primed the shoppers with more fun or pleasure-seeking experiences even though I controlled for these effects in all non-device conditions by manipulating the website design and selection of the product categories. In both Essays 1 and 2, touch interface users were more engaged with their shopping and had a more positive mood than mouse users. In Essay 2, touch interface users were also more satisfied with their overall shopping experiences reporting higher satisfaction with the website usability (e.g., ease of use, product information, web design) than reported by mouse users. These associations with engagement, mood, and satisfaction may be meaningful indicators that touch interface environments facilitate pleasantness. Such pleasant user experiences may be due to the casual and fun image of touch interface itself, or interface touch interactions (i.e., touching the monitor to browse content). However, the fact that touch-interface users’ higher satisfaction with shopping was significant in Essay 2 only implies that in Essay 1, the involvement manipulations (i.e., using product categories) may have attenuated the impact of both touch interfaces and mouse devices on satisfaction. Therefore, further research is necessary to confirm which aspect of touch interfaces enhances or reduces the pleasantness of the shopping experience in relation to shoppers’ involvement levels.

**Contributions**

In Essays 1 and 2, I discussed theoretical contributions of this research in detail. In summary, this research contributes to the literature and marketing research in several
ways. First, the findings suggest the need to rethink the definitions of online retail environments, which have been limited to websites. Second, this is the first study to find a negative impact of touch interfaces on online shoppers’ cognitive performance, product choices, and the indirect effect of engagement of touch interface users on purchase intentions. Third, this research strongly indicates that touch-interface user experiences may be a better fit for hedonic product shopping. Fourth, the findings provide a strong initial platform for future studies on device environments, advanced touch-screen technologies, and a broader perspective of sensory cues in computer-mediated environments.

In addition to these contributions, the present research also has implications for broader areas of society. First, the focus of this research on device environments introduces a new research stream, not only for the field of marketing, but also for other areas. For example, it is possible that people using a certain device may report more favorable attitudes toward presidential candidates in political surveys. Hiring managers may also be more likely to have higher engagement during a Skype job interview if they use a particular device. Second, initiating interest on device environments supports the need for additional research on sensory experiences in computer-mediated environments. This effort will eventually improve the quality of device experiences for both general users and those with disabilities because some technologies can be a challenge for people with disabilities. For instance, for people with visual impairments, it is difficult to use touch-screen devices because they are not able to see where the buttons and keypads are placed. People with hearing impairments and those who have lost their voice are not able
to use full voice command features (e.g., Siri in Apple devices). Therefore, this research provides meaningful recommendations that urge researchers to further explore how to improve the sensory experience in computer-mediated environments.

**Managerial Implications**

As different input device environments are likely to influence online shoppers’ decision-making processes and final decisions, marketing practitioners, including retailers, need to consider their customers’ input device environments more deeply when designing web content and customizing types of content to display. For customers using a touch interface to visit a shopping website, practitioners may want to display or highlight products with hedonic characteristics while providing extra support for information recall. For instance, because touch-interface users are more likely to choose a hedonic option, it may be more effective to advertise hedonic products (vs. utilitarian products), such as travel packages or brand new gaming tools, to those who are accessing the website using touch interfaces. At the same time, it may be helpful to make information as concise and easy as possible in order to aid touch-interface users’ information recall.

Most importantly, marketing practitioners need to realize that they can control their customers’ experience beyond simply improving the user-friendliness or user experiences (UX) of their sites. Marketers and online retailers most often analyze web traffic to understand what type of content customers access more frequently. They compare web traffic with sales data, marketing communications activities (e.g., online ads), and special promotions to understand how effective their website is. Based on the data, they usually identify the overall purchase patterns and search history, and optimize
their content for different groups of customers by recommending or advertising products these customers may be interested in. However, if input devices are also identifiable, the content optimization is more accurate in targeting right customers and eventually helps grow businesses by improving customers’ information recall, purchase intentions, and engagement.

The findings on touch interfaces are not only relevant to online shopping but also offline retail activities. These days, many stores in the United States have computers available in stores for shoppers to use in order to check product information, check product inventory, or order products that are not available in the store itself. These retailers may want to reconsider the type of input device that they provide for their customers. For instance, if the majority of products that are sold by a particular retailer requires customers to be more conscious of detailed product information, or if the retailer’s website architecture is more complex than other sites, then adding external input devices like a keyboard or a mouse may ease information processing and device operation.

Marketers may also want to utilize touch-screen devices in other marketing activities, such as charity events or fundraisers. At such events, attendees tend to make donations through a touch-screen computer station or through a hand-held touch-screen device provided by the event. Thus, participation rates may increase when a touch interface is used because this is likely to result in more immediate decisions and higher purchase intentions. Likewise, similar applications may be possible in non-marketing areas. Teachers may be more engaged with the content of their students’ assignments if
they grade the work on a touch interface, and as discussed earlier, hiring managers may perceive job candidates more or less positively depending on which devices they used to interview the candidates.

**Limitations and Future Research Directions**

**Limitations**

Although this research provides numerous meaningful contributions, it also has its limitations. First, the device conditions in both essays used the same desktop monitors; however, results may vary if smaller devices were used due to the limited screen space to display information. If tested on screen sizes larger than the test monitor, slight variations may exist because larger screens require greater hand and arm movements and deliver more impactful visual effects. The size variations in monitors are often due to the specific tasks that will be performed (e.g., gaming); therefore, future studies need to explore the various device sizes in relation to a greater variety of tasks such as shopping, gaming, or working.

Second, although I hypothesized that the nature of touch is cognitively more challenging due to potential vision and touch conflict and body movements, I did not directly measure vision and touch conflict in my study beyond perceived task-complexity and website usability. Specifically, perceived task-complexity showed mixed results. Also, the significant finding of information recall is limited to brand names only, and the results on information recognition yielded no significant differences between the devices. Thus, further measures might expand the generalizability of the present results, and future
studies might need more rigorous tests to measure the different levels of cognitive challenges.

Third, product categories in my research may have created confounding effects because some individuals may be more or less interested in certain product categories. The selection of product categories was based on the pilot study results. From the pilot study, electronics and clothes were the top two product categories that the college student demographic group most often browsed online. As all the experiments in this research focused on online shoppers’ product browsing experiences, I chose products from the most popular product categories for product browsing in order to create the most natural online shopping experience and ensure greater generalizability. Despite the effort, individual differences may still exist in terms of interested product categories or product familiarity regardless of the control on involvement.

**Future Research Directions**

Because touch-screen technologies and Internet user environments evolve at a fast pace, it is critical to conduct follow-up research on advanced technologies and other potential factors of online retail environments as promptly as possible. For instance, future research needs to explore more advanced touch-technologies such as 3D touch, force touch, and transparent touch panels. It may also be useful if researchers examine the impact of specific touch-screen interactions such as swiping directions or intensity of tapping behavior. Furthermore, exploring other environmental factors is also necessary. One possible factor may be shoppers’ posture when shopping online. As device types vary, occasions where shoppers use the devices also vary. Some people sit on a couch,
while others lie in bed, and others may even stand at a standing desk when browsing products. In addition to device type examined by this research, these different postures may influence customers’ information processing, and in turn, their shopping behavior. Other sensory cues may also affect the impact of devices on online shoppers. For example, olfactory cues such as coffee scents in a Starbucks coffee shop may affect customers who are shopping online using their touch-interface laptop. Auditory cues such as background music or noise in a room may also influence online shopping.

Lastly, future research needs to expand this study further and explore the impact of device types in the context of the current multi-channel shopping trends such as webrooming and showrooming. Because these multi-channel shopping habits often involve extensive time spent browsing products online using computer devices, it will benefit both researchers and marketers to have a more specific idea of the device impact on the user behavior.

**Conclusion**

Technology is one of the most important factors that strongly influences and changes consumers’ lifestyles. Due to the emergence of the Internet, understanding how advanced technologies transform the way consumers shop and use products has become increasingly important. The touch-interface technologies that this research explored are one of the several areas that have recently made remarkable changes to computer users’ device experiences. Consumers’ device environments today are very dynamic and are deeply embedded in their daily activities. Consumers constantly use their smartphones in
addition to multiple other computer devices, such as tablet PCs and laptops, and having multiple mobile devices handy allows them to browse product information almost anywhere, even while shopping at brick-and-mortar stores. With the consideration of the current device usages, it is extremely important that both researchers and marketing practitioners keep pace with these changes, pay careful attention to the patterns driven by technologies, and find effective ways to approach these new trends. As part of such efforts, the findings of this research contribute to an understanding of the basic mechanisms between touch interfaces and mouse devices, which provides an early foundation for future research on more advanced touch-screen technologies.