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Exploring the Impacts of Consumers' Systematic and Intuitive Cognitive Styles on Their Visual Attention Patterns in Online Shopping Environments: Emphasis on Eye-Tracking Method

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Abstract

We are living in a hypercompetitive market. Therefore, companies running online shopping malls must muster their wisdom to make online shopping websites one of their strategic assets. To meet this objective, companies should understand online consumers' cognitive styles, and then design their online websites according to the styles. In this sense, we focus on two cognitive styles such as systematic type and intuitive type. The former means that consumers may pay more attention to reasonable statements about target product before making decisions, while the latter indicates that consumers may react more sensitively to intuitive information such as images and abstract conjecture. For the sake of novel approach to conducting experiments, we adopted an eye-tracking approach which we believe is more reliable in providing relevant information capable of answering our research questions. For the utilitarian product like notebook computer, systematic type users may show higher TFD (Total Fixation Duration) and FC (Fixation Count) to consumer reviews than intuitive type users. Also, intuitive type users may be more sensitive to special purchase opportunity-giving events information with higher TFD and FC than systematic type users. Through our experiments with an eye-tracking method, we could conclude that a strategic redesign of the online shopping websites is necessary where consumers' cognitive styles need to be significantly considered.

Keywords: *Systematic/Intuitive Cognitive Style, Online Shopping Behavior, Eye-Tracking Approach*

1. Introduction

Since introduction of the Internet technology into the market in 1995, commerce activities on the Internet has undergone dramatic changes. Among those changes, the most prominent thing is that the proportion of online commerce on the web has increased in an unprecedented scale [1]. However, there still exists a critical disadvantage about the online commerce- all the commerce activities must be made on a small web screen. Therefore, online consumers are limited by the small screen in terms of viewing product information and images. Moreover, it is impossible for the consumers to touch and feel the products displayed on the web like they can do in the physical markets [2]. Therefore, how they feel about the product information and image displayed on the websites is likely to significantly influence on the customers' online shopping behavior. Therefore, how to design product information in a small web screen will play a significant role in delivering the true value of a product to consumers [3].

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In the fields of psychology and marketing, previous studies asserted that consumers' cognitive styles like systematic style and intuitive style have huge impacts on consumer behaviors. Unlike physical shopping environment, consumer's purchasing decision in the online shopping websites tends to depend on a small set of particular information [4]. In the online shopping setting, consumers only observe and perceive such information to which they feel interested depending on their cognitive style [5]. Unfortunately, we found that there exists a void in the literature suggesting empirical results to prove how the consumers' cognitive styles will influence on the consumers' online behavior and visual attention patterns.

Therefore, this study aims to investigate whether consumer's visual attention patterns may change significantly depending on their cognitive styles towards the product information displayed. The two types of consumer's cognitive styles are considered in this study – systematic style and intuitive style. The systematic style consumers are likely to focus on analytical information. Meanwhile, intuitive style consumers may be attracted more towards hedonic and qualitative information than analytical information.

This study places main focus on interpreting consumers' way of observing product information displayed on the online shopping mall. In this sense, we adopt an eye-tracking approach as a main research methodology. Especially, we will rely on eyeball fixation counts and time, and eye-movement paths to answer research questions.

2. Research Background

Individuals are known to possess unique cognitive style, independent of their intelligence capacity. Cognitive style represents ways that people receive, organize, and process information [3]. In other words, an individual's cognitive style shows how they think about information. Therefore, it is natural that depending on cognitive styles they have different impacts on the person's decision-making process [4]. This study considers two cognitive styles such as systematic cognitive style and intuitive cognitive style. Those who have systematic cognitive style tend to analyze information in a rational and consistent manner. Thus, people possessing systematic cognitive style take more time looking for relevant information and analyzing it. Contrarily, intuitive cognitive style is concerned with the individual's tendency to grasp information globally and to make decisions after he/she has already understood the entire context of the required decision. Interestingly, our brain is categorized into two hemispheres-left and right. It is widely known that the left hemisphere is responsible for analytic, logical, and sequential information perception. In contrast, the right hemisphere is good at intuitive and simultaneous information perception [5]. Therefore, the left part of our brain controls the systematic cognitive style, and the right part of our brain reign in the intuitive cognitive style.

Jung [6] discussed the systematic and intuition cognitive styles as one of psychological types. In the education area, the systematic and intuition cognitive styles were addressed as one of the learning styles and information perception type [7]. Persons with systematic cognitive style consciously operate rational cognition system which involves intentional, logical, and analytic thinking [8]. They primarily search for information and analyze it to comprehend facts in reality. By contrast, intuitive style is related to the person's tendency to organize information globally. They attempt to understand the entire context of information for decision making [9].

Thus, in the context of online shopping environments, this study hypothesizes that consumers with systematic cognitive styles will be more concerned with empirical and analytical information like consumer review, while consumers with

intuitive cognitive styles are likely to be more reactive about preconscious and holistic information like special event information.

3. Experiments

3.1. Online Shopping Screen

Our research question is concerned with proving hypotheses about whether cognitive styles may lead to consumers' different behavior on the online shopping screen. To prove this research question, we prepared experiment online screens as depicted in Figure 1. In prior studies, consumers' shopping behaviors on the product types [10]. In case of purchasing a utilitarian product like a notebook, consumers prefer analytical information processing in order to make a purchase decision. On the contrary, for the purchase of a hedonic product like perfume, consumer's decision to purchase the product is likely to be more influenced by experiential affect [11]. In this respect, we designed experiments such that participants are exposed to two types of online shopping screen- notebook and perfume- to obtain valid and reliable results. It is known without doubt that a notebook computer is a typical utilitarian product, and perfume a hedonic product [12].

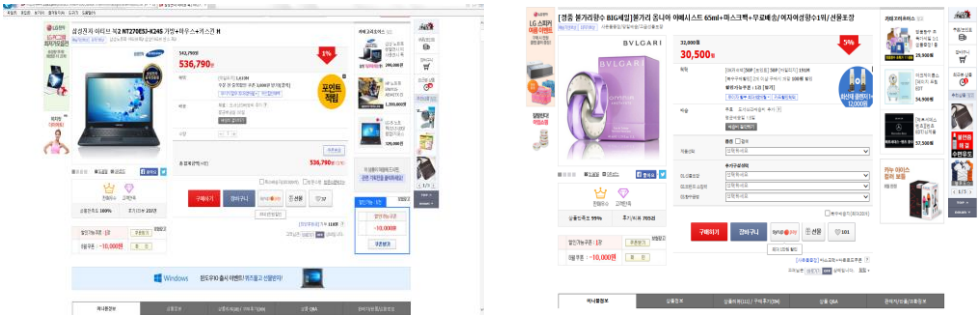

Figure 1. Online Shopping Screens (Notebook and Perfume) for Experiments

The online shopping screens for our experiments were designed in the consideration of typical online shopping mall in South Korea and Amazon. The screens were composed of total nine information types to represent product characteristics- product image, product description, price, consumer's review, consumer's Q&A, seller information, shipping information, exchange/return information, and event information. On the basis of information in the screens, participants of the experiment were required to recognize product's quality and value. In this process, we expected that the participants might implicitly follow their cognitive styles to comprehend information on the screens before making a purchase decision. Since our main experiment method is an eye-tracking analysis, we categorized nine types of areas of interest (AOIs) of the online screens depending on the nine information types as shown in Figure 2. Each AOI represents a target area in which the participant's visual attention patterns are methodically investigated. However, in order to protect our research intentions from participants, how to set AOI categories on the screens was not revealed to participants.

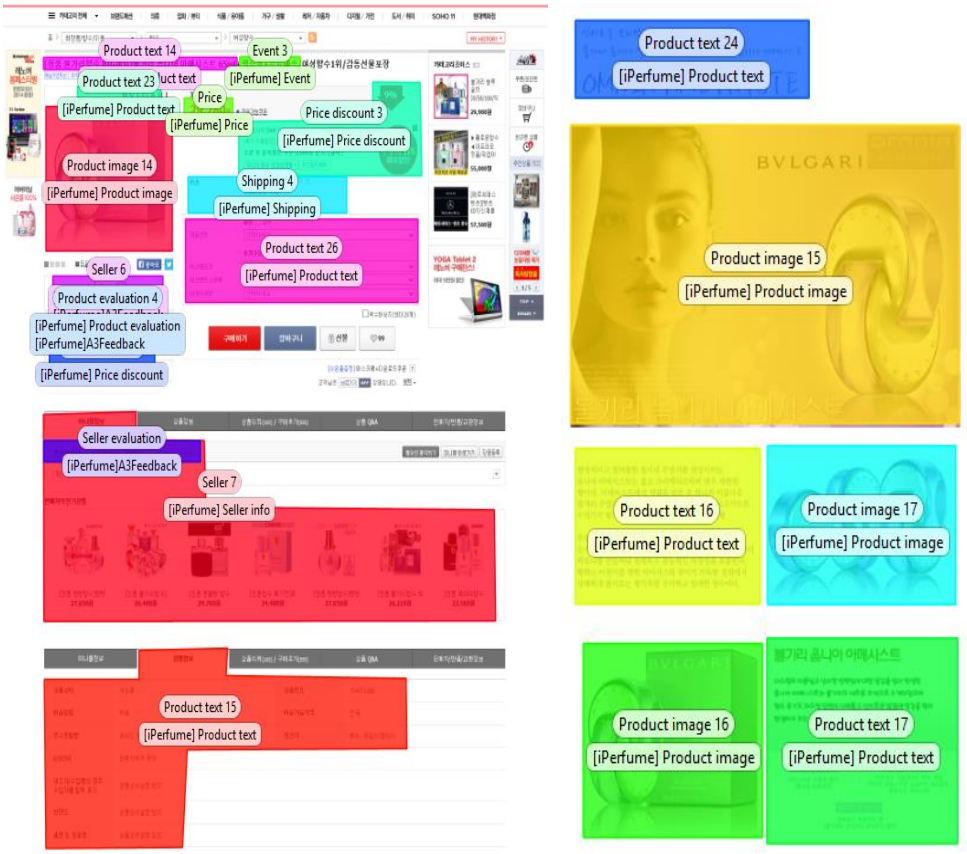

Figure 2. Areas of Interest (AOIs) on the Online Shopping Screens

3.2. Experiment Procedures

Total 47 college students (15 men and 32 women) were recruited from a major university campus in South Korea in May of 2015. Participants got paid $10 for their participation in our experiments. We applied an eye-tracking technology to record participants' visual attention patterns on the online screens for experiments [13]. Metrics about visual attention patterns include eyeball fixation, fixation length, time to first fixation, total fixation duration, and fixation count, *etc*. For example, eyeball fixation presents how long a participant's eyes stay focused on a particular area on the target screen.

In the first step of experiment, participants were introduced to the whole picture of the experiments. Then, they were urged to fill in two questionnaire surveys to collect their demographic information and discover their cognitive styles. Especially, each participant was asked to answer an index of learning style in order to identify their cognitive style such as systematic or intuition [7]. In the second step, a calibration test was conducted in order to correctly trace a participant's eye movement before applying an eye-tracking method to the participant's eye movements. In the final step, the online shopping screens designed for our experiments were displayed to the participants, and the eye-tracking device was used to record their visual attention patterns. The participants were asked to observe the screen and related product information for 100 seconds. The experiment for each participant lasted about 40-50 minutes. Figure 3 depicts the experiments setting used for this study.

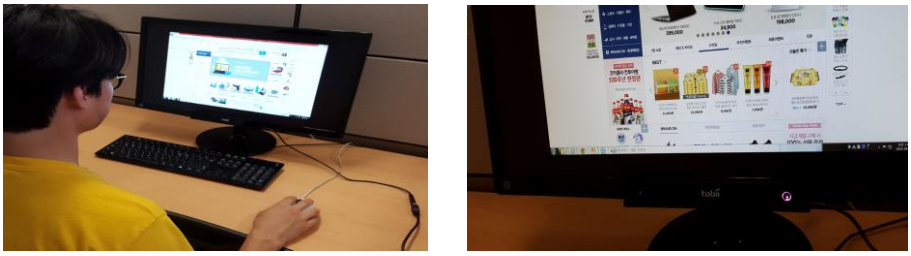

Figure 3. Experiments Setting for the Eye-Tracking Analysis

4. Data Analysis

The primary objective of this study is to investigate consumer's online shopping behavior depending on their cognitive style (systematic vs. intuitive). Especially, our main focus is placed on answering the research questions about how the participants' visual attention patterns differ depending on their cognitive styles like systematic vs intuitive cognitive styles.

To add rigor to our analysis of experiment results, we used three metrics representing participants' visual attention patterns- time to first fixation, total fixation duration, and fixation count. Firstly, time to first fixation (TFF) represents the time in seconds from when the stimulus was shown until the start of the first fixation within an AOI. Total fixation duration (TFD) presents the length of the fixation in seconds within a particular AOI. Finally, fixation count (FC) explains the number of fixations within a specific AOI. In general, TFF indicates where the participants' eyes stop first on the specific AOI, while TFD and FC represent how long and how many times the participant takes a look at the AOI. Each measure was calculated as mean values (seconds in TFF/TFD, count numbers in FC) from the eye-tracking software (Tobii studio 3.2.2). Then, the cognitive style of each participant was calculated by survey results for index of learning style by Felder and Spurlin [7]. Through the survey, 26 participants were identified as the systematic type and the remaining 21 participants were recognized as intuitive type.

As a prelude to measuring TFF, TFD, and FC, we checked the heat map as shown in Figure 4 which visually illustrates general difference of visual attention between the notebook screen and perfume screen. The denser heat map area becomes, the more consumers pay visual attention to that area. As is depicted in In Figure 4 (b), the density of visual attention on product image was more highly formed in the perfume than the notebook. This indicates that participants pay more attention to the perfume's image than the notebook's image because perfume is a hedonic product. In contrast, in Figure 4 (a), we see that participants' visual attention was attracted more to analytical information in notebook than qualitative and hedonic image.

(a) at the Screen for Notebook (b) at the Screen for Perfume

Figure 4. Example of Heat-Map

4.1. Eye-Tracking Results of Notebook

Table 1 addresses the three main measures of the eye-tracking results from the experiments with the notebook for the systematic and intuitive participants. From the TFF results, we found that intuitive consumers began to observe the price information at first glance (5.52 seconds). In contrast, systematic consumers took a glance at product image most quickly (13.90 seconds). This result seems a little bit contrary to our general perception of the systematic consumers and intuitive consumers. However, we obtained relatively consistent results for other AOIs. For example, for the consumer's evaluation, systematic consumer's TFF was 45.50 seconds, and intuitive consumer's TFF was 62.66 seconds, meaning that systematic consumers are more reactive to the analytical and rational information like consumer's evaluation. This is the same with the consumer Q&A, where the systematic consumers show 59.89 seconds for TFF, and the intuitive consumers 91.36 seconds for TFF. This notes that the systematic consumers are more sensitive to the consumer's evaluation than the intuitive consumers.

Let us think about TFD results in Table 1. For the consumer's evaluation information, the systematic consumers paid 8.06 seconds, and the intuitive consumers 5.27 seconds. This result is in sync with our prior belief that the systematic consumers are likely to be more perceptible to analytical information like consumer's evaluation than the intuitive consumers. This result is the same with FC. Let us think about event information. The intuitive consumers paid more attention to the event information than the systematic consumers, considering the TFD results (2.08 seconds vs 1.02 seconds) and FC results (8.54 seconds vs 4.19 seconds).

General findings from the Table 1, we could conclude that the systematic consumer's visual attention was highly targeted to the empirical and realistic information, and that the intuitive consumers paid more visual attention to the preconscious and holistic information.

Table 1. Eye Tracking Results of Notebook

	TFF (Time to First Fixation)		TFD (Total Fixation Duration)		FC (Fixation Count)	
AOI (Areas of Interest)	Systematic	Intuitive	Systematic	Intuitive	Systematic	Intuitive
Product image	13.90	17.12	5.49	5.09	25.50	24.57
Product text	22.10	17.58	5.62	6.53	23.96	28.19
Price	15.08	5.52	0.26	0.43	0.69	1.76
Event	31.45	29.76	1.02	2.08	4.19	8.54
Consumer's Evaluation	45.50	62.66	8.06	5.27	34.88	22.29
Consumer Q&A	59.89	91.36	1.11	2.19	4.40	8.67
Seller information	22.76	22.76	1.05	0.82	4.62	4.32
Return/exchange	64.29	72.75	0.77	0.88	3.50	3.57
Shipping information	37.05	30.57	0.64	0.42	2.20	1.77

4.2. Eye-Tracking Results of Perfume in Each Cognitive Style

In case of a hedonic product like perfume, the TFF, TFD, and FC results were little different from notebook. Table 2 is the eye-tracking results from the experiments with perfume. The TFF results told us that that both of systematic and intuitive consumers observed price information at first (6.76 seconds; 14.45 seconds). Then they similarly began to observe the other areas. From the TFD and FC results, systematic consumers paid most frequent and longest attention to the consumer's evaluation area (5.31 seconds; 23.23 counts), which is similar in the notebook case. However, the intuitive consumers showed different types of visual attention from the case of the notebook. Intuitive consumer gave more visual

attention to consumer's product evaluation (4.73 seconds for TFD; 22.38 counts for FC). Also, their visual attention for the price and event information was similar with systematic consumer. However, intuitive consumer's visual attention was highly targeted to the product related information such as product image, product description, and product Q&A areas than the systematic consumer.

Table 2. Eye Tracking Results of Perfume

	TFF (Time to First Fixation)		TFD (Total Fixation Duration)		FC (Fixation Count)	
AOI (Areas of Interest)	Systematic	Intuitive	Systematic	Intuitive	Systematic	Intuitive
Product image	15.14	17.88	3.79	4.51	15.44	18.18
Product text	17.04	17.24	3.38	5.70	13.32	20.60
Price	6.76	14.45	0.59	0.43	2.35	1.45
Event	17.61	21.22	1.23	1.30	6.81	6.10
Consumer's Evaluation	54.07	64.06	5.31	4.73	23.23	22.38
Consumer Q&A	74.16	84.64	0.53	1.78	3.00	7.29
Seller information	27.58	31.10	0.92	0.76	4.57	3.83
Return/exchange	60.50	65.26	0.62	0.39	3.31	2.33
Shipping information	35.15	35.32	0.59	0.82	2.80	2.67

5. Discussion and Conclusions

The empirical results above revealed that the consumers' visual attention patterns vary depending on their cognitive styles. As noted in [7], persons tend to have two typical cognitive styles. In this study, we pursued the systematic styles and intuitive styles. For example, in the case of hedonic product like perfume, intuitive consumers are strongly attracted and paid more time to both product text and image. They also were attracted more to other consumer's evaluation about perfume.

In literature, the cognitive processing theory has argued that an individual has self-schema containing perceptions, attributes, and experiences related to the self [15]. Accordingly, this study investigated how consumers with different cognitive styles paid different visual attention patterns to different types of information on the online shopping screen. As a result, we could conclude with general findings from our experiments that there exist differences in the visual attention patterns depending on whether they are systematic consumers and intuitive consumers. However, we know that we need to back-up our empirical results with more samples to obtain significant statistical results. In the near future, we will release more valid results about the same research topic. We hope that our results can be used as a catalyst to prompting the similar studies to help online shopping malls.

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