

Examination of a Package Design Analysis Method Using the Saliency Map

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Abstract. This study focuses on consumers' unconscious attentions to package designs and considers a rapid and convenient analysis method using the Saliency Map. To examine the effectiveness of the analysis method using the Saliency Map, the authors selected four packages via a website and classified them into four types of packages according to the familiarity with language and the clearness of characters. And the authors conducted an eye-tracking experiment using these packages. By comparing the results of the eye-tracking experiment with outputs from the Saliency Map, the authors presented several findings. At the end of paper, the authors discussed contributions and future research directions of this study.

Keywords: Package design, Visual attentions, Unconsciousness, Saliency Map, Eye-tracking experiment

1. Introduction

An importance of the package design is increasing in various markets faced to the problems of commoditization. Especially self-service style shops prevailed in various markets, the package design is very important since many consumers often decide to purchase a product based on the attractiveness of its package design.

To examine the effectiveness of the package design, it is necessary to focus on the consumers' attentional process (Hashida and Uetake 2010). Usually the consumers' attentional process can distinguish between the top-down (conscious) processes and the bottom-up (unconscious) processes.

According to Togawa (2010), package design studies are classified into following three categories.

- Studies about packages as stimulations to consumers
- Studies about packages as objects for development
- Studies about packages as solutions to public policy

In particular, studies about packages as stimulation to consumers examined the effectiveness of the following topics.

- Visual elements
 - e.g. colors, figures, and characters
- Structural elements
 - e.g. sizes and shapes

However, as described below, the most existing studies were considered in the situation that consumers paid attention to packages consciously. There are few studies that treated in unconscious situations. Recently, a neuromarketing is being paid much attention to treat in unconscious situations (Fugate 2007). The neuromarketing is a new field of marketing research that studies consumers' sensorimotor, cognitive, and affective response to marketing stimuli. But it is necessary to use expensive technologies such as functional magnetic resonance imaging (fMRI) to measure changes in activity in parts of the brain, it is difficult to analyze consumers' unconscious attentions easily. It is still needed to examine a simple analysis method to analyze consumers' unconscious attentions.

In this situation, we focus on the unconsciousness and consider a rapid and convenient analysis method to clarify consumer's unconscious visual attentions to packages.

2. Prior Researches

Schoormans and Robben (1997) focused on a color of package design and found that attentions to a package were increasing when its color changed drastically and evaluations of

a package were highest when its color varied moderately. Garber, Burke, and Jones (2000) also examined a color of package design using a simulation software of grocery store. As the result of experiment, they figured out that consumers tended to buy a product when its package color was changed and the tendency was decreasing according to the numbers of shopping. Bone and France (2001) investigated the relationship between package color and consumer belief and purchase intention. Based on double pilot tests, they executed an experiment and a statistical analysis which pointed out a package color affected a consumer belief and purchase intention directly.

In addition to a color of package, its size and shape were examined. Wansink (1996) paid attention to a size of package and investigated the relationship between size and product usage volume. He found that a usage volume was increasing by a size based on an experiment using a food oil and a spaghetti. The subjects lost resistances to large usage volumes due to the lower unit costs of larger size of packages. Raghubir and Krishna (1999) focused on a height of package and its volume. According to an experiment, they pointed out that a package volume was perceived larger because of higher package. Folkes and Matta (2004) proceeded a research on shape of package and its volume and they found that the package volume tended to be perceived larger if it was paid more attention. As well as Yang and Raghubir (2005) also examined an effect of shape and they figured out that bottle beers were perceived larger than can beers, Raghubir and Greenleaf (2006) found that a purchase intentions and preferences were affected by a ratio of long side and short side of rectangle.

Several studies about characters and figures were proceeded correspondingly. Rettie and Brewer (2000) indicated that putting characters and figures on the right and left side of package respectively promoted recalls of them according to the brain laterality. Based on the concept, the left brain is good at processing of verbal elements (characters) and the right brain is conversely good at processing of nonverbal elements (figures) and the both brains processes information immediately from the opposite side. Underwood, Klein, and Burke (2001) executed an experiment using a virtual reality and examined an effects of illustrations on packages. They found out that the illustrations were useful for obtaining attentions to low familiar brands and in particular the effects were more obvious in food categories. Underwood and Klein (2002) investigated affections of figures on brand beliefs and brand evaluations and figured out that figures of package design contributed to changing brand

beliefs and brand evaluations were raised as the result. Ishii, Onzo, and Terao (2008) and Ishii (2010) focused on the brain laterality and reexamined effects of characters and figures on packages.

3. Research Procedures

To analyze the consumers' attentional process, it is useful to distinguish between the top-down processes and the bottom-up processes. The unconscious attentions are closely related to the bottom-up processes. We used an arranged map “Saliency Map” that represents visual saliency of a corresponding visual scene (Koch and Ullman 1985) to analyze people’s unconscious attentions. The Saliency Map can visualize the domain which people pay the visual attention in a picture and be computed systematically (Itti et al 1998; Itti and Koch 2001) (see Fig. 1). In this study, we use the iLab Neuromorphic Vision C++ Toolkit¹ to draw the Saliency Map of packages (see Fig. 2).

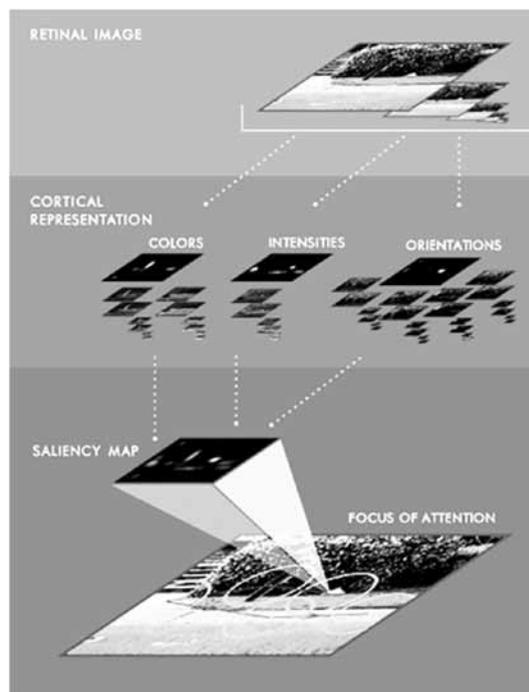


Fig.1 Saliency Map (<http://ilab.usc.edu/bu/theory/>)

¹ <http://ilab.usc.edu/toolkit/>

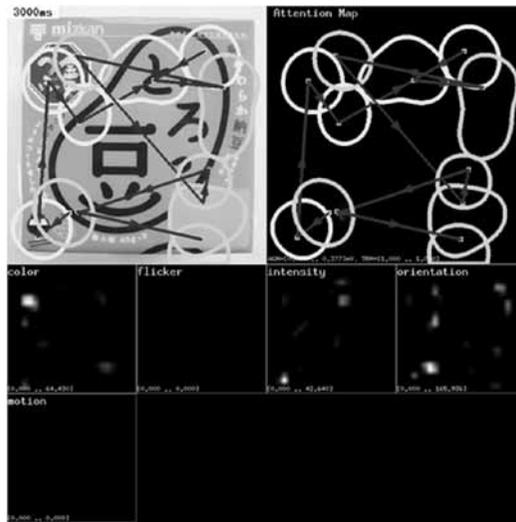


Fig. 2 Package Analysis using the Saliency Map

In order to evaluate the effectiveness of Saliency Map as a rapid and convenient method to analyze consumers' unconscious attentional process, Hashida and Uetake (2013) conducted two experiments and compared their results with outputs of Saliency Map. Although the authors found the partial usefulness of Saliency Map as a consequence, yet they could not examine the personal factors of participants adequately. We focus on the personal factors to solve the problem of existing research so that the effectiveness of Saliency Map is confirmed additionally.

4. Experiments

At first, we selected four packages via a website (<http://www.packagingoftheworld.com/>) and classified them into four types of packages according to the familiarity with language and the clearness of characters, since characters have strong influence on consumers' recognition process (see Fig.3). Secondly, we conducted following experiment using an eye camera to investigate about the gaze objects. The research participants are 7 graduate school students. The participant watched four packages on a computer screen to examine the points of gaze (see Fig.4). We showed the participant each package for three seconds. Finally, we analyzed four packages using Saliency Map to compare them with the results of eye-tracking experiment.

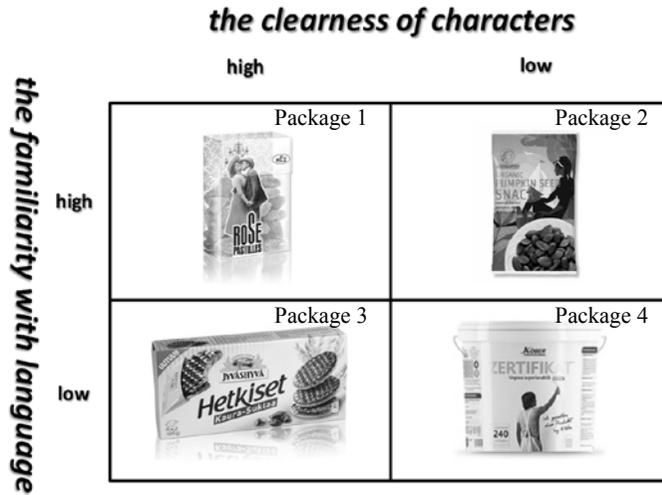


Fig.3 Samples of Package Designs



Fig.4 An Eye-tracking Experiment

5. Results and Discussion

5.1 Results of Eye-tracking Experiment

The results of eye-tracking experiment are shown in figure.5-8 corresponding to the samples of four packages. The 7 subjects pay attentions to circle fields and the orders of attentions are indicated by arrows in the figures.



Fig. 5 Results of Eye-tracking Experiment (Package 1)



Fig. 6 Results of Eye-tracking Experiment (Package 2)



Fig. 7 Results of Eye-tracking Experiment (Package 3)

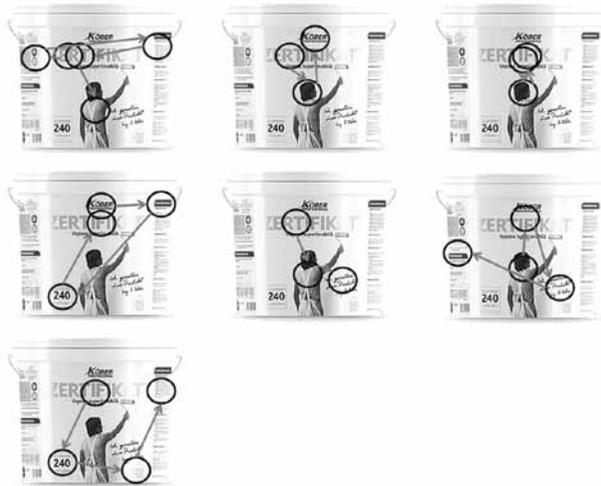


Fig. 8 Results of Eye-tracking Experiment (Package 4)

5.2 Discussion

The average number of fixations is shown in table. 1.

Tab.1 Average Number of Fixations

		Clearness of characters	
		high	low
Familiarity with language	high	4.3	3.8
	low	4.1	3.8

Table.1 showed that the average number of fixations tended to decrease when the clearness of characters was low. It also showed that the average number of fixations tended to decrease when the familiarity with language was low.

Next, we categorized the gaze objects into following two types.

- Verbal objects
- Non-verbal objects

We focused on the number of fixations (higher or lower than the average number) and clarified the major type of gaze objects (verbal objects or non-verbal objects) that participants paid more attentions (see Fig.9, Fig.10 and Tab.2).

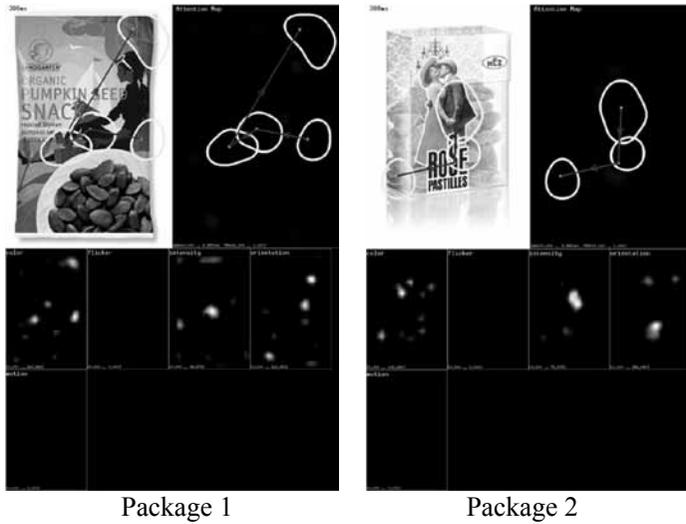


Fig.9 Results of the Saliency Map (Package 1 and Package 2)

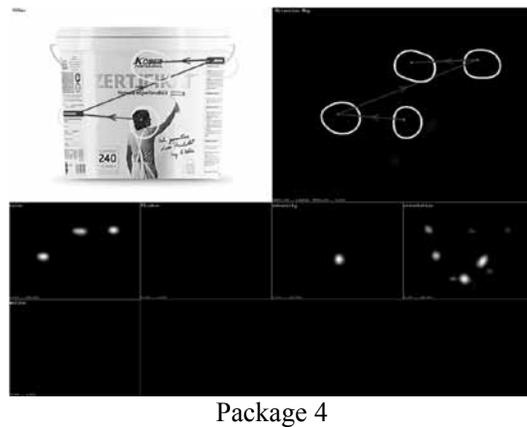
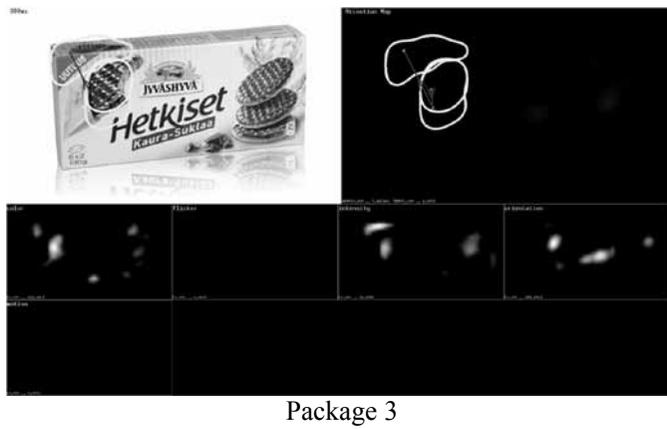


Fig.10 Results of the Saliency Map (Package 3 and Package 4)

Tab.2 Major Types of Gaze Objects Participants Paid More Attentions*

Major type of gaze objects	Clearness of characters			
	High		low	
	Package 1	Package 3	Package 2	Package 4
Verbal objects	57.1% (4/7)	71.4% (5/7)	85.7% (6/7)	100% (7/7)
Non-verbal objects	42.9% (3/7)	28.6% (2/7)	14.3% (1/7)	0% (0/7)

*A colored cell means the major type of gaze object analyzed by using the Saliency Map

We also clarified the major type of gaze object analyzed by using the Saliency Map. Table 2 showed that the percentage of the non-verbal objects tended to decrease when the clearness of characters was low. It also showed that the percentage of the non-verbal objects tended to decrease when the familiarity with language was low. And we found that there was low consistency between the result of eye-tracking experiment and the output of Saliency Map when the clearness of characters and the familiarity with language were low (see Fig.11).

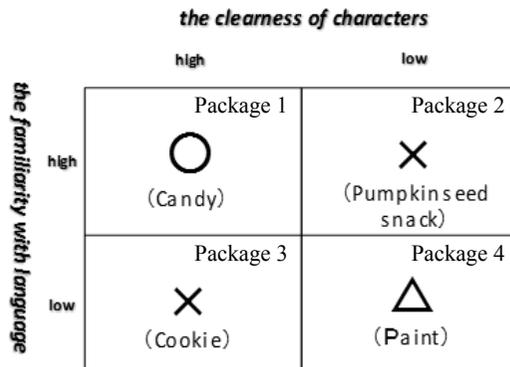


Fig.11 Comparison between results of eye-tracking experiment and the Saliency Map

Moreover, we found that there were some participants who only paid attention to the verbal objects. On the other hand, we also found that there was one participant who watched the non-verbal objects constantly.

6. Conclusion and Future Research

In conclusion, we identified that consumers paid attention to verbal cues on the package which had the low familiarity with language and the low clearness of characters while consumers watched not only verbal objects but also non-verbal cues on the package which

had the high familiarity with language and the high clearness of characters. We also found that the result of eye-tracking experiment tended to be consistent with the output of Saliency Map about the packages that had the high familiarity with language and the high clearness of characters. In other words, the package design analysis method using the Saliency Map could be useful for the packages that had the high familiarity with language and the high clearness of characters according to above results.

As further researches, it is necessary to evaluate additionally the usefulness of Saliency Map as a method to analyze consumers' unconscious attention processes. Moreover, we need to examine the relationship between the result of Saliency Map analysis and consumers' preferences to packages. An Experiment is also important to investigate the usefulness of Saliency Map in an actual situation, specifically, where many products are displayed on shelves in a store.

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