I. Introduction

The development of technology has led to the rapid growth of online shopping. Specifically, the surge in the use of smartphones, together with the internet, has led to online becoming the main shopping channel. According to the Statistics Korea (2020), in 2018, the transaction amounts of the online fashion market reached about KRW 13.2 trillion which accounting for about 15% of the total online market. This represents 16.8% growth over the previous year, as with the great growth of the online channel, the number of online fashion stores has also increased. In order to survive the fierce competition, retailers have to invest an increasing amount of effort into attracting consumers.

The distinguishing feature of the online channel is that consumers cannot actually see or touch products; thus, they have to base their purchase decisions entirely on the information provided by the online store (Lohse & Spiller, 1998). In the case of fashion products, consumers perceive the risk of identifying fabric, designs, or fits, because they cannot actually try on products (Yoon & Lee, 2018). Among the various types of information provided by online stores, product information helps users gain an understanding of attributes through images and text (Park & Kim, 2003). When a person encounters a visual stimulus, an imaginal code is activated, whereas the verbal code will be activated when the person encounters a verbal stimulus. Those two co-
des proceed distinctly but they work interactively when human proceed information, particularly the visual stimulus is proceeded prior, whereas the verbal stimulus is sequentially proceeded (Paivio, 1986). Especially, information about fashion products consists of various images, such as the model view, product flat view, and product detail view, and text, such as to do with price, fabric, actual size, care method, and so on. In general, image information is used to help consumers understand the appearance of the product and its fit when worn, while text information is used to convey the attributes of the product. Therefore, both types of information interactively influence consumer judgment. Generally, on the online fashion stores, product information is organized vertically and presented to consumers to scroll down and search for. Online fashion stores operating present information in various ways, also there exist differences in the type and order of information presented. As the online environment has an abundance of information, online fashion stores should understand how consumers perceive information differently based on the form of information and figure out how can information elements interact effectively with others. In other words, online stores have to organize information effectively to attract consumers' attention and facilitate a convenient shopping experience.

Many studies have examined consumers' information searching behavior in the context of online stores (Hausman & Siekpe, 2009; Holbrook & Moore, 1981; Kim & Kim, 2001; Lohse & Spiller, 1998; Park & Kim, 2003), but most have focused on the overall information provided also there is a lack of practical study (Hausman & Siekpe, 2009; Holbrook & Moore, 1981; Lohse & Spiller, 1998). Although the fashion market is a big part of the online market, an empirical study of consumer information search behavior in the context of fashion products has limitations in terms of methodology (Hong & Jin, 2011; Kim & Lennon, 2008; Nitse et al., 2004). To supplement methodological limits, eye-tracking technology was used to analyze consumers' visual behavior in exploring product information. Visual behavior refers to a series of eye movement such as when, how long and where does individual gaze at (Maughan et al., 2007). This study used visual behavior as objective measurement to examine consumers' information search behavior in the context of fashion products. Particularly, this study focused on product information, classified product information into two image-based elements (model image information, detail image information), and two text-based elements (basic text information, detail text information) through content analysis of the product information presented in the online fashion stores. Differences in visual behavior according to those information elements were identified with three visual behavior indicators. For identifying consumers' information search behavior empirically, this study examined in what order consumers search for product information, and what information they focus on more. Furthermore, we analyzed whether consumers' information search behavior was affected by involvement. This study will provide practical and objective evidence of online consumer's information searching behavior by using various visual behavior indicators. It is also expected to provide implications for online fashion stores to establish strategies on how to organize product information efficiently.

II. Background

1. Product Information

The information provided by online stores plays an important role in consumers' purchase decisions (Fiore et al., 2005; Lohse & Spiller, 1998; Nitse et al., 2004). Consumers have to purchase entirely on the information provided by the online store, owing to this, information provision holds more value for online stores than traditional channels (Lohse & Spiller, 1998). As obtaining information is one of the motivations for online shopping behavior, providing proper information is very important for online stores (Hausman & Siekpe, 2009). Information provided by online stores can be divided into product information and service information (Park & Kim, 2003). Product information conveys product attributes, reviews, and evaluations, while service information provides details about memberships, FAQs,
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and delivery. Especially, product information has been seen to have a greater impact on consumer satisfaction than service information (Park & Kim, 2003). Furthermore, according to Lohse and Spiller (1998) product information has the greatest impact on online stores’ traffic and sales than other informations. Especially in the fashion domain, the accuracy of product information, such as the degree of difference between the physical product and the online image, exact sizing, and image clarity, greatly affects consumer satisfaction (Hong & Jin, 2011; Kim & Kim, 2001; Nitse et al., 2004).

Also, depending on how it is presented, information provided by online stores can be divided into image and text (Ho, 2014; Kim & Lennon, 2008; Park & Kim, 2003). Information is presented as either image or text, and such differences in form lead to variations in information processing (Park & Kim, 2003). Image facilitates evoke imagery information processing, while text facilitates evoke discursive information processing (Kim & Lennon, 2008). According to dual coding theory, which is first proposed by Paivio (1986), cognition activities are as a result of two mental subsystems; a verbal system and an imaginal system. Those two subsystems work interactively, particularly the visual stimulus is simultaneously processed, whereas the verbal stimulus is sequentially processed. Therefore, image is suitable for initially capturing consumers’ attention (Clement et al., 2013; Kim & Lennon, 2008, Paivio, 1986). In the case of fashion product which is highly subjective, image and text information are interconnected, influencing the purchase decision (Holbrook & Moore, 1981). Especially the text information ultimately affects purchase decisions by explaining product attributes (Behe et al., 2015; Mazursky & Vinitzky, 2005). Wang et al. (2014) analyzed differences of consumer information search searching on the product information between electronic and fashion product, which in the case of electronic products consumers mostly explored text information about performance of product, while in the case of clothing, images and text were mutually explored. Luan et al. (2016) focusing on online reviews between electronic and fashion product, analyzed differences of consumer information search searching, and the result also shows that consumers mostly explored text information about electronic products while they mutually explored images and text information about clothing.

However, although fashion forms a big part of the online market, there is a lack of practical research examines consumers’ information searching behavior focusing on fashion product information. Therefore, this study examined consumers’ information search behavior focusing on product information provided by online fashion stores using eye-tracking technology to assess visual behavior. Especially, based on how it is presented, we categorized product information into two image-based elements (model image information, detail image information) and two text-based elements (basic text information, detail text information). Image-based elements are classified according to their characteristic (whether a model exists), while text-based elements are classified according to the classification method used by online fashion stores. Consumers' visual behavior toward each element was examined by using eye-tracking technology.

2. Eye-tracking Technology

Eye-tracking technology monitors where a person is looking. Eye-tracking is a technology that tracks pupils and analyzes visual behavior, such as when, where, and how long people gaze for a specific area (Maughan et al., 2007). Cognitive processing of presented information must be preceded by visual processing. Thus, the visual behavior identified by tracking eye movements can be an empirical factor in measuring an individual’s attention (Kanwisher & Wojciulik, 2000; Orquin & Loose, 2013). In other words, staring at a particular object means that an individual recognizes the object and thinks about it or pays attention to it; thus, a person’s cognitive process can be demonstrated by tracking their visual behavior (Huddleston et al., 2018). Visual behavior reveals a person’s cognitive, emotional, and conceptual processes and is further used to predict and interpret behavior (Luan et al., 2016). Pieters and Warlop (1999) also posited that consumers’ eye
movements can offer objective information about attention, which facilitates a better understanding of product attractiveness and the processes involved in product choice. Huddleston et al. (2018) suggested that these visual behaviors can be an indicator of purchasing. In this way, visual behavior is not only an objective measure of consumer interest and attention but is also an important predictor of purchase decisions.

Generally, eye-tracking technology involves analyzing visual behavior by setting up the area of interest (AOI). The visual behavior data include time to first fixation (TFF), duration of fixation (DOF), and the number of fixations (NOF) (Ho, 2014; Orquin & Loose, 2013). TFF is more influenced by how visual stimulus is presented than the individual's characteristics, while DOF and NOF are more influenced by individual's characteristics than the form of stimuli (Bang & Wojdynski, 2016; Kanwisher & Wojciulik, 2000; Rayner et al., 2008). There are two broad determinants of visual attention; bottom-up factors in the stimulus and top-down factors in the person and in the attentional process itself (Pieters & Wedel, 2004). Bottom-up factors are features of stimulus such as size, shape and color. These factors capture attention rapidly and almost automatically, even when the consumer is not actively searching for them. Top-down factors reside in the person and in his or her attentional process, Personal factors, such as familiarity with brands, cognitive demand tasks, or preference toward ads encourage individual to voluntarily pay more or less attention to stimuli (Bang & Wojdynski, 2016; Rayner et al., 2008). In other words, TFF is more influenced by bottom-up factors than top-down factors while DOF and NOF is more influenced by top-down factors than bottom-up factors. Therefore, in prior studies used TFF as a measure of visual attention, while DOF and NOF have been used separately as measures of individual's interest and attention to the area (Bang & Wojdynski, 2016; Maughan et al., 2007; Orquin & Loose, 2013). According to Ho (2014), which analyzed consumers' visual behavior especially while purchasing handbags online, TTF for each component of the handbag was different from the DOF and NOF. Bang and Wojdynski (2016) examined the effects of person-alization and cognitive demand tasks in banner advertising on visual behavior, and TFF was not affected by them. Rayner et al. (2008) examined relation between TFF and consumers' perceived effectiveness and likeness toward ads, the result showed that there is no correlation between them. Therefore, in this study, we considered TTF separately from DOF and NOF.

1) **TFF**

TFF is the amount of time it takes for the consumer to look at a specific AOI from stimulus onset and is an indicator of how quickly the AOI was viewed (Behe et al., 2015). In other words, the shorter the TFF, the shorter the response time in looking at the specific AOI. As TFF is more influenced by bottom-up factors than top-down factors, it is affected how stimulus presented. Generally, TFF is shorter when image is presented rather than text one (Clement et al., 2013). This tendency is consistent with Paivio (1986) which assumed visual information is simultaneously processed. Especially, TFF tends to be shorter with visual stimulus with a human face than without it (Hwang & Kim, 2013). Also, TFF is shorter when the stimulus presented in a distinct color, large in size, and not very crowded (Orquin & Loose, 2013, Pieters & Wedel, 2004). Therefore, TFF is mainly used in advertising, where visual attention is directly related to performance. By analyzing differences in consumers' visual behaviors, which vary by advertisement types and presentation methods, it has been possible to measure advertising effectiveness and propose methods for creating advertisements that draw visual attention (Bang & Wojdynski, 2016; Maughan et al., 2007; Simmonds et al., 2020). Therefore, with TFF expected to be greatly influenced by the characteristics of product information for fashion products, the hypotheses of this study are as follow.
H1. There will be differences in TFF for the four information elements for fashion products.
H1a. The Model image information will get the shortest time in TFF than the others.
H1b. The Detail text information will get the longest time in TFF than the others.

2) **DOF and NOF**

DOF is the total time spent looking at a specific AOI and NOF refers to the number of meaningful fixations on a specific AOI and is an indicator of how many times the consumer has looked at an AOI (Behe et al., 2015). NOF is measured in terms of one fixation of 0.33 seconds or more; this indicates a meaningful fixation with the consumer paying attention to the AOI, not a saccadic eye movement. Generally, text has more information to deal with, it requires more gazing to be comprehended than image (Pieters & Wedel 2004). Especially, more attention per unit surface is required for visual stimulus when the information is heavily packed in. In other words, since verbal stimulus require more attention to be proceeded, they got more DOF and NOF rather than visual stimuli (Pieters & Wedel, 2004). Otherwise, according to Rayner et al. (2008), a visual stimulus can get more DOF and NOF because it can be processed wider in scenes than a verbal one. The greater the amount of information to be proceeded, the greater DOF and NOF.

However, DOF and NOF are more affected by bottom-up factors such as the consumer's interest and attention, rather than the top-down factors (Huddleston et al., 2015; Orquin & Loose, 2013). Studies to explain consumers' behavior have found that two visual indicators are affected by product and brand recognition (Huddleston et al., 2018; Simmonds et al., 2020), and that product preference can be predicted (Maughan et al., 2007; Rayner et al., 2008; Russo & Leclerc, 1994). According to Pieters and Warlop (1999) and Liu et al. (2017), DOF is influence by time constraints and motives for performing the task at the time of purchase. Therefore, if the information search time is limited, the consumer tends to focus only on the information necessary to complete the task. According to Mundel et al. (2018), there may arise differences in information that the consumer considers important depending on the characteristics of the product itself, and such differences also affect DOF. Therefore, with DOF and NOF expected to greatly influence consumers' interest and attention on the basis of the product information for fashion products and the amount of information, the hypotheses of this study are as follow.

H2. There will be differences in the DOF and NOF toward the four information elements for fashion products.
H2a. The Detail text information will get the most DOF and NOF than the others.
H2b. The Basic text information will get the least DOF and NOF than the others.

3. **Involvement**

According to Hausman and Siekpe (2009), information processing behavior is affected by not only the characteristics of online stores but also those of consumers. Therefore, both these aspects need to be considered in the provision of consumer-oriented information. Involvement can be defined as a person's perception of the relevance of an object based on inherent needs, values, and interests ( Zaichkowsky, 1985). Involvement is a continuous and relative concept, but for convenience, it is divided into high involvement and low involvement. Having been the subject of much research, while it is not a novel concept, it is useful in explaining consumer characteristics. Involvement has been noted as an important variable that explains consumer behavior by acting as a motive for information processing, purchasing behavior, satisfaction etc. (Chakken, 1980; Kang & Sung, 2014; Petty et al., 1981). Laurent and Kapferer (1985), who suggested the need for a multidimensional tool to measure involvement as it is influenced by a variety of factors, developed the Consumer Involvement Profile (CIP). This tool assesses the importance of products, risk perceptions, heuristic values, and symbolic values. Product contribution refers to the value or level of interest that consumers
assign to the product itself (Krugman, 1971).

Especially, Petty and Cacioppo (1986) illustrated how the key factors of consumers’ involvement influence information elaboration which determines their perception and behavior. With high motivation and high ability, elaboration likelihood is high, so consumers tend to make a deeper and more conscious analysis of information. On the contrary, with low motivation and low ability, elaboration likelihood is low and consumers tends to form their attitude or decision by some simple or peripheral cues. In other words, in the case of high involvement, central information such as product attributes and information quality greatly influence the purchase decision, while in the case of low involvement, surrounding information such as the model and the brand tend to become significant (Chaiken, 1980; Petty et al., 1981; Petty et al., 1983). In addition, in the case of a high-involvement product, as consumers are more aware of its importance, they actively engage in complex information processing, while in the case of a low-involvement product, consumers tend to passively engage in simple information processing (Petty et al., 1983). Furthermore, Pieters and Wedel (2004), visual stimulus relies more on peripheral and preattentive processes that are automatic, parallel, fast, and less effortful. In addition, image is often perceptually more distinct than text which requires more attentions to be comprehended.

According to Yang (2015), which examined the effect of elaboration level toward DOF, high elaboration group tends to gaze longer overall information including pictures and function attributes information than low elaboration one. Behe et al.’s (2015) also examined the effect of involvement toward visual behavior indicators including TFF, DOF and NOF. The result showed that TFF for overall information was shorter for low-involved participants than high-involved participants, while DOF and NOF for overall information were higher for high-involved participants than low-involved participants. As TFF is more influenced by bottom-up factors than top-down factors, Bang and Wojdysnski (2016) showed that personal characteristics (personalization and cognitive demand tasks) affected DOF and NOF while they didn’t affect TFF. Rayner et al. (2008) also showed that there is no correlation between personal characteristics and TFF. Most prior studies examining the link between consumer characteristics and visual behaviors have utilized DOF and NOF, but not TFF (Maughan et al., 2007; Menon et al., 2016; Russo & Leclere, 1994; Simmonds et al., 2020; Wästlund et al., 2015). Therefore, to provide concrete basis, this study used all three indicators to determine if there are differences in visual behavior based primarily on involvement which is explaining consumer characteristics. Thus, the hypotheses of this study are as follow.

H3. There will be no difference in TFF depending on the degree of involvement with four information elements for fashion products.
H4. There will be difference in DOF and NOF depending on the degree of involvement with four information elements for fashion products.
H4a. DOF and NOF for detail text information will be higher in high-involvement group than the low-involvement group.
H4b. DOF and NOF for image information will be higher in low-involvement group than the high-involvement group.

III. Methods

1. Participants

This study was conducted on women in their 20s and 30s, who form the main customer base of online stores. The participants were 41 college and graduate students in Seoul who had expressed willingness to take part in the study. This study got approval from the Institutional Review Board of affiliated university on in July 2019, informed consent was also obtained for experimentation with all participants. Owing to the nature of the eye-tracking experiment, which involved analyzing the visual perceptual processing of the human pupil, based on expert advice regarding accurate data extraction, there were some constraints on participant selection. As a result, the participants were limited to those who had sufficient visual acuity with regard to the sti-
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2. Stimuli

The product information constituting the experimental stimuli was based on what was observed on the websites of the top 67 domestic online stores, as ranked by ‘ranky.com’. The product attribute information provided by online fashion shopping malls was analyzed and classified into image-based and text-based elements. Based on the analysis of online fashion shopping malls, the top six image elements considered for experimental stimuli were: model front view (97.0%), model side view (91.0%), flat front view (89.6%), wearing detail view (86.6%), model rear view (85.1%), and flat detail view (79.1%). The top eight text elements considered for experimental stimuli were: product name (100.0%), price (100.0%), size (100.0%), description (100.0%), actual size (100.0%), care method (100.0%), fabric (98.5%), and color (94.0%). Finally, the product information included in the experimental stimuli consisted of two image-based elements according to their characteristic—model image information (front view, side view, rear view) and detail image information (wearing detail view, flat front view, flat detail view)—as well as two text-based elements according to the classification by online stores—basic text information (product name, price, color, size) and detail text information (product description, fabric, actual size, and care method). The area taken up by each of the elements was the same in size, but their placement differed for each experimental stimulus in order to exclude sequential effects and minimize the possibility of boredom. The stimuli were produced using images posted in the ZARA online store with informed consent. As shown in <Fig. 1>, product informations were edited into one image. The reasons for editing and using it in a form different from the presentation on actual online stores are customization for the experiment, facilitation of the setting of the AOI, and accurate analysis of visual behavior.

3. Design

For the purpose of configuring the various experimental stimuli, a preliminary survey on the most purchased fashion products was conducted. The survey was conducted online to get various responses and consisted of seven questions. Questionnaires are about demographic characteristics and the most purchased items by top, bottom, dress, and outerwear categorizations.

![Fig. 1. Example of stimuli. Adapted from 벨트 원피스 [Belted dress] (n.d.). https://zara.com](image-url)
used on most online stores. The survey was conducted on 154 women in their 20s and 30s with online shopping experience. As per the results, the most purchased items were t-shirts (38.3%) in the top category, jeans (52.6%) in the bottom category, dresses (87.0%) in the one-piece category, and coats (48.1%) in the outwear category. Accordingly, these 4 items, which had basic design and low saturation, were used as the experimental stimuli.

After preliminary survey, 64 experimental stimuli were made which consist of 16 styles of each t-shirts, pairs of jeans, dresses, and coats. Then, preliminary experiment was conducted on a total of six graduate students and professor to design experiment. Based on the interviews and advice offered in the preliminary experiment, intended to reduce the possibility of the selected participants experiencing fatigue, finally 8 styles of each items, totally 32 styles were selected as the experimental stimuli. The product information type was configured to be placed twice each, in allocated spaces of four partitions (2 (top, bottom) × 2 (right, left)). In order to effectively promote information search behavior, the viewing of each experimental stimulus, which was randomly presented, was limited to 15 seconds. This is because observers tend to navigate effectively, focusing on the information they are interested in when the given time is limited (Huddleston et al., 2018). In addition, before the presentation of each 32 experimental stimuli, the participant's attention was refocused to the center of the screen by presenting a bull's eye “+” display against a black background. It was presented for 2 seconds, as a result, include 32 experimental stimuli and 31 bull's eye screens, it took about 10 minutes for eye-tracking experiments.

4. Procedure

All selected participants were provided with a description of the study in the same environment and asked to complete a questionnaire consisting of 19 questions about demographic characteristics, online shopping experience, and involvement in fashion products. To understand the level of the online shopping experience, we measured the number of purchases of fashion products through online shopping on average a month. Questionnaires for measuring involvement in fashion products were referred to the questionnaires used in Lee and Park’s (2006) and the CIP (Laurent & Kapferr, 1985). Questionnaires were modified to suit the research questions, they consist of eight questions about importance, utility, perception of risk, value, pleasure of fashion products on a seven-point Likert scale.

Following the completion of the questionnaire, eye-tracking experiment was conducted with Gazepoint GP3 HD eye-tracker. It is a fixed model, used by attaching monitor which presents visual stimuli. The eye-tracker recognizes experimenter's pupils, measures visual behavior and extracts visual data. For eye-tracking experiment, participants sit on chairs 60 cm away from 17-inch monitor attached with the eye-tracker. The experiment was conducted by staring at the monitor with their forehead and chin fixed to the head and chin rest. After conducting two-three eye-tracking calibrations, the participants were told “Imagine that you are actually shopping online and accordingly search for the product information displayed on the monitor” and asked to focus on the 32 pages of experimental stimuli presented on the monitor. Dual monitors were used, with the monitor being used by the participant showing only the screen for the experiment as set by the researcher, while through the other monitor, the researcher was able to confirm that the experiment proceeded smoothly by observing the real-time data extracted during the process and the eye-tracking experiment. The total amount of time spent on the eye-tracking experiment was about 10 minutes. Finally, participants were thanked and debriefed.

IV. Results

1. Demographic Characteristics of Participants

The visual behavioral data of three participants were removed owing to technical problems during the experiment, resulting in valid data from 38 participants fin-
ally being used for analysis. The mean age of participants was 25 years (S.D.= .73), with a range of 20 to 39 years. 56.1% of participants are undergraduate students (n=23), 14.6% are graduate students (n=6), 17.1% are office worker (n=7) and 4.9% are freelancer (n=2). All participants purchased fashion products online at least once a month, with the average number of such purchases being 3 (S.D.=2.31), with a range of 1 to 10.

2. Data Analyses

Heat map and visual behavior data extracted using the Gazepoint Analysis program. Before quantitative analysis, a heat map analysis was conducted. Heat map is a qualitative analysis that visually represents the results of the sum of all participants’ visual behavior. Heat map shows the amount of fixation in each area. In a heat map, visual behavior data is displayed as different colors according to the duration and the number of fixation. Red represents the highest level of fixation, followed by yellow, green and blue, and areas without color attract no fixations (Luan et al., 2016). Therefore, eye-tracking studies use heat map generally to help easily recognize the results of visual behavior. For quantitative analysis, extracted visual behavior data and questionnaires were analyzed using SPSS 23.0.

1) Visual Behavior on the Fashion Product Information

Heat map result of visual behavior data for information elements by item is shown in <Fig. 2>–<Fig. 5>. The figures below, which are the results of one style

![Heat map result of visual behavioral data for information elements (t-shirt).](https://zara.com)
for the item, represent a heat map result of each item. As shown in heat map, generally for every item, model image and detail text information were gazed more rather than basic text and detail image information. Compared to other items, especially for a coat, detail text information was gazed much more than other elements of information. The 8 styles were integrated, the visual behavior for information elements was analyzed by using the average value of the data measured for 8 styles, and the result of descriptive statistics is shown in <Table 1>. Except for t-shirts, the other 3 items showed the same tendency on information elements in the case of TFF. However, all 4 items showed the same tendency on information elements in the case of DOF and NOF. The results of DOF and NOF for information elements showed the same tendency, while TFF tended to be distinct from them.

A one-way ANOVA was conducted to analyze the differences in visual behavior by information elements and the result is shown in <Table 2> and <Fig. 6>. Although there were differences in the three visual behavior factors for the four information elements by item, because the ANOVA results were not significant (TFF ($p>.29$), DOF ($p>.37$), NOF ($p>.09$)), the four items were integrated into a fashion product. Thus, the differences in visual behavior for information elements were analyzed by using the average value of the data measured for 4 items. Welch’s $F$ was used because homogeneity of variance was not achieved. The results of the analysis showed that TFF ($F(3, 148)=37.69, p<.05$), DOF ($F(3, 148)=22.88, p<.05$), and NOF ($F(3, 148)=33.93, p<.05$) showing significant differences, there-
fore, H1 and H2 were supported. Post-hoc analysis was conducted and by using Dunnett's T3 to examine the differences in information elements. As a result, in the case of TFF, fixations occurred quickly in the order of model image > detail image > basic text, detail text information, therefore, H1a and H1b were supported. This is consistent with the findings of a previous study that images, and particularly human images, attract visual attention more quickly than text (Clement et al., 2013; Hwang & Kim, 2013; Paivio, 1986). In the case of DOF, longer fixations occurred in the order of detail text, model image > detail image, basic text information. In the case of NOF, many fixations occurred in the order of detail text, model image > detail image > basic text information, therefore, H2a and H2b were also supported. This can be interpreted as detail text and model image information got the most attention and consumers most actively searched for those. Especially, detail text information received lots of attention because of the large amount of information presented compared to other types. Also, the tendency of DOF and NOF were identical, but TFF showed differently. This is consistent with previous studies in which TFF has shown different tendency from the other two visual behavior indicators (Ho, 2014; Maughan et al., 2007; Orquin & Loose, 2013).

2) Visual Behavior on the Fashion Product Information by Involvement

With the reliability of eight involvement of fashion product questions having been ensured ($\alpha=.895$), they were integrated and used as an involvement of fashion
products measure. In order to analyze the difference in visual behavior regarding information elements according to the degree of involvement, high/low-involvement groups were created based on the mean value of involvement (M=37.31, S.D.=8.34). The result of heat map of visual behavior data for information elements by groups is shown in <Fig. 7>. As shown in heat map, generally, high-involvement group gazed detail text and model image information more than detail image and basic text information, while low-involvement group gazed overall image information and basic text information more than detail text information.

To examine the differences in visual behavior for information elements between the two groups, independent samples t-test was conducted and the result is shown in <Table 3> and <Fig. 8>. In the case of TFF, all four information elements were not significantly different between the groups (p>.13). This result is not consistent with Behe et al. (2015) which showed that involvement affected TFF. However, it is consistent with Bang and Wojdynski (2016) and Rayner et al. (2008) which showed that personal characteristics did not affect TFF, therefore H3 is supported. This result can be interpreted that TFF is more influenced by bottom-up factors than the personal top-down factors.

However, in the case of DOF and NOF, for some information elements, there were significant differences between the groups, therefore, H4 was partially supported. First, in the case of DOF, the differences between the groups with regard to basic text, detail text, and model image information were significant. In basic text information (M_{High-Low}=-.21, t=-2.01, p=.05) and mo-
del image information ($M_{\text{High-Low}}=-.56, t=-2.07, p=.04$), fixations occurred for longer periods of time in the low-involvement group, but regarding detail text information ($M_{\text{High-Low}}=1.38, t=3.99, p<.00$), fixations occurred for longer periods of time in the high-involvement group. In the case of NOF, the differences between the groups regarding detail text and detail image information were significant, and many fixations occurred in detail text information ($M_{\text{High-Low}}=3.98, t=4.60, p<.00$) in the high-involvement group and in detail image information ($M_{\text{High-Low}}=-1.18, t=-2.44, p=.02$) in the low-involvement group. Therefore, H4a was supported while H4b was partially supported.

Later, a two-way analysis of the variance (two-way ANOVA) was conducted to analyze the effects of the interaction between the involvement group and the information element toward visual behavior and the result is shown in Table 4. In case of TFF ($R^2=.46$), there was significant main effect for information element ($F=47.76, p<.05$), but a main effect for group ($F=3.39, p=.10$) and an interaction effect of group with information element was not significant ($F=1.73, p=.24$). However, in case of DOF ($R^2=.49$), there was no significant main effect for group ($F=.70, p=.40$), but a main effect for information element ($F=29.69, p<.05$) and an interaction effect of group with information element was significant ($F=13.89, p<.05$). Also, in case of NOF ($R^2=.50$), there was no significant main effect for group ($F=1.19, p=.28$), but a main effect for information element ($F=31.29, p<.05$) and an interaction effect of group with information element was significant ($F=15.14, p<.05$). Thus, for DOF and NOF, as the effects of the interaction between the group and the information element, high-involvement group tends to pay more attention toward detail text information than low-involvement one, while low-involvement group tends to pay more attention toward basic text, model image and detail image information. Moreover, the information element that shows the highest DOF and NOF in the high-involvement group is detail text information, while in

<table>
<thead>
<tr>
<th>Product</th>
<th>Information</th>
<th>TFF (n=38)</th>
<th>DOF (n=38)</th>
<th>NOF (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-shirts</td>
<td>Basic text</td>
<td>3.96 (2.03)</td>
<td>2.42 (.57)</td>
<td>6.18 (1.55)</td>
</tr>
<tr>
<td></td>
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<td>3.56 (1.14)</td>
<td>9.95 (3.42)</td>
</tr>
<tr>
<td></td>
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<td>3.22 (1.00)</td>
<td>9.05 (2.63)</td>
</tr>
<tr>
<td></td>
<td>Detail image</td>
<td>2.23 (1.02)</td>
<td>2.43 (.70)</td>
<td>7.92 (1.70)</td>
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<tr>
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<td>2.31 (.70)</td>
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<tr>
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<td>Detail text</td>
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<tr>
<td>Dresses</td>
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<td>2.35 (.74)</td>
<td>6.04 (1.16)</td>
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<td></td>
<td>Detail image</td>
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<td>2.38 (.62)</td>
<td>8.38 (2.00)</td>
</tr>
<tr>
<td>Coats</td>
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<td>2.51 (.67)</td>
<td>6.79 (1.57)</td>
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</tr>
<tr>
<td></td>
<td>Detail image</td>
<td>2.48 (1.04)</td>
<td>2.52 (.89)</td>
<td>7.46 (2.24)</td>
</tr>
</tbody>
</table>
In the low-involvement group it is model image information. This is consistent with Petty and Cacioppo (1986), which argued that high-involvement consumers focus on the central information, while low-involvement consumers focus on the peripheral information. Furthermore, as visual stimuli were presented in limited time, it seemed that DOF and NOF of other information elements excluding detail text information are higher in low-involvement group since high-involvement group spent lots of time exploring detail text information.

### V. Conclusion

#### 1. Discussion

Online stores provide product information in their own ways. Product attribute information is generally arranged vertically on the product detail page, so that it can be read while scrolling down. Owing to technological developments, consumers' expectations of online stores are permanently on the rise, making it nece-
A Study on Visual Behavior for Presenting Consumer-Oriented Information on an Online Fashion Store

It is necessary for online stores to find new ways to maximize the shopping experience. In particular, because of the nature of the online domain, which has an abundance of information, effective product information presentation is an important issue for retailers and managers. Online stores need to understand consumers' search behavior in order to provide consumer-oriented product information and enhance consumer satisfaction. Therefore, this study focused on the attribute information of fashion products, classifying it into four types, and empirically analyzed consumers' information searching behavior using eye-tracking technology.

First, it was found that in the context of the speed of attracting visual attention, among the types of product information, images take precedence over text. Specifically, the model image information attracts visual attention faster than the detail image information and this result is consistent with the findings of a previous study (Luan et al., 2016; Wang et al., 2014). This can be interpreted in the context of the nature of fashion products, which are associated with pleasure, and in which empirical aspects are considered important. When consumers search for information on fashion products, they first seek to determine the design and fit when worn. The types of images that received the most visual attention were detail text and model image information, meaning that consumers consider the information of product attributes such as fabric and actual size as well as the model images the most. Despite the limited time in which the experimental stimulus was presented, the fact that it received most attention implies that detailed information is regarded as an important factor (Liu et al., 2017). In addition, DOF and NOF for product information were identical, but differences were found in the case of TFF, which is consistent with previous studies (Ho, 2014; Maughan et al., 2007; Orquin & Loose,
2013) where TFF was used separately from the other two visual behavior indicators.

Furthermore, analysis showed that product involvement influences information search behavior. In the case of TFF, there was no difference between the two groups classified by involvement. This result is not consistent with Behe et al. (2015) but consistent with Bang and Wojdynski (2016) and Rayner et al. (2008). Therefore, it seems that further research is needed to determine whether an individual's characteristics affect TFF. However, there were differences between the groups in terms of DOF and NOF. Although the results of the

### Table 3. Differences in visual behavior for fashion products information elements by group

<table>
<thead>
<tr>
<th>Visual behavior</th>
<th>Variables</th>
<th>Mean (S.D.)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High-involvement (n=20)</td>
<td>Low-involvement (n=18)</td>
<td></td>
</tr>
<tr>
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<td>3.84 (1.36)</td>
</tr>
<tr>
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<td>Detail text</td>
<td>3.62 (.95)</td>
<td>4.47 (2.08)</td>
</tr>
<tr>
<td></td>
<td>Model image</td>
<td>1.76 (.90)</td>
<td>1.59 (.69)</td>
</tr>
<tr>
<td></td>
<td>Detail image</td>
<td>2.19 (.67)</td>
<td>2.34 (.65)</td>
</tr>
<tr>
<td>DOF</td>
<td>Basic text</td>
<td>2.30 (.30)</td>
<td>2.51 (.35)</td>
</tr>
<tr>
<td></td>
<td>Detail text</td>
<td>4.41 (1.09)</td>
<td>3.03 (1.04)</td>
</tr>
<tr>
<td></td>
<td>Model image</td>
<td>3.01 (.84)</td>
<td>3.57 (.84)</td>
</tr>
<tr>
<td></td>
<td>Detail image</td>
<td>2.38 (.37)</td>
<td>2.59 (.34)</td>
</tr>
<tr>
<td>NOF</td>
<td>Basic text</td>
<td>6.19 (.96)</td>
<td>6.45 (1.17)</td>
</tr>
<tr>
<td></td>
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<td>12.31 (2.84)</td>
<td>8.33 (2.45)</td>
</tr>
<tr>
<td></td>
<td>Model image</td>
<td>8.84 (1.98)</td>
<td>10.00 (2.37)</td>
</tr>
<tr>
<td></td>
<td>Detail image</td>
<td>7.21 (1.34)</td>
<td>8.39 (1.64)</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01, ***p<.001

![Fig. 8. Differences in visual behavior for fashion products information elements by group.](image_url)
two types of visual behavior did not match exactly, the patterns of DOF and NOF for the two groups of information types were the same. Fixations for detail text information occurred for longer periods of time in the high-involvement group, and fixations for basic text and model image information occurred for longer periods of time in the low-involvement group. Besides, fixations for detail text information occurred more frequently in the high-involvement group, while fixations for detail image information occurred more frequently in the low-involvement group. Taken together, these results show that consumers with high involvement tend to pay more attention to detailed information so as to determine the attributes of products, while consumers with low involvement tend to pay more attention to image-based and basic information such as product price. This result is consistent with previous studies (Chaiken, 1980; Petty et al., 1981; Petty et al., 1983) reporting that higher involvement is accompanied by central information about the product receiving increased significance and more active seeking of other information.

The results of this study can be summarized as follows. There are differences in consumers’ information search behavior according to the type of product information. Furthermore, the type of information that consumers value may differ depending on the degree of involvement. Therefore, online stores need to present various information types in different ways to effectively attract consumers with varying characteristics. Generally, consumers first search for model images, which they consider the most important. In particular, low-involvement consumers consider image-based information important. Text-based information, however, detailed information on products is also generally recognized as important, particularly for high-involvement consumers, while basic information tends to be important to low-involvement consumers.

Based on these results, it can be suggested that consumer-oriented information be presented as follows. Regarding the placement order, the model image should either be the representative product image or positioned first, with the detail text information also placed relatively preferentially, so that it may interact with the image information in order to effectively facilitate con-

<table>
<thead>
<tr>
<th>Visual behavior</th>
<th>Information element</th>
<th>Group (n=20)</th>
<th>Group (n=18)</th>
<th>Group × Information element</th>
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<tbody>
<tr>
<td>TFF</td>
<td>Basic text</td>
<td>3.38 (.92)</td>
<td>3.84 (1.36)</td>
<td>3.39 47.76* 1.73</td>
</tr>
<tr>
<td></td>
<td>Detail text</td>
<td>3.62 (.95)</td>
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<td>Model image</td>
<td>1.76 (.90)</td>
<td>1.59 (.69)</td>
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<td>2.34 (.65)</td>
<td></td>
</tr>
<tr>
<td>DOF</td>
<td>Basic text</td>
<td>2.30 (.30)</td>
<td>2.51 (.35)</td>
<td>.70 29.69* 13.89*</td>
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<td></td>
<td>Model image</td>
<td>3.01 (.84)</td>
<td>3.57 (.84)</td>
<td></td>
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<td></td>
<td>Detail image</td>
<td>2.38 (.37)</td>
<td>2.59 (.34)</td>
<td></td>
</tr>
<tr>
<td>NOF</td>
<td>Basic text</td>
<td>6.19 (.96)</td>
<td>6.45 (1.17)</td>
<td>1.19 31.29* 15.14*</td>
</tr>
<tr>
<td></td>
<td>Detail text</td>
<td>12.31 (2.84)</td>
<td>8.33 (2.45)</td>
<td></td>
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<tr>
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<td>Model image</td>
<td>8.84 (1.98)</td>
<td>10.00 (2.37)</td>
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<tr>
<td></td>
<td>Detail image</td>
<td>7.21 (1.34)</td>
<td>8.39 (1.64)</td>
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</tr>
</tbody>
</table>

*p<.05

a: $R^2=.46$
b: $R^2=.49$
c: $R^2=.50$
sumers' information searching. With regard to the presentation method, if the basic information can be visually expressed to effectively capture consumers' visual attention, and the detailed information configured to sufficiently provide accurate and detailed product information, consumers' satisfaction with not only information quality but also service can be enhanced.

2. Implication

This study, which used eye-tracking technology to analyze consumers' information searching behavior regarding product information, utilized three visual behavior indicators. Therefore, this study not only can facilitate a better understanding of the characteristics of each visual behavior indicator but also present a concrete basis for understanding information searching behavior by mutually verifying the various visual behavioral indicators. In particular, by examining differences in product information types as well as involvement, the study clearly demonstrates that the characteristics of TFF differ from those of DOF and NOF.

In theoretical aspects, this study provides more empirical and accurate evidence by overcoming the methodological limitations of previous studies. By using overall visual behavior indicators to analyze consumer behavior, particularly measuring which information element is explored in the first place when consumers search product information in online fashion stores and which information elements they pay more attention to, this study can help to have more complex understanding of consumers' information searching behavior. Furthermore, as this study empirically validated prior research by demonstrating that involvement influences consumers' information search behavior, it is also expected to contribute to a deeper understanding of how involvement affects consumers' information search behavior. Also, as this study focuses on product attribute information provided by online fashion stores and analyzes it from consumers' perspective, it is expected to help to understand online consumers' information searching behavior at a more detailed and specific level.

In managerial aspects, the results are expected to be of help in preparing a guide for presenting consumer-oriented product information at online stores. The study provides a basis for an effective information presentation by collecting and analyzing consumers' information search behavior according to the characteristics of each product information element through eye-tracking technology. Therefore, the results of this study are expected to provide an objective basis for marketers and managers to come up with not only effective ways to present product information but orders of presentation. Furthermore, the results of the differences in consumers' information searching behavior according to involvement would help establish strategies for how to appeal effectively to a wide range of consumers, ultimately maximize online consumers' shopping experience.

3. Limitations and Further Research

Instead of observing an actual online store, this study was conducted in an experimental environment to analyze consumers' information search behavior with regard to product information. Furthermore, while visual behavior may be influenced by the arrangement of stimuli and other visual factors such as layout, font, color, despite attempts to control for such factors, there exists a possibility that we were unsuccessful in this regard. In addition, despite the fact that information search behavior may be influenced by the characteristics of the fashion product itself, such as price, fit, and design, this study integrated four products into a single fashion product, because there are no significant differences among them.

In further research, based on the results of this study, may be able to explain consumer behavior in a more in-depth manner by organizing product information elements vertically, in the same environments as online stores, but arranging order of product information elements differently, and analyzing consumers' purchase behavior. Furthermore, by subdividing fashion products from various perspectives, it may be possible to analyze differences in information searching behavior according to the characteristics of the products themselves and to provide more specific implications.
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ZARA. [Ribbon shirts dress]. (n.d.). Retrieved from https://www.zara.com/kr/en/search?searchTerm=%EB%B2%A0%20%EC%85%94%EC%B8%A0%EC%88%AC%EC%9D%8C%EC%9D%8C%EC%8A%A4

A Study on Visual Behavior for Presenting Consumer-Oriented Information on an Online Fashion Store

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