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Digital product presentation, information processing, need for cognition and behavioral intent in digital commerce

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ABSTRACT

The purpose of this experimental study was to examine the effects of digital product presentation on consumer information processing and behavioral intent in apparel e-retailing contexts. The Stimulus-Organism-Response Model and Dual Coding Theory were used as theoretical frameworks. This research employed a 2 (visual: large vs. small) x 2 (verbal: concrete vs. abstract) between-subjects factorial design and included Need for Cognition as a moderator. Research findings showed that verbal stimuli which varied in concreteness of product descriptions were more effective in evoking both imagery and discursive processing than were visual stimuli which varied in sizes. Imagery processing was positively associated with behavioral intent. A significant moderating role of need for cognition was found.

1. Introduction

With the advancement of the Internet and related technology, digital commerce has grown tremendously and continues to evolve. Global e-commerce sales reached more than $2 trillion in 2017 and are expected to more than double by 2021 (Neufeld and Roghanizad, 2018). The wide adoption of digital commerce has profoundly transformed how people shop and buy. Regardless of where actual purchases are made, consumers today begin their shopping journey on digital devices (Think with Google.com, 2016). More than 55% of consumer traffic to the major U.S. e-retailing sites were from mobile devices in 2015 (Sterling, 2016). M-commerce continues to gain excellent traction in digital commerce. In 2017, m-commerce accounted for over one third of total digital commerce sales. In 2018, m-commerce is predicted to generate over $90 billion in sales in the U.S. (Lazar, 2016a). By 2021, m-commerce is expected to generate more than half the total digital commerce sales (Statista, 2018b). Despite its impressive growth rates, however, digital commerce still struggles with low conversion rates as compared to offline retail conversion rates (Neufeld and Roghanizad, 2018), suggesting that consumer experience in digital commerce may fall short on meeting consumer expectations.

Parallel to the growth of digital commerce, there has been growing research interest among scholars and practitioners about digital product presentation. Academic research has investigated various elements of digital product presentation such as picture size (Kim and Lennon, 2008; Song and Kim, 2012), the number of views (Song and Kim, 2012), verbal product information (Kim and Lennon, 2008), model's face (Yoo and Kim, 2012), product display modes (Kim, Kim, and Lennon, 2009), screen size (Kim and Sundar, 2016), 3D views (Kim and Forsythe, 2008), video (Kim and Sundar, 2016), site interactivity (Xu and Sundar, 2014), image interactivity (Beuckels and Hudders, 2016), image backgrounds (Maier and Dost, 2018; Yoo and Kim, 2014) and virtual fitting room (Beck and Crié, 2018) and their impact on consumer behaviors. Collectively, this stream of research has enhanced the understanding of consumer behavior in digital commerce and brought new insights for practitioners.

Nevertheless, empirical findings regarding digital product presentation have been somewhat mixed, and some empirical questions remain unanswered. For example, despite strong empirical support for picture superiority in advertising research (Childers and Houston, 1984; Mitchell and Olson, 1981; Rossiter and Percy, 1978), research on visual and verbal information in e-commerce supported verbal superiority (Kim and Lennon, 2008). Furthermore, research by Song and Kim (2012) found that e-shoppers perceived more information with one large product photo than four large product photos (multiple views of the same product) although the four large photos were more effective in mitigating mental intangibility than one large photo. Such mixed results warrant additional research on digital product presentation, especially considering the increasingly important position of digital sites as the first touchpoint of today's consumers (Think with Google.com, 2016).

Expanding existing research on digital product presentation, this study aims to articulate the relationships between digital product presentation modes (visual and verbal) and types of information processing

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(imagery vs. discursive) in apparel e-retailing. In particular, this study focuses on the context of apparel e-retailing for two reasons. First, due to the aesthetic and sensory nature of apparel products as experience goods (vs. search goods), product presentation in apparel e-retailing plays a more vital role in influencing consumer shopping experiences than for search goods (Klein, 1998; Yoo and Kim, 2014). Second, the return rate in e-retailing is more than double that of the brick-and-mortar, and even up to five times more depending on product categories. Despite strong apparel e-retail sales accounting for over 80 billion U.S. dollars in 2017 (Statista, 2018a), return rates for products like apparel and other soft goods range from 25% to 40%, eroding the profitability of apparel e-retailers (Dennis, 2017). The importance of detailed product descriptions and better visuals as the strategic methods to reduce online returns for fashion products is well documented (Lazar, 2016b; Mulpuru, 2017). Therefore, the current research investigates the dimensions of digital product presentation that are meaningfully connected to consumer decision-making in apparel e-retailing. Specifically, this research has three research objectives: to examine (1) the differential effects of visual and verbal stimuli on types of information processing, (2) the moderating role of individual trait (need for cognition), and (3) the relationships between types of information processing and behavioral intent. Considering the essential role of product presentation in apparel e-retailing, the findings of this study are expected to offer new insights to improve the effectiveness of digital product presentation in apparel e-retailing.

2. Conceptual development

The Stimulus-Organism-Response (S-O-R) paradigm by Mehrabian and Russell (1974) and Dual Coding Theory by Paivio (1971) provide theoretical frameworks to explain the relationships among digital product presentation (visual and verbal), types of information processing (imagery and discursive), need for cognition, and behavioral intent.

2.1. Stimulus-Organism-Response model

According to the S-O-R paradigm, stimuli (S) in the environment influence an individual's internal states (O), and these internal states of emotion and cognition mediate the person's approach or avoidance behaviors (R). This paradigm has been widely adopted to explain consumer behaviors in various retail contexts (Donovan and Rossiter, 1982), including digital commerce (Eroglu et al., 2003; Kim et al., 2009; Manganari et al., 2012; Richard and Chebat, 2016; Wu et al., 2016). According to the S-O-R paradigm in the context of e-retailing, involvement and atmospheric responsiveness as individual factors were posited to moderate the relationship between stimuli and internal responses (Eroglu et al., 2003). Applying the S-O-R paradigm to the apparel e-retailing context of this study, digital product presentation in visual and verbal forms (S) are posited to evoke different types of information processing (O) in response to visual and verbal stimuli, which in turn induce behavioral intent (R) as an avoidance/approach response. In the current study, need for cognition as an individual trait is posited to moderate how digital product presentation influences different types of information processing.

2.2. Dual coding theory

The Dual Coding theory by Paivio (1971) helps explain the differential effects of visual and verbal stimuli. This theory views the cognition activities as resulting from two mental subsystems: a verbal system (processing verbal events) and an imaginal system (processing nonverbal events). These two subsystems are separate but interconnected components of human cognition. The verbal system facilitates sequential processing, while the imaginal system facilitates parallel processing.

According to Paivio (1971, 1986), different encoding systems of information in memory are activated as a function of type of stimuli. For example, a visual stimulus activates an imaginal coding, meaning that information is encoded as a pictorial form. On the other hand, a verbal stimulus like text will activate the verbal coding, encoding information as a verbal form. Dual Coding theory further explains three distinctive levels of processing of encoding; representational, referential and associative processing. As the most basic level of processing, representational processing is the direct correspondence to the type of incoming stimuli; a visual stimulus is coded using an imaginal system, whereas a verbal stimulus is coded using a verbal system. The next level of processing, called referential processing makes connections between the verbal and imaginal systems. This occurs when a visual stimulus is named or an image is created for a verbal stimulus. The most complex associative processing occurs when incoming visual and verbal stimuli become connected with other verbal and imaginal codes stored in memory. Dual coding theory supports the picture superiority effect.

2.3. Digital product presentation

Product presentation for digital commerce has evolved to include more visualization technology such as magnified views, zoom, and video (Kim et al., 2018). Nevertheless, the fundamental elements of digital product presentation remained constant: product image(s) (visual) and product descriptions (verbal). Other resources such as video can be added to augment product presentation for some products, but not for all products. Thus, it is important to understand how digital product presentation in visual and verbal forms influence consumer decision-making in digital commerce.

On e-commerce websites, product images are generally placed on the left with product descriptions on the right. On mobile Internet, product descriptions are placed either on right or below due to small screen sizes. Therefore, both product images and product descriptions in text seem to be vital sources of product presentation in evolving digital contexts.

In previous research on visual and verbal information in apparel e-retailing, Kim and Lennon (2008) found that more verbal product information and larger product image as visual information had greater effects on inducing positive affective and cognitive attitudes than would less product information and small product image, respectively. Contrary to predicted picture superiority, the results showed that verbal information had far stronger effects on inducing positive consumer attitudes than visual information. Verbal information had an effect on purchase intent, whereas visual information had no effect on purchase intent.

In the context of m-commerce, Kim and Sundar (2016) examined how mobile screen size and presentation mode (text vs. video) influenced consumers' information processing (systematic vs. heuristic), trust (affective, cognitive, and behavioral), and purchase intentions. Their findings showed that large screen size and video mode were effective in eliciting greater affective and behavioral trust and purchase intentions through eliciting heuristic information processing. On the other hand, small screen size and text mode influenced cognitive trust through eliciting systematic information processing.

Another study in the context of m-commerce examined how perceived visual complexity of mobile sites and perceived visual congruence between the mobile online store and the fixed online store influence consumers' perceptions of processing fluency and ultimately satisfaction (Sohn, 2017). Rather than focusing on specific mobile pages, this m-commerce study by Sohn (2017) captured mobile shoppers' overall assessment of perceived visual complexity and perceived visual congruence using web surveys. This study revealed that perceived visual complexity lowered perception of processing fluency, while perceived visual congruency improved fluency perception.

A recent study by Yoo and Kim (2014) further examined digital product presentation as visual and verbal elements from the mental imagery perspective in an apparel e-retailing context. Rather than

focusing on product images as in previous research (Kim and Lennon, 2008; Song and Kim, 2012), Yoo and Kim focused on the background images of product presentation; concreteness of visual presentation [relevant consumption background (e.g., swimwear in the beach) vs. solid background] and concreteness of background descriptions in text. Their findings showed that concrete visual presentation depicting relevant consumption background was more effective in eliciting stronger imagery processing than solid background, which subsequently led to positive emotional reactions and higher behavioral intent. No effects for concreteness of verbal descriptions were found. A study by Maier and Dost (2018) provides empirical support for the positive effect of contextual imagery backgrounds (vs. white background) on fluency perception and liking in e-commerce, especially for ambiguous products. However, contrary to the finding in Yoo and Kim (2014), Maier and Dost (2018) did not find the significant effect of contextual imagery backgrounds on mental imagery of furniture products. Lack of the effect of verbal context on mental imagery in Maier and Dost (2018) was consistent with prior research (Yoo and Kim, 2014).

Extending the findings from previous digital presentation research to concreteness and product presentation, the current study focuses on visual and verbal stimuli and their differential effects on information processing styles. Visual stimuli are operationalized as product images that differ in sizes (large vs. small). Verbal stimuli are operationalized as product descriptions in text that differ in the level of concreteness (concrete vs. abstract).

2.4. Information processing styles

Information processing can be categorized into two different types of processing, discursive processing (e.g., verbal retrieval, cognitive responding, and verbal encoding) and imagery processing. In consumer research, discursive processing has received initial attention as to how words or numbers are processed in working memory to denote or solve problems (e.g., Bettman, 1979). With the growth of various advertising and marketing strategies, research attention has shifted to the role of imagery processing (Childers and Houston, 1982, 1984; Childers et al., 1985; Lutz and Lutz, 1978; Rossiter, 1982; Percy and Rossiter, 1983). In the context of apparel e-retailing, Yoo and Kim (2014) examined how different visual backgrounds of product displays and verbal descriptions of backgrounds evoke imagery processing; their results supported the important role of background visuals eliciting imagery processing.

Imagery processing is conceptually distinctive from discursive processing in the way that information is represented in working memory, specifically sensory representations. Imagery processing involves sensory experience, ranging from a single sensory dimension (e.g., sight) to multisensory dimensions (e.g., sight, taste, smell, sound). Because discursive processing lacks inner sensory experience, it becomes more abstract (or less concrete) than imagery processing (MacInnis and Price, 1987). Concreteness of imagery processing lies on an elaboration continuum, ranging from simple retrieval of cognitive concepts to relating multiple concepts and mental structures. The elaborate imagery processing has been found to influence affective responses to stimuli and behavior (Cohen, 1982; Greenwald and Leavitt, 1984; Rossiter and Percy, 1978).

Early research on imagery processing generally supports the positive effect of imagery processing on superior memory (Paivio, 1971) and incidental learning (Bower, 1972). In the context of advertising, Childers and Houston (1984) demonstrated that imagery processing facilitated by redundancy in visual and verbal information led to better recall for the ads than discursive processing facilitated. Bower (1972) demonstrated that instructions to imagine elicited imagery processing, which enhanced incidental learning.

It has been supported in previous research that imagery processing is superior to discursive processing (MacInnis and Price, 1984). Because imagery processing facilitates a more holistic evaluation rather than a summation of attributes as is done in discursive processing, imagery processing is more effective in processing a complex decision situation and building decision confidence. Furthermore, because imagery processing facilitates the visualization of the outcomes of a decision, imagery processing is posited to increase behavioral intent and reduce time delays between intent and actual behaviors (MacInnis and Price, 1984).

2.5. Need for cognition (NC)

Need for Cognition (NC) refers to “the tendency for an individual to engage in and enjoy thinking” (Cacioppo and Petty, 1982, p. 116). NC has been extensively studied in persuasion contexts. Individuals high in NC were more influenced by the quality of ads’ messages (Haughvedt et al., 1988) and were more engaged in systematic information processing (Chaiken, 1980) than were individuals low in NC. Individuals low in NC tend to avoid effortful cognitive activities and rely more on heuristic information processing (Petty and Cacioppo, 1984). Petty et al. (2009) further found that people in high NC tend to engage in effortful cognitive activities regardless of incentives, whereas people in low NC are likely to engage in effortful thinking only in the presence of incentives.

General findings on NC research support that as NC increases, information processing would increase. See et al. (2009) noted that individual differences in NC determine people's motivation to engage in information processing. Their research demonstrated that people in high vs. low NC reacted differently, depending on perceived complexity of messages. That is, people in high NC engaged in more effortful processing when the message is perceived to be complex. On the other hand, people in low NC engaged in more effortful processing when the message is perceived to be simple.

2.6. Behavioral intent

Defined as “whether customers will remain with or defect from the company” (Zeithaml et al., 1996, p. 33), behavioral intent means “what the person intends to do” (O’Keefe, 2002, p. 101). Behavioral intent influences customers’ future interaction with a firm and ultimately has an influence on the profitability of the firm (Zeithaml et al., 1996).

This study operationalizes behavioral intent as the most commonly referenced digital behavioral intent: intent to patronize and purchase from a website without switching to another store. Although behavioral intent does not equate with actual behaviors, it has a good predictability of actual behaviors (Jamieson and Bass, 1989).

3. Hypotheses development

3.1. Digital product presentation (S) and information processing (O)

In an apparel e-retailing context, both visual and verbal stimuli comprise essential elements of the digital product presentation environment and are expected to evoke consumers’ internal responses, specifically information processing (see Fig. 1 for the conceptual model).

3.1.1. Visual stimuli and information processing

Pictures are direct predictors of imagery (Paivio, 1971). Pictures as visual information are better remembered than verbal information due to imagery evoked by pictures (Childers and Houston, 1984; Paivio, 1971). Researchers have identified various factors that influence the degree of imagery processing. Schlosser (2003) noted that how products are presented in mediated environments influence the level of mental imagery evoked. Research from neuroscience suggests that visual depictions such as product presentation can lead people to imagine interacting with the product (Tucker and Ellis, 1998).

In vacation advertising contexts, Miller and Stoica (2003) demonstrated that concreteness of stimuli is positively related to imagery

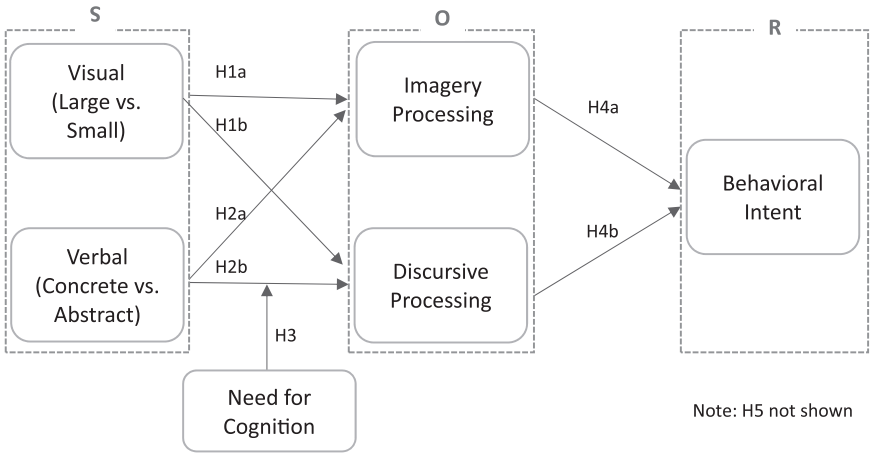

Fig. 1. The proposed research model.

processing. As a function of abundant realistic cues, Miller and Stoica (2003) found that a photograph was superior to an artistic rendering in evoking more vivid mental images. Similarly, Childers et al. (1986) showed how the presentation format (dynamic vs. static) influences (encourage vs. discourage) imagery processing. In e-commerce contexts, differences in concreteness of stimuli between dynamic and static product presentations were found to influence the degree of mental imagery (Overmars and Poels, 2015).

The positive effect of picture size has long been supported in psychology (Kossyln, 1980) and in advertising (Percy and Rossiter, 1983). Large pictures were posited to get more attention, reduce competing images and facilitate the simulation of consumption images (Kossyln, 1975; Percy and Rossiter, 1983). Percy and Rossiter (1983) found that large pictures in print ads induced more favorable attitudes than small pictures. Using the attention hypothesis Percy and Rossiter (1983) argued that the greater attention people expend on a large picture explains the stronger effect of a large picture on attitudes than a small picture.

Visual stimuli automatically generate imagery processing. In an apparel e-retailing context, Kim and Lennon (2008) found that large pictures were more effective in eliciting positive affective and cognitive responses than small pictures. Additionally, Song and Kim (2012) showed that large product pictures were more effective in increasing mental tangibility of handbag products in e-commerce.

Researchers further suggested that visual stimuli could also evoke discursive processing when people interpret the visual stimuli by naming or labeling them in words (Rossiter and Percy, 1978). Percy and Rossiter (1983) posited that large images lead to greater elaboration on discursive processing because large images evoke more attention to an image and block out other competing stimuli. Based on the review of literature and theoretical frameworks, the following hypotheses are proposed.

H1a. In the context of apparel e-retailing, consumers experience greater imagery processing when exposed to large visual stimuli, in comparison to small visual stimuli.

H1b. In the context of apparel e-retailing, consumers experience greater discursive processing when exposed to large visual stimuli, in comparison to small visual stimuli.

3.1.2. Verbal stimuli and information processing

Verbal stimuli primarily activate verbal comprehension responses and generate discursive processing of information. However, when the verbal stimulus has imagery value, it can simultaneously evoke imagery processing (Paivio, 1971; Rossiter and Percy, 1978). As argued by Holbrook and Moore (1981), stimuli may initiate one type of information processing, but depending on the characteristics of the stimuli, the other type of information processing may be activated. For example, when verbal stimuli are concrete in nature, they tend to have higher imagery value. When there are clear and direct referents (e.g., rose) versus vague and abstract referents (e.g., beauty), verbal stimuli are concrete, which evokes imagery processing simultaneously with discursive processing (Rossiter and Percy, 1978; Yoo and Kim, 2014).

The study by Kim and Lennon (2008) demonstrated that the amount of verbal information had substantial effects on online shoppers' responses. More information about apparel products led to more positive affective and cognitive responses and higher purchase intent for displayed apparel products. In that study, different types of information processing were assumed as a function of types of stimuli and affective (imagery) and cognitive (discursive) attitudes were measured. However, their findings suggest that both types of information processing may have been activated by verbal product information. On the other hand, when focusing on verbal descriptions of background images rather than descriptions of products, no effect of verbal information was found (Yoo and Kim, 2014).

Researchers have criticized a simple approach of equating the mode of information presentation (e.g., visual vs. verbal) and its representation in working memory and emphasized the importance of understanding how different modes of information are associated with different types of information processing (Percy and Rossiter, 1983; MacInnis and Price, 1987). Cognitive psychologists have long argued that words can also stimulate imagery processing. For example, concrete words evoke imagery processing (Paivio et al., 1968; Richardson, 1980). Paivio et al. (1968) showed that the level of concreteness of words was positively associated with ratings of imagery value.

In the current study, verbal stimuli vary in their level of concreteness by including or excluding concrete style descriptions to examine which types of information processing are triggered as a function of verbal stimuli. Based on the review of literature and theoretical frameworks discussed, the following hypotheses are proposed.

H2a. In the context of apparel e-retailing, consumers experience greater imagery processing when exposed to concrete verbal descriptions, in comparison to abstract verbal descriptions.

H2b. In the context of apparel e-retailing, consumers experience greater discursive processing when exposed to abstract verbal descriptions, in comparison to concrete verbal descriptions.

3.2. Moderating role of NC

Verplanken et al. (1992) postulated that NC is an antecedent to external information search. The findings of Verplanken et al. (1992)

showed that NC, as a general trait, was positively associated with the amount of effort individuals were willing to expend on external information search. Individuals high in NC desired more information and engaged in more extensive cognitive activities than individuals low in NC.

In the context of Internet use, researchers argued information search as one of the most prevalent use of the Internet (Hills and Argyle, 2003). Browsing was further considered as a non-systematic review and processing of information (Amichai-Hamburger et al., 2008). In their study, Amichai-Hamburger et al. (2008) predicted that high NC people would spend more time at a single site and make greater uses of hyperlinks than low NC people. However, those relationships were not empirically supported. Instead, Amichai-Hamburger et al. (2008) found that high NC people were more persuaded by the information available on the site, whereas low NC people were more convinced by an interactive site. Additionally, high NC people were not affected by time pressure. Extending this research, the study by Kaynar and Amichai-Hamburger (2008) showed that people high in NC spent more time in activities related to information. High NC people tended to consider the informational attributes to be more critical elements in making a persuasive website than other non-informational attributes. In the context of e-commerce for furniture, Maier and Dost (2018) examined the moderating role of NC for the effect of contextual backgrounds and found that the effect of contextual backgrounds on fluency perception and liking are amplified for individuals high in NC.

In their study of the relationship between NC and information processing styles, Heckler et al. (1993) found that people high in NC showed preference for verbal processing versus visual processing. Despite the findings in Heckler et al. (1993), the relationship between NC and information processing styles remain largely unexplored. For the current study, non-directional hypotheses were developed to examine moderating roles of NC on the relationship between product presentation and information processing in the context of apparel e-retailing.

H3a. In the context of apparel e-retailing, the effect of visual stimuli on information processing differs as a function of NC.

H3b. In the context of apparel e-retailing, the effect of verbal stimuli on information processing differs as a function of NC.

3.3. Information processing (O) and behavioral Intent (R)

Both imagery and discursive information processing are used to frame and solve problems (MacInnis and Price, 1987). Prior research generally supports greater effects of imagery processing on behavioral change or behavioral intent than discursive processing. The effects of imagery processing on influencing behaviors are well documented (Taylor and Pham, 1996). Sensory and emotional reactions experienced as a result of imagery processing explain the superior effect of imagery processing over discursive processing (Taylor and Pham, 1996). In clinical contexts, Cautela and McCullough (1978) demonstrated that imagery processing influenced behavioral intent more effectively than did discursive processing. Cautela and McCullough (1978) uncovered that people were approaching objects they had positive association with in their imagery processing, while avoiding objects they had negative association with in imagery processing. MacInnis and Price (1987) further posited that the greater imagery processing reduces the gap between purchase intentions and actual purchases.

H4a. In the context of apparel e-retailing, imagery processing is positively associated with behavioral intent.

H4b. In the context of apparel e-retailing, discursive processing is positively associated with behavioral intent.

H5. In the context of apparel e-retailing, imagery processing explains more variance in behavioral intent than discursive processing.

4. Methodology

This research employed a 2 (visual: large vs. small) × 2 (verbal: concrete vs. abstract) between-subjects factorial design and included NC as a moderator.

4.1. Stimulus development

Using an online experiment, this study simulated an e-commerce apparel site branded as *e-fashion*. The mock website was developed by a professional web developer to create a realistic look and feel of e-commerce sites. To select appropriate apparel products for the study, women's tops were selected. In Pretest, 48 college women viewed 30 women's tops downloaded from the commercial brand websites and evaluated them on attractiveness, fashionability and likableness. In order to avoid any idiosyncratic effects due to experimental stimuli, the five apparel items with most neutral responses on those dimensions were selected for the main experiment for stimulus sampling purposes. For the visual stimuli, large and small picture sizes were operationally defined as 400 × 480 pixels and 150 × 180 pixels, respectively. For the verbal stimuli, product descriptions from the original product websites were adopted and edited by fashion industry professionals. For the concrete verbal condition, 3 or 4 concrete style descriptions (e.g., gathered puff sleeve with tiered ruffle lace single button cuff) were included, whereas the abstract verbal condition included 1 abstract style description (e.g., sophisticated style instantly creates a polished look). Both verbal conditions contained the same basic information such as color, fabric, care instruction, size, and country of origin and only differed in the number of concrete style descriptors.

4.2. Instrument development

This study measured two different types of information processing. For imagery processing, the 4-item mental imagery scale by Schlosser (2003) was adopted (Cronbach's $\alpha = 0.82$). For discursive information processing, 2 items by Kim and Lennon (2008) (Cronbach's $\alpha = 0.96$) were adopted from and 2 additional items were developed for the study. To measure behavioral intent, 4-item behavioral intent scale by Kim and Lennon (2011) were adopted (Cronbach's $\alpha = 0.96$). All these items used a 5-point scale (1 = not at all, 5 = a lot).

To assess NC as a moderator, the 18-item short version of the need for cognition scale by Cacioppo et al. (1984) was adopted for the study (Cronbach's $\alpha = 0.90$). This scale used a 5-point scale (1 = extremely uncharacteristic of me, 5 = extremely characteristic of me).

4.3. Procedure

College women were recruited from a large public university in the U.S via emails. They were invited to visit a mock apparel website (*e-fashion*) using the URL included in the recruitment email. When participants logged onto the mock website, they were randomly assigned to one of four experimental conditions. Because this study focused on product presentation in apparel e-retailing, the mock website simulated apparel product pages.

On the mock website, participants viewed a total of five product pages displaying one apparel item at a time. Following a typical product page layout in apparel e-retailing, a product image was shown on the left-hand side, and product descriptions in text were shown on the right-hand side. After browsing five apparel items and selecting items to purchase, participants were asked to complete the survey questionnaire. Participants were instructed to assume that they were given a gift certificate to shop from the site.

5. Results

5.1. Sample description

A total of 169 college women participated in the online experiment. The mean age of the participants was 22.3 (SD = 6.0), with a range of 18–56. About 90% of participants were aged between 18 and 24. Approximately 82% of the participants were Caucasian, over 10% were Asian, and 6.5% were African American. Over 93% indicated that they use the Internet very frequently or frequently. About two thirds of the participants considered themselves frequent or very frequent digital shoppers.

5.2. Manipulation checks

After completing the dependent measures, participants were asked to rate the perceived size of the picture and the perceived concreteness of product information on a 5-point scale. As anticipated, ANOVA showed that the actual size of picture had a significant effect on perceived picture size, F (1, 167) = 125.43, $p < 0.0001$. Participants in the large picture condition (M = 3.83, SD = 0.75) perceived product photos to be larger than those in the small picture condition (M = 2.62, SD = 0.64).

ANOVA further revealed that the amount of concrete product descriptions had a significant effect on the perceived concreteness of product information, F (1, 167) = 19.69, $p < 0.0001$. Participants in the concrete verbal condition (M = 3.91, SD = 0.87) perceived product information to be more concrete than those in the abstract verbal condition (M = 3.34, SD = 0.80).

5.3. Preliminary analysis and evaluation of measures

Reliabilities were assessed using Cronbach's alpha. All dependent measures had adequate reliabilities; imagery processing (α = 0.81), discursive processing (α = 0.81) and behavioral intent (α = 0.86). Based on established reliabilities, composite scores were developed for hypotheses testing.

The moderating variable, NC comprising 18 items was subjected to Exploratory Factor Analysis to assess dimensionality. Using the scree plot, a 1-factor solution was deemed most relevant. This factor contained 11 items explaining 31.4% of variance (α = 0.85). Scores from the 11 items were averaged to develop a single NC indicator. Higher scores indicated that participants were high in NC, whereas lower scores indicated participants were low in NC. In order to divide participants into high vs. low NC individuals, the distribution of NC scores was checked and found to approximate a normal distribution rather than a bimodal distribution. Therefore, participants were divided into three groups [low NC (1–3.09), mixed (3.10–3.56), high NC (3.57–5)] on a 5-point NC scale. Only low NC (n = 49) and high NC (n = 54) groups were retained for the test of moderating effects.

5.4. Hypotheses testing

A multivariate analysis of variance (MANOVA) was first conducted to test hypothesized relationships between visual and verbal stimuli and types of information processing. Results indicated significant multivariate effects for size of visual stimuli [Wilks's λ = 0.93, F (2, 164) = 6.14, $p < 0.01$, partial η^2 = 0.07] and concreteness of verbal stimuli [Wilks's λ = 0.82, F (2, 164) = 17.85, $p < 0.001$, partial η^2 = 0.18] on types of information processing. No interaction was found (p = 0.77).

Follow-up univariate analysis of variance (ANOVA) indicated that when the stimulus was visual, there was a significant relationship found for picture size on both imagery processing [F (1, 165) = 11.20, $p < 0.01$, partial η^2 = 0.06] and discursive processing [F (1, 165) = 6.98, $p < 0.01$, partial η^2 = 0.04]. Participants exposed to large visual stimuli (M = 3.52, SD = 0.71) engaged in greater imagery processing than those exposed to small visual stimuli (M = 3.18, SD = 0.78). Additionally, participants exposed to large visual stimuli (M = 3.64, SD = 0.61) further engaged in greater discursive processing than those exposed to small visual stimuli (M = 3.39, SD = 0.76). Therefore, H1a and H1b were supported.

Subsequent ANOVAs for verbal stimuli showed that there was a significant relationship found for concreteness of verbal stimuli on both imagery processing [F (1, 165) = 29.46, $p < 0.0001$, partial η^2 = 0.15] and discursive processing [F (1, 165) = 24.66, $p < 0.0001$, partial η^2 = 0.13]. Participants exposed to concrete product descriptions (M = 3.65, SD = 0.75) engaged in greater imagery processing than those exposed to abstract descriptions (M = 3.09, SD = 0.67). Participants exposed to concrete product descriptions (M = 3.78, SD = 0.73) further engaged in greater discursive processing than those exposed to abstract descriptions (M = 3.30, SD = 0.57). Therefore, H2a and H2b were supported.

To examine the moderating effect of NC, MANOVAs were conducted by adding NC group (high vs. low) to the model. MANOVA revealed significant multivariate interaction effects for size of visual stimuli by NC groups on types of information processing [Wilks's λ = 0.93, F (2, 98) = 3.83, $p < 0.05$, partial η^2 = 0.07]. Follow-up ANOVAs showed that size of visual stimuli by NC interaction effects were significant only for discursive processing [F (1, 99) = 4.85, $p < 0.05$, partial η^2 = 0.05]. Simple effects tests revealed that the effect of size of visual stimuli on discursive processing was significant only in the high NC group [F (1, 99) = 11.0, $p < 0.001$, partial η^2 = 0.10] (see Fig. 2). High NC participants experienced greater discursive processing when exposed to large picture (M = 3.76, SD = 0.72) than small picture (M = 3.11, SD = 0.87). The effect of size of visual stimuli on discursive processing was not found for low NC participants.

MANOVA further revealed significant multivariate interaction effects for concreteness of verbal stimuli by NC groups on types of information processing [Wilks's λ = 0.90, F (2, 98) = 5.46, $p < 0.01$, partial η^2 = 0.10]. Follow-up ANOVAs showed that concreteness of verbal stimuli by NC interaction effects were significant for imagery processing [F (1, 99) = 4.33, $p < 0.05$, partial η^2 = 0.04] and discursive processing [F (1, 99) = 10.72, $p < 0.0001$, partial η^2 = 0.10]. Simple effects tests revealed that the effect of concreteness of verbal stimuli on imagery processing was marginally significant for low NC

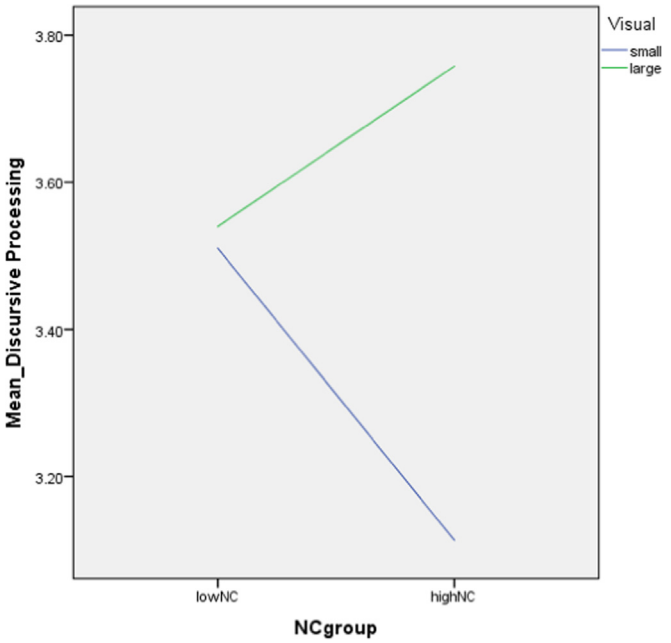

Fig. 2. Moderating role of NC on the effect of size of visual stimuli on discursive processing.

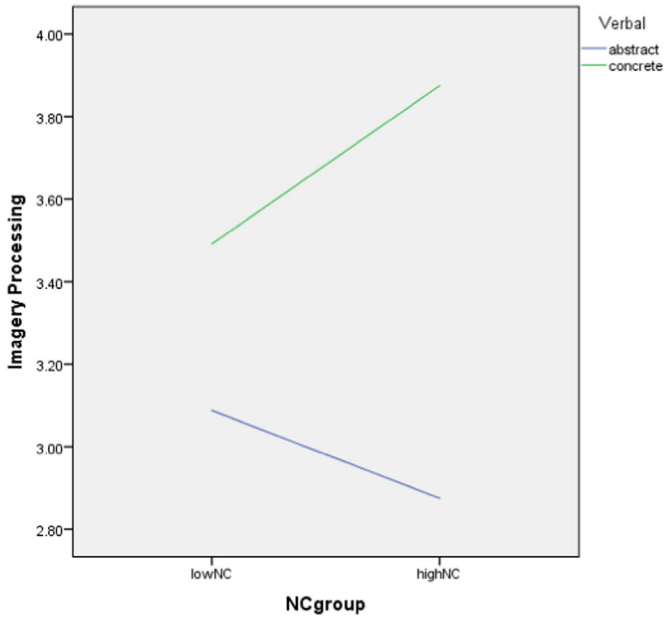

Fig. 3. Moderating role of NC on the effect of concreteness of verbal stimuli on imagery processing.

participants [F (1, 99) = 3.86, p = 0.05, partial η^2 = 0.04] and highly significant for high NC participants [F (1, 99) = 25.15, p < 0.0001, partial η^2 = 0.20]. As shown in Fig. 3, concrete product descriptions elicited greater imagery processing than did abstract product descriptions for both low NC participants [M = 3.49 (SD = 0.71) vs. M = 3.09 (SD = 0.81)] and high NC participants [M = 3.88 (SD = 0.75) vs. M = 2.88 (SD = 0.61)]. This difference in imagery processing was much greater for high NC participants than low NC participants.

Simple effects tests further revealed that the effect of concreteness of verbal stimuli on discursive processing was significant only for high NC participants [F (1, 99) = 24.35, p < 0.0001, partial η^2 = 0.20] (see Fig. 4). High NC participants experienced greater discursive processing when exposed to concrete product descriptions (M = 4.08, SD = 0.76) than abstract product descriptions (M = 3.15, SD = 0.69). For low NC

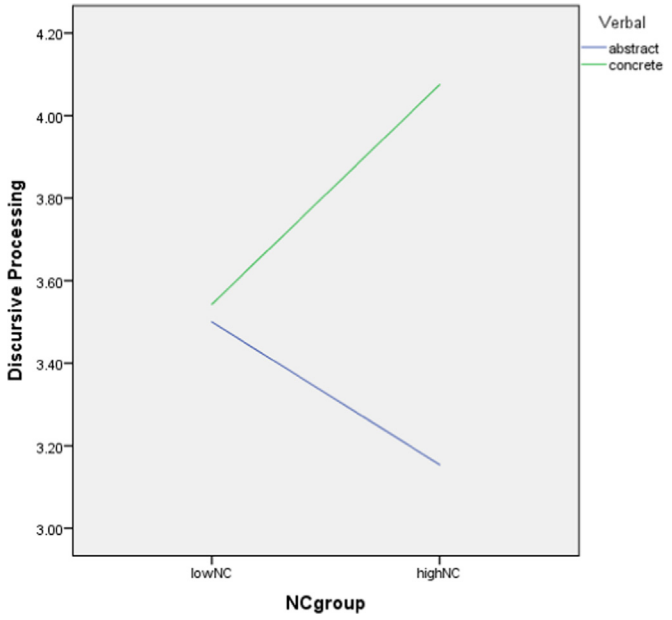

Fig. 4. Moderating role of NC on the effect of concreteness of verbal stimuli on discursive processing.

participants, concreteness of verbal stimuli had no effect on discursive processing. Therefore, H3 predicting the moderating roles of NC were partially supported.

Multiple regression analysis was conducted to assess relationships among imagery processing, discursive processing, and behavioral intent. The result showed that only imagery processing was positively associated with behavioral intent, F (2, 166) = 6.64, p < 0.01, R^2 = 7.4%, b = 0.29. Discursive information processing was not associated with behavioral intent, p = 0.62. Therefore, H4a and H5 were supported.

6. Discussion

With the quickly emerging digital technologies, digital product presentation strategies will continue to evolve and advance. In addition to knowing which presentation strategies work effectively, it is also critical to understand the underlying mechanism by which digital product presentation influences consumer decision-making in digital commerce. By examining consumers' information processing evoked by visual and verbal stimuli as digital product presentation in an apparel e-retailing context, this study offers new insights into how digital as an environmental medium affects consumers' internal processes and behavioral intent.

Using an experimental design that manipulated size of visual stimuli (product picture) and concreteness of verbal stimuli (product descriptions in text), this study examined how visual and verbal stimuli induce different types of information processing and how information processing is related to behavioral intent in an apparel e-retailing context. This study further examined the moderating role of NC on the relationship between digital product presentation and information processing.

6.1. Theoretical contribution

The results of this study provide empirical support for the S-O-R model in digital commerce. Digital product presentation as an environmental stimulus in digital commerce influences how people respond to the digital environment (Kim et al., 2009; Richard and Chebat, 2016). Supporting the S-O-R model in an apparel e-retailing context, this study found that size of visual stimuli and concreteness of verbal stimuli (S) influence the level of imagery and discursive information processing elicited (O). Large visual stimuli and concrete verbal stimuli were associated with greater imagery and discursive processing as compared to small visual stimuli and abstract verbal stimuli respectively. Between imagery and discursive processing, imagery processing (O) was significantly related to behavioral intent (R). This study further found that NC as an individual factor moderated the relationship between visual and verbal stimuli and information processing elicited.

The findings of this study add to existing literature about information processing. Extending the current knowledge from advertising and psychology research, this study conceptualized and empirically tested the underlying mechanism by which consumers' information processing is influenced by digital product presentation and the role of NC as a moderating variable. Supporting the arguments by Holbrook and Moore (1981) and Rossiter and Percy (1978), this study provides empirical evidence for dynamic relationships between visual and verbal stimuli and information processing. Visual stimuli evoked not only imagery processing but also discursive processing, suggesting that some labeling or naming of visuals in words may have occurred (Rossiter and Percy, 1978). Furthermore, verbal stimuli varied in level of concreteness evoked both imagery and discursive processing. Researchers have suggested that concreteness of words elicit imagery processing (Biehal and Chakravarti, 1982; Bower, 1972). Bipedal and Chakravarti (1982) stated that detailed product descriptions can help facilitate visualizing a product, activating imagery processing. Together, the findings suggest that in an apparel e-retailing context where sensory product

examination is essential (Yoo and Kim, 2014), both visual and verbal stimuli elicit not only imagery processing but also discursive processing. This suggests that visual and verbal stimuli in this study may have evoked referential or associative processing proposed in the Dual Coding theory.

This study further advances the understanding of the role of NC in the evolving digital commerce. Overall, the findings of this study are fairly consistent with existing research in NC in psychology and marketing: individuals high in NC tend to expend more effort in cognitive activities and are motivated to engage in information processing (Kaynar and Amichai-Hamburger, 2008; Petty and Cacioppo, 1984). The results of this study revealed that NC moderates the effect of visual stimuli on discursive processing. For individuals high in NC, size of visual stimuli influenced the level of discursive processing elicited. That is, individuals high in NC were engaged in greater discursive processing when exposed to larger visual stimuli than small visual stimuli. No such differences were observed for individuals low in NC. This finding suggests that consumers view product images to gather product information in the absence of actual physical examination. With higher intrinsic motivation to engage in effortful cognitive activities, individuals high in NC appear to use larger product images to capture and process more information about apparel products.

NC also played a significant moderating role for the effect of verbal stimuli on information processing. Verbal stimuli influenced imagery processing for both low and high NC groups although the effect was much greater for individuals high in NC. The effect of verbal stimuli on discursive processing was found only for high NC individuals, but not for low NC individuals. This finding is somewhat consistent with Heckler et al. (1993) that individuals high in NC tend to prefer discursive processing.

Another noteworthy finding of this study is the larger effect sizes (partial η^2) for verbal stimuli over visual stimuli. According to Cohen's (1988) guidelines, effect sizes for visual stimuli in the current study range from small for discursive processing to medium for imagery processing. On the other hand, effect sizes for verbal stimuli are relatively large for both imagery and discursive processing. The findings of this study provide strong empirical evidence that concrete verbal product descriptions in the context of apparel e-retailing can be powerful tools in facilitating information processing (Biehal and Chakravarti, 1982; Holbrook and Moore, 1981; Rossiter and Percy, 1978). Although the findings of this study do not support picture superiority predicted by the Dual Coding theory, the findings of the current study support verbal superiority found in Kim and Lennon (2008). Despite a common belief about the importance of visuals for apparel e-retailing, empirical research findings continue to stress the importance of verbal product descriptions.

This study further contributes to the understanding of the role of different information processing on behavioral intent. Consistent with prior research (Cautela and McCullough, 1978; MacInnis and Price, 1987; Taylor and Pham, 1996), imagery processing was positively associated with behavioral intent, whereas discursive processing had no influence on behavioral intent.

The findings of the current study offer new insights into understanding the mechanism by which digital product presentation affects consumer decision-making processes in the context of apparel e-retailing. This study demonstrates how visual and verbal stimuli in the evolving digital environment shape how people process such information, ultimately influencing their approach/avoidance behavior.

6.2. Managerial implications

The findings of this study provide digital commerce businesses with practical insights to consider as they continue to develop and create effective digital product presentation that satisfies the needs of digital shoppers. As conventionally believed, more descriptive information and larger pictures were found to be more effective. However, the important discovery revealed in this study is that the type of information processing is an underlying factor impacting consumers' behavioral intent. In an apparel e-retailing context, imagery processing elicited by both visual and verbal stimuli was positively associated with behavioral intent. Discursive processing was also elicited by both visual and verbal stimuli, but had no influence on behavioral intent. Additionally, contrary to a conventional belief "a picture is worth a thousand words", this study demonstrates that concrete product descriptions were more effective in eliciting imagery processing than product images. Size of visual stimuli played a role in eliciting imagery processing, but concreteness of verbal stimuli played a stronger role in eliciting imagery processing. In the current study, the concreteness of product descriptions varied by including 3–4 concrete style descriptions or 1 abstract style description.

Digital businesses, especially apparel e-retailers are under constant pressure to adopt new visualization technology to enhance their product presentation. This study does not suggest that apparel e-retailers should invest less on visualization technology, but suggests that companies should pay more attention to concreteness of verbal descriptions they offer on their websites and optimize them to facilitate imagery processing. Optimizing verbal product descriptions is an effective and affordable digital strategy that can be readily implemented by apparel e-retailers. In the context of apparel e-retailing, this study showed that concrete style descriptions evoked imagery processing, suggesting that elaborated style descriptions perhaps help satisfy the need for sensory evaluation for apparel products.

While this study was conducted in the context of e-commerce websites for apparel, the findings of the study are applicable to m-commerce because apparel product sites in m-commerce comprise both visual and verbal stimuli, just as for e-commerce websites. Given the fast growth of m-commerce and different digital environments (e.g., smaller screen for m-commerce) (Lazar, 2016a; Sterling, 2016), the effect of concreteness of verbal product descriptions may be further accentuated in the context of m-commerce and the effect of size of product imagery may change in the context of m-commerce.

6.3. Limitations and future research

Given the nature of experimental research, this study lacks external validity, and thus generalization to other contexts needs caution. Another limitation of the study is the relatively small sample size. Future study is suggested to examine other digital platforms, such as tourism websites and entertainment websites, to further the understanding of consumer experiences in the digital environment. In addition, comparative study of both men and women could further this research stream. Similar research in the context of m-commerce is expected to expand the findings of the current research. Inclusion of other individual factors such as style of processing could offer additional insights into understanding the effect of digital product presentation on consumer responses.

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