A Comparison of Buying Decision Patterns by Product Involvement: An Eye-Tracking Approach

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Abstract. This research investigated whether buying the decision process differs by the level of product involvement. We analyzed visual attention based on the eye-tracking technique to explore the cognitive characteristics of buying decisions. More specifically, we observed visual attention of involvement by conducting experiments in a website environment. Through eye-tracking experiments, we applied physiological data in order to test our research hypotheses regarding the buying decision process and product involvement, measuring fixation length as visual attention. The results of the eye-tracking experiment showed that the decision process for high involvement products is more complicated than that for low involvement products.

Keywords: Product Involvement, Buying Decision, Eye-Tracking.

1 Introduction

Individuals' decision-making mechanisms contain inconsistencies and errors, and individuals tend to depend on a few specific pieces of information or cues when processing information [7]. Furthermore, all information is not considered when making a decision even though much information is available. Rather, each individual applies his or her own efficient decision rule to specific information [14].

Involvement is a useful concept for exploring whether individuals use different cognitive tools during information search and decision-making processes. Individuals in a high involvement situation are highly motivated to gather as much information as possible and to pay more attention to the purchase, and have a tendency to utilize many cognitive resources. On the other hand, individuals in a low involvement

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situation tend to allocate fewer cognitive resources to the decision-making process because they have low motivation related to the information search and attention to the purchase. Therefore, it is generally accepted that every customer does not consider all of the available information when making a buying decision. Rather, they may use specific pieces of information related to the buying situation. The high involvement situation requires focusing more attention on the information search in a buying decision, while the low involvement situation requires less attention from customers.

The eye-tracking method was recently used to measure an individual's visual attention. Eye-tracking is a physiological technique used to sense visual attention by tracing eyesight, and has recently been adopted in various areas such as the usability and psychological analysis of customers in marketing research. In the current research, we investigated whether buying decisions differ for high and low involvement products by analyzing visual attention (through the measurement of eye movements using the eye-tracking technique) regarding the cognitive characteristics of a buying decision. More specifically, we observed visual attention of involvement by conducting experiments in an online environment. In order to analyze visual attention, we used fixation length to measure eyeball fixation and movement path items, which the eye-tracking technique provides.

2 Theoretical Foundation and Hypotheses

2.1 Product Involvement

Involvement refers to special attention paid to an important object on the basis of an individual's unique desires, values, and interests [15]. Product involvement can also be defined as an individual's perceived level of importance or interest [1, 5]. Meanwhile, several research studies on the effects of product involvement in customers' buying decision processes have been conducted. According to the research of Engel *et al.* [5], customers' information searches become more active and their alternative assessment becomes more complex when the level of involvement increases. Rust *et al.* [12] argued that value equity, which is determined by product quality, price, and convenience, is relatively important in the buying decision for high involvement products. On the other hand, brand equity becomes relatively more important in purchase decisions for low involvement products.

According to the explanation of customer attitude formation in the elaboration likelihood model, in the case of high product involvement, intrinsic clues are considered more important than extrinsic clues when assessing a product because customers tend to pay more attention to the intrinsic attributes of products. However, in the case of low product involvement, extrinsic clues are considered more important factors in product assessment [9].

2.2 Buying Decision

It is generally accepted that a reasonable purchase decision-making process consists of five stages: problem identification, information search, alternative assessment,

product selection, and response after purchase [5]. Problem identification can be considered as the stage when a distinct desire for the product is perceived, and occurs when customers perceive a distinct difference between the actual and desired states [8, 13]. Although the information search stage involves a conscious effort to find products that satisfy the customer's needs, its purpose is to gain pleasurable value, such as a change in surroundings and enjoyment. In other words, customers do not always search for products in order to make a purchase, and may research products with a continued interest even though they do not have an intention to buy [2]. The alternative assessment stage involves evaluating which products can satisfy a customer's needs after narrowing the choices down to several alternatives based on the information search. During reasonable decision making processes, customers evaluate product attributes based on several criteria and methods, and try to cognitively select the best alternative.

Goldsmith and Horowitz [6] found that the information search processes of customers intending to make a purchase through the Internet become more complex because customers with no space limitations can access many alternative products and a huge amount of information. As a result, more time and expenses are required to make a reasonable buying decision. According to Goldsmith and Horowitz, customers consume cognitive and emotional resources in this process.

2.3 Research Hypotheses

According to Rothschild and Gaidis [11], customers' level of activity in gathering information increases and their evaluation processes become more complex when they consider purchasing a high involvement product because they tend to use all of the given information for their buying decision. Moreover, Robertson *et al.* [10] stated that the level of involvement could change customer behaviors such as purchase-related information searching and processing.

Research on the relationship between involvement and the characteristics provided by an online environment has shown that highly involved customers show a positive attitude toward online shopping. For example, Cho *et al.* [4] found that the degree of a customer's information search is related with the degree of involvement. Based on this finding, we can argue that customers considering low involvement products do not put much effort into the information search. On the other hand, customers considering high involvement products conduct more detailed information searches, exerting more effort. In this sense, when the degree of product involvement is high, customers consider many factors in their buying decision processes and consequently require a large amount of information in order to find differences among the products. On the other hand, in the case of low involvement products, customers do not tend to search for information about differences among the products and consequently process related information through alternative channels [3].

Based on the previous studies discussed above, we developed a research question and related hypotheses regarding the relationship between customers' buying decisions and the level of product involvement. Our research question is whether the decision processes regarding the purchase of high involvement products are more

complicated than those used for the purchase of low involvement products. Our research hypotheses are as follows.

H1. The buying decision process for high involvement products takes more time than the buying decision process for low involvement products.

H2. The buying decision process for high involvement products includes more consideration factors than the buying decision for low involvement products.

3 Experiment and Analysis

3.1 Experimental Design and Procedure

In order to explore the relationship between the buying decision and involvement processes for high and low involvement products, an experiment was conducted with 70 university students in Korea in September 2011. Each student participated in two experiments related to buying decisions with a high involvement product and a low involvement product on an Internet website. The high and low involvement products were a used car and used book, respectively. Participants were asked to make a decision based on using a specialized mediating site for used products. The length of the experiment was about 20 minutes. Information on demographics and cognitive variables was collected through a questionnaire after the experiment ended. As summarized in Table 1, participants were asked to choose one seller and a selling condition after considering several seller conditions, such as product quality, price, credit, and so on, with the target products fixed (used car and used book). At this point, participants selected one seller on the basis of the information provided about the products on the website. In the experiment, participants were provided with seven pieces of information for each high and low involvement product, such as seller, product information, credit, price, register date, and quality in order to match the real environment.

In order to measure eye movement and gather related data during the buying decision process on the website, Eye-Tracker, which was developed by Tobii Technology Corporation, was used. Eye-Tracker can measure participants' visual attention, including eyeball fixation and saccade. Eyeball fixation shows how long a participant's eyes stay focused on a certain area and saccade is the momentary movement between eyeball fixations. In this research, visual attention was based on the fixation length, or how long the participant's eyes stayed focused on certain product information displayed on the website.

The experimental procedure was as follows. First, a calibration test was conducted in order to correctly trace a participant's eye movement before starting the product buying experiment. Second, four buying processes were displayed sequentially to participants, as shown in Figure 1, following the process of a real purchase in the online shopping environment. The sequence of the buying process is as follows: (1) access to the specialized website for used products, (2) search for product, (3) evaluation and buying decision, and (4) confirmation of the selected product. Lastly, participants were asked to complete the questionnaire.

Table 1. Experiments

Experiment	Experiment for Buying Decision
Experiment 1 (High Involvement Product)	• Buying Decision of the used-car by the process of online shopping through on-line dealing site for used cars. • Traced participant's eye movement and decision time with eye-tracking equipment during the whole processes of used-car shopping. • Consideration factors for buying decision: Seller Information, Product Information, Credit, Price, Register Date, Quality1(Release Date), Quality2(Mileage)
Experiment 2 (Low Involvement Product)	• Buying Decision of the used-book by the process of online shopping through on-line dealing site for used books. • Traced participant's eye movement and decision time with eye-tracking equipment during the whole processes of used-book shopping. • Consideration factors for buying decision: Seller Information, Product Information, Credit, Price, Register Date, Quality1(Condition), Quality2(Delivery Quality)

(a) Experiment of Buying Processes for High Involvement Product(Used-car)

(b) Experiment of Buying Processes for Low Involvement Product(Used-book)

Fig. 1. Experiment of Buying Processes

3.2 Experimental Results and Analysis

We analyzed the data gathered during the third process (the evaluation and buying decision process) in order to compare the complexity of the buying decision for high and low involvement products from the perspective of the decision time required to make the purchase and where the user's visual attention was focused. Among the data gathered using Eye-Tracker, we used two variables for analysis: decision time required and fixation length, as defined by the area of interest (AOI). Seven AOI areas were set by the analyzing software Tobii provided in accordance with seven factors in the buying decision: seller, product information, credit, price, register date,

quality item 1, and quality item 2. In order to verify Hypotheses 1 and 2, the complexities of the buying process for high and low involvement products were analyzed using a t-test in SPSS 13.0.

(1) Analysis of Decision Time Required

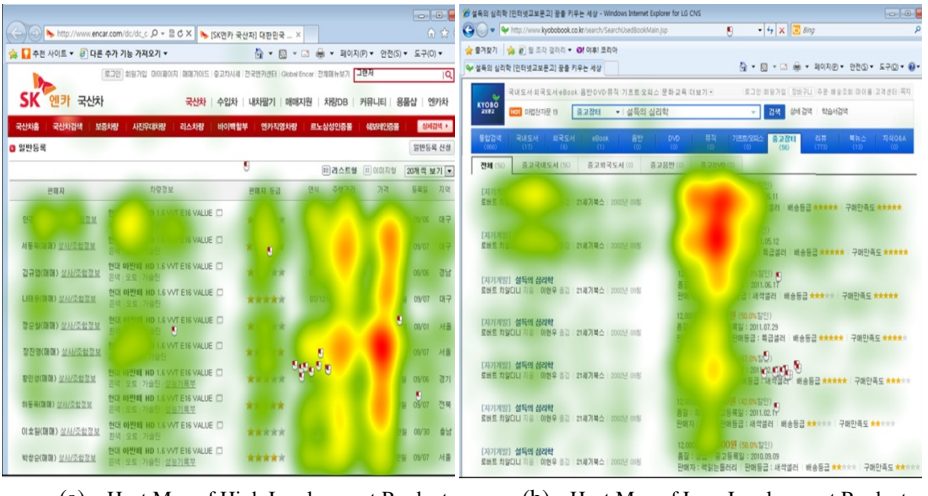
Table 2 shows the t-test results regarding Hypothesis 1. The results show a significant difference between high and low involvement products in terms of the time required to make a buying decision. The t-value of the decision time required is 2.599, showing a significant difference between the buying decision related to high and low involvement products. The mean decision times required for the high and low involvement products are 32.136 and 25.978 seconds, respectively. Therefore, Hypothesis 1 was accepted, as the purchase of a high involvement product requires a longer decision time than the purchase of a low involvement product, as shown in Table 2.

Table 2. T-test Results for Decision Time Comparison

Decision Time	Mean		Standard Deviation		t-value	Sig.	Mean Difference
	HIP (n=70)	LIP (n=70)	HIP (n=70)	LIP (n=70)			
Decision Time	32.136	25.978	15.567	12.268	2.599	0.010*	6.156

*$p<0.05$

HIP: High Involvement Product, LIP: Low Involvement Product



(a) Heat Map of High Involvement Product (b) Heat Map of Low Involvement Product

Fig. 2. Heat Map measured by Eye-Tracking

(2) Analysis of Consideration Factors for Buying Decision

In this research we analyzed how many factors were considered during the buying decision process for high and low involvement products based on the perspective of visual attention. We considered visual attention to be how long the individual's eye focused on the consideration factors on the website provided during the buying decision. When the fixation length of a consideration factor is long, the factor can be regarded as a more important factor in the buying decision.

Figure 3 presents the heat map, which is a visualization tool provided by Tobii Eye-Tracker. It shows the average fixation length of participants, which can be interpreted as the degree of visual attention for each consideration factor, namely AOI. As seen in Figure 2, the purchase of a high involvement product leads a user to consider more factors than when purchasing a low involvement product.

In order to statistically verify the intuitive results, the data on fixation length for each AOI provided by Eye-Tracker were analyzed. Figure 3 and Table 3 show the comparison of means among the seven factors and the t-test results to verify whether the buying decision differs for the purchase of high and low involvement products.

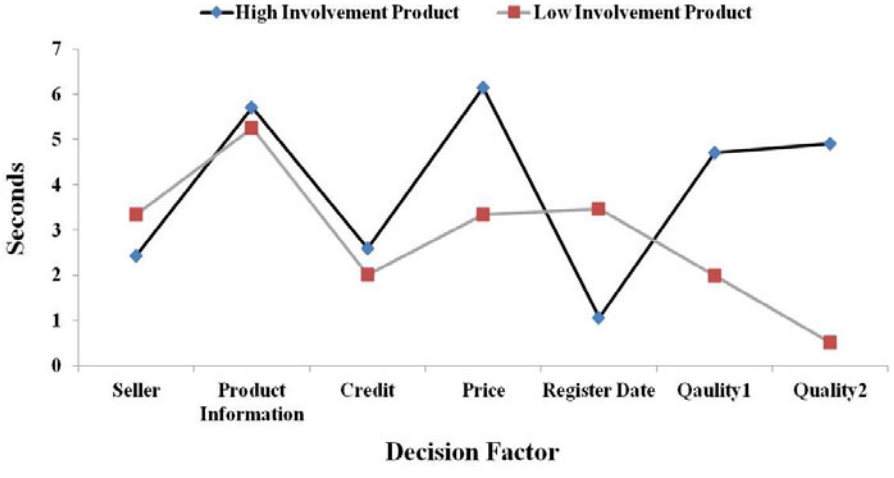


Fig. 3. Comparison of Mean-value of Consideration Factors for Buying Decision

The t-values for product information and credit were 0.698 and 1.747, respectively, showing that there were no differences between the two product involvement types in terms of fixation length. However, five factors (seller, price, register date, quality 1, and quality 2) showed significant differences in terms of fixation length. Four factors (seller, price, quality 1, and quality 2) had a longer fixation length for the high involvement product than for the low involvement product. Moreover, four factors (product information, price, quality 1, and quality 2) had a fixation length of more than 4.000 seconds for the high involvement product. This indicates that participants considered these four factors as the most important criteria in the buying decision during the experiment. On the other hand, only one factor, product information, had a

fixation length of more than 4.000 seconds in the case of the low involvement product. Therefore, we can infer that the factors considered are more important for high involvement products than for low involvement products in terms of customers' buying decisions.

Table 3. T-test Results for Consideration Factors Comparison

Consideration Factor	Mean		Standard Deviation		t-value	Sig.	Mean Difference
	HIP (n=70)	LIP (n=70)	HIP (n=70)	LIP (n=70)			
Seller	2.431	3.344	1.709	2.429	-2.570	0.011*	-0.912
Product Information	5.718	5.254	4.819	2.758	0.698	0.486	0.463
Credit	2.586	2.001	2.119	1.833	1.747	0.083	0.585
Price	6.144	3.330	3.151	2.235	6.095	0.000***	2.814
Register Date	1.064	3.466	1.615	2.908	-6.042	0.000***	-2.402
Quality1	4.713	1.987	4.262	1.932	4.874	0.000***	2.726
Quality2	4.910	0.515	3.979	0.618	9.133	0.000***	4.396

*p<0.05, **p<0.01, ***p<0.001

HIP: High Involvement Product, LIP: Low Involvement Product

Table 4. T-test Results for Consideration Factors Comparison by Fixation Length

Fixation Length	Mean		Standard Deviation		t-value	Sig.	Mean Difference
	HIP (n=70)	LIP (n=70)	HIP (n=70)	LIP (n=70)			
More than 8.0 seconds	0.87	0.29	1.034	0.640	4.028	0.000***	0.586
More than 7.0 seconds	1.11	0.54	1.210	0.943	3.116	0.002**	0.571
More than 6.0 seconds	1.54	0.87	1.401	1.076	3.181	0.002**	0.671
More than 5.0 seconds	2.03	1.37	1.560	1.194	2.799	0.006**	0.657
More than 4.0 seconds	2.60	1.90	1.663	1.385	2.706	0.008**	0.700
More than 3.0 seconds	3.49	2.66	1.576	1.710	2.981	0.003**	0.829
More than 2.0 seconds	4.43	3.60	1.538	1.536	3.190	0.002**	0.829
More than 1.0 second	5.69	5.06	1.015	1.318	3.162	0.002**	0.629

*p<0.05, **p<0.01, ***p<0.001

HIP: High Involvement Product, LIP: Low Involvement Product

A t-test was also conducted to verify whether there were statistically significant differences in the number of consideration factors in accordance with the range of fixation length. Table 4 shows the t-test results when the fixation length ranges were set every few seconds. The number of consideration factors used for the high involvement product is higher than that used for the low involvement product, and the difference is statistically significant. Therefore, the results support Hypothesis 2.

4 Discussion and Concluding Remarks

The experiment investigating the customer buying decision with an eye-tracking technique showed that there are statistically significant differences in eye movements during the buying decision between high and low involvement products. Specifically, the results for fixation length, regarded as visual attention in this research, showed that the decision process for high involvement products is more complicated than that for low involvement products. First, there is a significant difference in the time required for a buying decision with high and low involvement products. The decision time required when purchasing a high involvement product is longer than that when purchasing a low involvement product. Second, the eye-tracking technique demonstrated that there is a significant difference in the number of factors considered in the buying process for high and low involvement products. Five of the seven factors considered in the experiment – seller, price, register date, quality 1, and quality 2 – differed significantly for the high and low involvement products in terms of fixation length. The fixation length for the high involvement product was longer than that for the low involvement product for seller, price, quality 1, and quality 2. Therefore, we can infer that more factors are considered when purchasing a high involvement product as compared with the purchase of a low involvement product.

In this research, the eye-tracking technique was adopted in order to reconfirm previous studies on differences in the buying process depending on the level of product involvement. By measuring fixation length as visual attention using Eye-Tracker, we applied physiological data through experiments in order to verify our research hypotheses regarding the buying decision processes at different levels of product involvement. Nevertheless, there are several limitations of this research. First, the experiments were conducted only on an online website, which means that there is difficulty in generalizing the results to the broader population. Second, the sample size was relatively small and the participants consisted only of university students. In future studies, more consideration factors, such as an offline situation, should be applied in order to generalize the research findings.

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