

# The Layout Optimization of Newssite-inserted Advertisements Using Two Conflicting Objectives

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**Abstract:** This paper proposes a new method to measure the effectiveness of web advertising. The goal of this study is to show the effective layout of advertisements on news website, which gives the best impression and gets the most attention at the same time. We pursue this goal by conducting experiments where the participants view a variety of page layouts of news websites. The results of the experiment on the attention degree and the impression degree are analyzed from the viewpoint of the multi-objective optimization. Our analyses revealed that the layouts inserting advertisement into the left-up layout achieved the better performance than those in the right-up position and inner-right layout, which are the current standard layout.

**Keywords:** advertisement layout, news website, multi-objective optimization, subject experiment

## I. Introduction

In 1994, the now ubiquitous banner advertisement was first introduced. In the eight years since, the internet advertising industry has exploded [1][6][7]. From this background, the June 2007 issue and the April 2011 issue of Journal of Advertising Research focused on the online marketing and advertising research. Studies included in those issues claimed that the necessity of specific strategies for exploiting the changing environment, where consumers are spending more time online than with any other marketing channel [1][6][7]. The specific strategies for how to best use each media will change as the capabilities of new media improve and the audiences learn how to use them. To cope with such changeable strategies, our study starts by focusing on a strategy for how to best use *news websites* as an advertising medium.

Advertisements (hereafter, ads) in news websites today are very important because they are watched by the majority of net users. According to Bizreport (January 13, 2009: [www.bizreport.com](http://www.bizreport.com)), over three quarters (76%) of internet users across the 16 countries included in TNS Global marketing research's survey said they had "looked up the news" online in the past month. In spite of this fact, very few studies have focused on *ads in news websites*.

From this viewpoint, Janoschka gives important functions for the ads to be effective in news websites [4]. Firstly, the effective ads in news websites motivate users to click. The *click-through* was the most commonly used measure of success in the advertising industry [7]. However, the banner ad click-through rates have fallen over time; when they first started to appear, it was not uncommon to have the rates above five percent. They have fallen since then, currently averaging closer to 0.2 or 0.3 percent. (Media connection, February 1, 2010: [www.imediainconnection.com](http://www.imediainconnection.com)). Secondly, the ads in news websites should attract users' attention. When the ads in the websites try to appeal to users, they compete with other elements and contents like articles, headlines, illustrations, etc., that are also placed on the websites. This means that the ads in the websites need to distract users from the actual content of the websites. From these viewpoints, the eyetrack III research [11] released by the poynter institute ([www.poynterextra.org / EYETRACK2004](http://www.poynterextra.org/EYETRACK2004)) observed where and how the ads are effective from the experiments where 46 participants viewed a variety of the ad placements and formats across their various homepages and article-level pages. The result of their experiment suggested that people often ignore the ads, but that depends a lot on *layout*. For example, the ads embedded in article text are often seen even if the size of the ad is in medium size, while the ads at the right side or at the bottom of the page are seen by only a small percentage of people ([http://www.poynterextra.org / eyetrack2004 / advertising.html](http://www.poynterextra.org/eyetrack2004/advertising.html)). This indicates that good ads placement and appropriate format for the ads can improve from the viewpoint of the users' *attention* time.

As shown in the above experiment by the eyetrack III research, the eye tracking studies have revealed valuable information of what extent people pay attention to the ads in websites. However, no researches have investigated what kind of *impressions* such as emotions are evoked by the ads as a result of getting attention. In web advertising, the term "impression" is sometimes used as a synonym for view, as in the ad view. From this viewpoint, online publishers offer and their customers buy advertising measured in terms of the ad views as impressions (<http://whatis.techtarget.com>). This is because the aspect of getting attention is believed to be crucial

to a web ad's effectiveness. In contrast to the printed texts, the screen reading requires more effort by users who have to select relevant information and to separate it from less interesting issues within a very large amount of data [4].

Unlike the above trend method relying on the *attention* degree, our study proposes a new method to measure the effectiveness of web advertising by considering not only the *attention* degree but also the *impression* degree. The goal of this study is to explore the effective placement of the ads on news website, which gives the best impression (in this paper the term "impression" is used as a synonym for positive or negative emotion) and gets the most attention at the same time. We pursue this goal by conducting experiments where participants view a variety of page layouts of news websites. The results of the experiments on the attention degree and the impression degree are analyzed from the viewpoint of the multi-objective optimization [2][3][5].

This paper is organized as follows; the next section starts by introducing the previous work and proposing a hypothesis. Section 3 describes the procedure of the subject experiment and its results. Section 4 analyzes the experimental results from the viewpoint of the multi-objective optimization, and conclusion and suggestions for future work are given in Section 5.

## II. Previous Works and Hypothesis

### A. Previous works

Takeyama and Sakamoto conducted the experiment using the eye tracking equipment to see how long participants viewed the ads on news websites [10]. After they saw the news websites, the participants were asked to answer whatever they remember the ads and articles shown on the websites. The ad placements on the news website used for the experiment were summarized as follows: (i) right-up position, (ii) left-up position, (iii) inner-up position, and (iv) inner-down position. The ad in the "Inner-up position" is, for example, the ad embedded up in the article text. The result showed that the ad placed on the inner-up position received the most eye fixations, which is consistent with the observation by the eyetrack III: the ads inserted within the article text are seen more than most other ads. These results suggest that the ads inserted within the news article text perform the best. However, Takeyama and Sakamoto reported that the number of memories of the articles and the ads significantly synchronized in the layouts in which the ads are inserted within the news article text [13]. This phenomenon indicates that the negative news may influence on the impression of the ads inserted. Since the ads in the websites are randomly inserted, they are frequently inserted into the negative news article. For example, the advertisement of a new car is inserted in the inner position of the news article reporting a car accident.

Following Takeyama and Sakamoto's study [13], the studies by Muraoka & Sakamoto [9] investigated what extent the impression of the ads is influenced by the impression of the news articles. They measured the impression degree of the ads in three patterns of the ad layouts: (i) right-up layout; (ii) up-layout; (iii) inner-up layout, under the condition that contents of the ads are related to those of the articles (*i.e.*, the advertisement of a new car is inserted in the news of a car accident). For each brand category of the ads, the articles of the positive and negative news were employed for the

experiment. In the positive articles related to the content of the ads, the variance analysis showed that the degree of influence of the articles on the impression of the ads has no difference among the three layouts ( $F(2,522) = 0.727, P=0.4839$ ). In the negative news articles, however, the variance analysis showed that the degree of influence of the articles on the impression of the ads was different among the three layouts ( $F(2, 522) = 18.419, p < .001$ ). The impression of the ads inserted in the nearer position to the article texts (*i.e.*, inner-up layout) was influenced significantly more by the negative news articles.

While Muraoka and Sakamoto examined the influence of news articles on the impression of the ads under the only one condition that the contents of the ads are related to those of the articles [9], Sakamoto conducted the experiment to compare the influence of the negative news articles on the impression of the ads between the ads inserted in the negative news articles related to the contents of the news articles and those inserted in the negative news articles in no relation to the negative news articles [12]. The variance analysis showed that the average impression value for the ads in no relation to the news articles was basically higher than that in relation to the news articles ( $(F(1,522)= 67.506, p < .001)$ ). Furthermore, in the ads in no relation to the contents of the news articles there was no more difference among the layouts than in the ads related to the contents of news articles.

To sum up, the layout is very important when the ads are inserted in the negative news articles related to the contents of ads.

### B. Hypothesis

Based on the results by the previous works mentioned above, we set up two hypotheses: (i) If the ads are positioned near to the news articles, the time of eye fixations on the ads is long; (ii) In the negative news articles, if the ads are related to the articles, the impression of ads positioned near to the articles related to the contents of the ads is negative. In other words, the time of eye fixation and the impression of the advertisement have the trade-off relation in the negative news articles related to the contents of ads.

## III. Psychological Experiment

In this study, we conducted the psychological experiments in order to verify the hypotheses described in Section 2.2, which claims that the time of eye fixation and the impression of the ads have the trade-off relation in the negative news articles related to the contents of ads. For this purpose, the participants of the experiment watch the various type of the news site samples in which the ads are positioned in various layouts. Through the experiments, we measured (i) the time of the eye fixations on the ads and (ii) the impression of the ads related to the contents of the negative news articles. The detailed procedure of the experiment is described in Section 3.2.

### A. Materials

Under the cooperation of a major Japanese advertising agency, Dentsu Ltd., the ads for six kinds of brand categories were selected as commonly appearing ads on news sites from 21 kinds of brand categories. The news articles, on the other hand, were selected from the news that could be regarded as negative in the relation to the selected six kinds of brand categories.

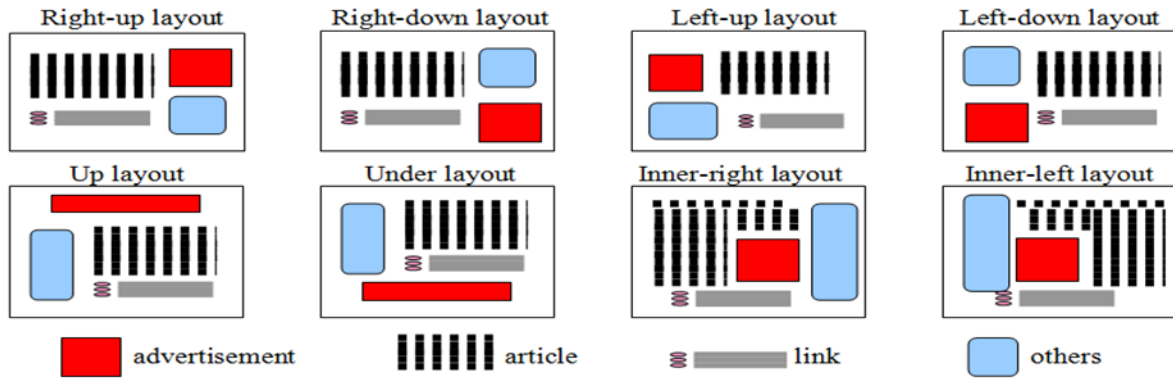


Figure 1. Eight patterns of ad layouts used for the experiments

Combining the ads of the six brand categories with the selected news articles, we created 128 newssites samples in which the ads were positioned in various layouts of the negative news articles. The layouts employed in the experiments were the eight patterns as shown in Figure 1, where the red square, black bars, grey box, and skyblue square indicate the advertisement, article, link, and others, respectively. In detail, the right-up/-down layout inserts the ad in the right-up/-down position in the news website; the left-up/-down layout inserts the ad in the left-up/-down position in the news website; the up/under inserts the ad in the up/down position in the news website; and the inner-right/-left insert the ad in the mostly center which is located at right/left of the article.

Figure 2 shows the newssite sample employed in the psychological experiment. These samples were written in Japanese and inserted in the inner-left layout shown in Figure 1. Here, the ad in Figure 2 shows “BMW automobile”, and the content of the advertisement is related to the content of the article reporting that people were killed by the car accident (i.e., the negative article).



Figure 2. A newssite sample of inner-left layout

B. Procedure

To explore the effective layout for the ads in the news website, we conducted the following two types of experiments.

1) Experiment A: Experiment on user’s attention

We measured the eye movements of the participants using the eye tracking equipment. In this experiment, six participants watched 16 newssite samples in the different layout patterns. The newssite samples were selected randomly and there was no time restriction for users in watching the web. Table 1

shows the example patterns that one participant watches in the experiment. For example, “Right-up (pc: 1)” inserts the ad of PC in the right-up position of the news website.

In this experiment, the following three types of the eye fixation data are measured: (i) the number of times of the eye fixation; (ii) the eye fixation duration (i.e., the total time of the eye fixation); and (iii) the rate of the participants who fixed their eyes on the ad at least once. From this experimental setting, 96 eye movement data (i.e., 6 participants × 16 newssite samples) are obtained.

2) Experiment B: Experiment on user’s impression

We measure the impression of the ads in the news websites showing the negative news articles. For this purpose, we conducted the questionnaire by asking the participants to evaluate the impression of the news articles after watching the news website including the ads. In the questionnaire, we employ the seven-points semantic differential scales from extremely negative (+1) through neutral (+4) to extremely positive (+7). Semantic Differential (SD) proposed by Osgood [10] is a frequently employed method in the psychological experiments to measure human qualitative evaluation. Based on the evaluation data of the news articles, we selected 16 articles as the negative news articles which had the average evaluation value of less than the neutral score 4.

In this experiment, 16 participants, who were different from those in the experiment A, watched 18 newssite samples (i.e., 12 newssite samples + 6 FAKE samples) as shown in Table 2 in a certain layout pattern by conducting three cycles. As one of the examples, “cola: 2” means the newssite sample showing the ad of the second picture of cola, while [FAKE] means the dummy sample, which is employed to keep participants unconscious on the purpose of our experiment. These newssite samples were shown randomly within one cycle shown in the column of Table 2 and there was no time restriction for users in watching the web. After the participants watched six newssite samples in one cycle, they were asked to evaluate the impression of the ads shown in the six newssite samples. From this experimental setting, 12 impression data for each layout pattern are obtained.

Note that the participants watched the newssites for the first time because all newssite samples employed in the experiment have not been used in the real newssites.

Table 1. An example pattern shown for one participant

Sample		Sample	
No. 1	Right-up (pc:1)	No. 9	Right-up (digital camera:2)
No. 2	Left-down (cola:1)	No. 10	Left-up (pc:2)
No. 3	Up (digital camera:1)	No. 11	Up (cola:2)
No. 4	Under (cellular phone:1)	No. 12	Under (cellular phone:3)
No. 5	Right-under (automobile:1)	No. 13	Right-under (automobile:3)
No. 6	Left-up (drinking water:1)	No. 14	Left-down (automobile:3)
No. 7	Inner-right (automobile:2)	No. 15	Inner-right (drinking water:2)
No. 8	Inner-left (cellular phone:2)	No. 16	Inner-left (pc:3)

Table 2. An example pattern shown for one participant

Cycle 1	Cycle 2	Cycle 3
pc:1	cellular phone:1	drinking water:2
cola:1	automobile:1	FAKE
FAKE	FAKE	digital camera:1
cola:2	cellular phone:2	FAKE
FAKE	FAKE	drinking water:2
pc:2	automobile:2	digital camera:2
<b>Questionnaire</b>	<b>Questionnaire</b>	<b>Questionnaire</b>

Table 3. The mean values of the number of fixations, fixation duration, and the rate of participants who watch ads

	Right-up	Left-up	Up	Down	Right-down	Left-down	Inner-right	Inner-left
1.number of eye fixations	1.17	1.40	0.09	3.20	0.55	0.50	2.27	4.08
2.eye fixation duration (time)	0.37	1.23	0.01	0.68	0.13	0.25	0.99	0.96
3.rate of subjects watching ads	0.67	0.75	0.25	0.83	0.50	0.42	0.83	0.92

Table 4. The mean values of ads impression for 8 SD scales

	Right-up	Left-up	Up	Down	Right-down	Left-down	Inner-right	Inner-left
impression	4.25	4.58	4.08	3.42	4.08	3.92	3.17	3.25
trustworthy	3.83	4.25	4.33	3.33	4.08	4.00	4.42	3.25
appeal	4.00	4.25	5.08	4.08	4.67	3.92	3.25	3.25
conscientious	4.25	4.25	3.83	4.08	4.25	4.17	3.33	3.67
refined	4.33	4.58	4.67	4.58	4.67	4.83	3.83	3.67
familiarity	3.92	4.67	5.75	4.17	4.42	4.42	3.50	3.92
liking	3.67	4.42	5.08	4.33	4.25	3.92	3.67	3.92
purchase intent	4.17	4.50	4.58	3.17	4.25	4.17	3.58	3.00

Table 5. Correlation coefficient to three measures of eye fixation data

	number of eye fixations	eye fixation duration (time)	rate of subjects watching ads
number of eye fixations	1	.678	.892**
eye fixation duration (time)		1	.847**
rate of subjects watching ads			1

The number of sample: N=8, [\*]:significant level of 5%, [\*\*]:significant level of 1%

Table 6. Correlation coefficient to eight measures of impression data

	impression	trustworthy	appeal	conscientious	refined	familiarity	liking	purchase intent
impression	1	.698**	.407**	.474**	.411**	.245**	.398**	.686**
trustworthy		1	.515**	.426**	.578**	.284**	.437**	.583**
appeal			1	.399**	.475**	.446**	.468**	.299**
conscientious				1	.551**	.230**	.336**	.378**
refined					1	.216**	.390**	.475**
familiarity						1	.559**	.351**
liking							1	.575**
Purchase intent								1

The number of sample: N=96, [\*]:significant level of 5%, [\*\*]:significant level of 1%

### C. Results of experiments

Table 3 shows the result of the experiment A, *i.e.*, (i) the number of times of the eye fixation; (ii) the eye fixation duration (*i.e.*, the total time of the eye fixation); and (iii) the rate of the participants who fixed their eyes on the ad at least once. In this table, the line indicates the three evaluation criteria on the eye fixation on the ads, while the column indicates the eight types of the web layouts.

Table 4, on the other hand, shows the result of the experiment B, *i.e.*, the mean values of evaluating the ads impression shown in six newssite samples from the viewpoint the following eight types of SD scales which refers to the BRANDX developed by Dentsu Ltd: (1) impression; (2) trustworthy; (3) appeal; (4) conscientious; (5) refined; (6) familiarity; (7) liking; and (8) purchase intent. In this table, the line indicates the eight types of SD scales, while the column indicates the eight types of the web layouts.

## IV. Multi Objective Optimization

### A. Setting up two objectives

Based on the hypotheses set up in Section 2.2, the eye fixation of the ads and the ads impression in the negative news articles are supposed to be two conflicting objectives. In order to analyze this relationship, we summarize the large number of scales into the minimum number of objectives, *i.e.*, from 11 scales (namely, three scales in Table 3 and eight scales in Table 4) to two scales.

For this purpose, we started by calculating the correlation coefficients among the three scales of the eye fixation data (*i.e.*, (i) the number of times of the eye fixation; (ii) the eye fixation duration; and (iii) the rate of the participants who fixed their eyes on the ad at least once), which values are shown in Table 5. From this table, the relatively strong correlations were

observed among all the combinations. This result means that the data of three scales are basically the same in property. From this analysis, the three measures were integrated into one scale and regarded this scale as “attention degree”. We define the “attention degree” as the degree to which the ads attract the eyes of users/consumers.

In the same way, we calculated the correlation coefficients among the eight scales of the impression data which values are shown in Table 6. From this table, the weak correlations less than 0.5 were observed in 11 combinations, and relatively strong correlation over 0.6 were observed in 17 combinations, and all combinations were significant in the level of 5%. From this analysis, the eight scales were integrated into one scale and regarded this scale as “impression degree”. We define the “impression degree” as the degree to which the ads are or are not influenced by the negative news articles. In order to integrate eight scales into one scale, we conducted a multiple linear regression analysis which set the impression scale as the objective variable and the other seven scales as independent variables. As a result, the impression scale ( $Y$ ) was formulated as follows, where  $Y$  = impression scale;  $a$  = trustful scale;  $b$  = appeal scale;  $c$  = conscientious scale;  $d$  = refined scale;  $e$  = familiarity scale;  $f$  = liking scale;  $g$  = purchase intent scale (note that [\*] indicates the significant level of 5%, and [\*\*] indicates the significant level of 1%).

$$Y = 0.437a^{**} + 0.11b + 0.210c^{**} - 0.191d^{**} - 0.55e - 0.84f + 0.477g^{**} + 0.294$$

Based on this result, “ $b$ ”, “ $d$ ”, “ $e$ ”, and “ $f$ ” are excluded as new objective functions because “ $b$ ”, “ $e$ ” and “ $f$ ” do not satisfy the needed significant level of 5%, and “ $d$ ” becomes a minus component of “ $Y$ ”. After all, four scales, namely “impression”, “trustworthy”, “conscientious”, and “purchase intent”, were selected as new objective functions.

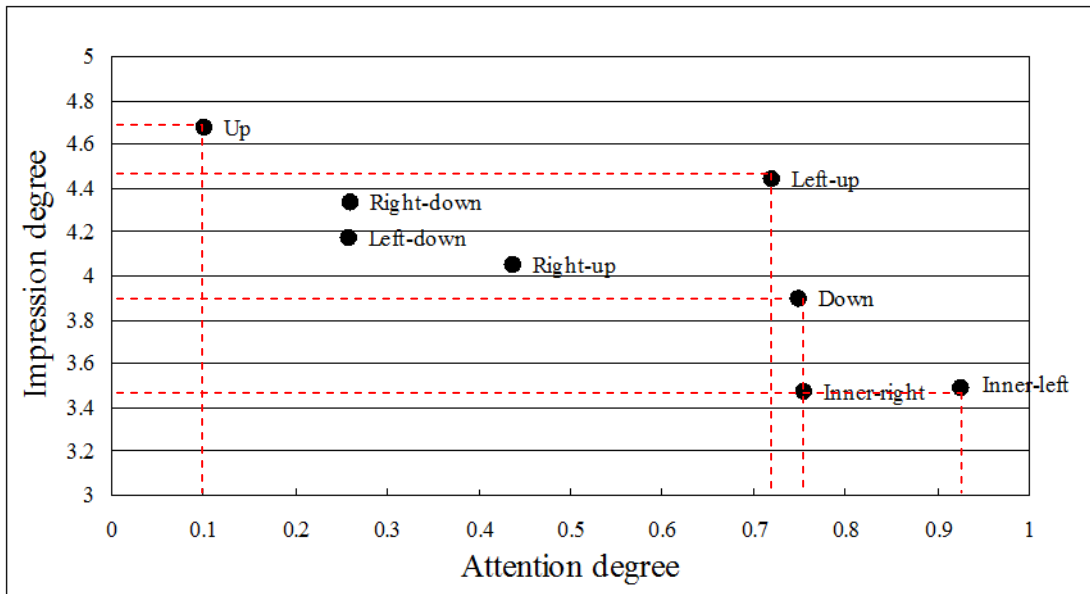


Figure 3. Distribution map with attention degree and impression degree

As the summary of the above calculation of the correlation coefficients, the three scales of the eye fixation and four scales from the eight types of SD scales, namely seven scales in total, were to be analyzed from the viewpoint of the multi-objective optimization in the next section.

#### B. Analysis of two objective functions

The analysis of the experiment result from the viewpoint of “attention degree” and “impression degree”, which are regarded as two objective functions, provides the distribution map of the eight types of the web layouts as shown in Figure 3. In this figure, the horizontal axis indicates the attention degree, while the vertical axis indicates the impression degree. From this figure, it is clear that the attention degree and the impression degree have the trade-off relationship, which is consistent with the hypothesis described in Section 2.2.

In order to find the Pareto front solutions which are better solutions than others in the two objective functions, we explain the concept of the *dominance* (here, the solution corresponds to the web layout in this experiment). We call “ $x$  dominate  $y$ ” ( $f(x) \succeq f(y)$ ) when two solutions satisfies the following two equations, where  $f_i(x)$  indicates the solution  $x$  on  $i$ -th objective function.

$$\begin{aligned} \forall i \in \{1, 2, \dots, m\} : f_i(x) &\geq f_i(y) \wedge \\ \exists i \in \{1, 2, \dots, m\} : f_i(x) &> f_i(y) \end{aligned}$$

In this experiment,  $m=2$  because two objective functions of “attention degree” and “impression degree” are employed. Using the concept of *dominance*, the Pareto front solutions  $P$  is described as follows, where  $F$  indicates all possible solutions (i.e., the eight types of the web layouts in this experiment).

$$P = \{Y \in F \mid \neg \exists x \in F : f(x) \succeq f(y)\}$$

From this viewpoint, the following four types of the web layouts become the Pareto front solutions in Figure 3: (1) up layout; (2) left-up layout; (3) down layout; (4) inner-left layout. The characteristics of these four types of the web layouts are summarized as follows:

#### 1) Up layout

This layout provides the high impression degree while the low attention degree, which suggests that the ad located at the up position is not frequently watched by users. This indicates that the ad is not sensitively influenced by the negative contents of articles. Since the primary purpose of users is to read news articles when users watch the newssites, the user’s eyes follow the articles from up to down. From this characteristic of the eye movement, it is not usual for users to watch the ad in the up layout because the ad located at the most top of web page in the newssite is upper than the location of the article’s title. Such layout contributes to keeping the impression degree high because the ad is not watched so much even when the users read the negative news articles. This result suggests that the up layout is suitable for well-known valuable brands which need to be kept the brand image high.

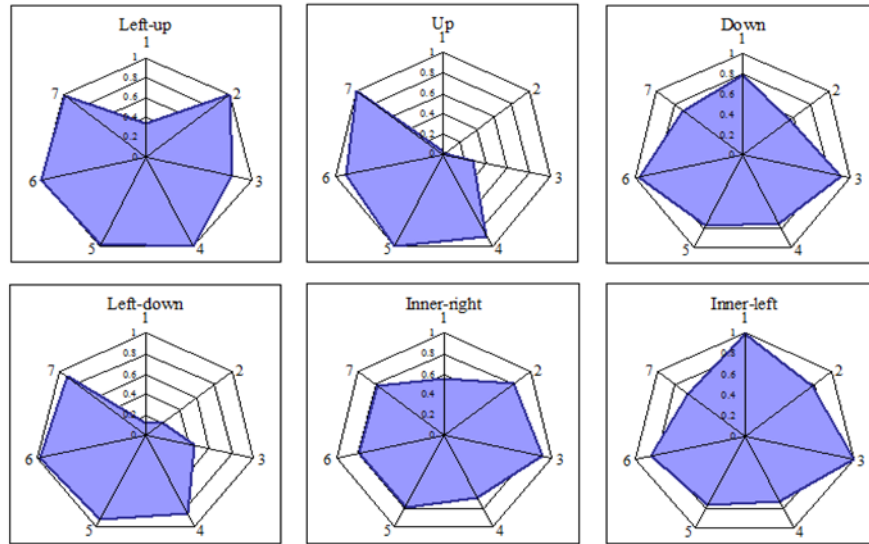
#### 2) Inner-left layout

This layout provides the low impression degree while the high attention degree, which suggests that the ad located at the inner-left position is often and frequently watched by users. This indicates that the impression of the ad in the inner-left position has the large risk to be influenced by the negative news articles because the ad in this layout tend to be watched frequently during reading the negative news articles. This result suggests that the inner-left layout is suitable for consumer goods which are newly into a sale to be paid attention to by many consumers even if the image of the goods somewhat becomes bad. In particular, the inner-left layout contributes to promoting users to remember the name of goods or the produced company.

#### 3) Down layout

This layout provides a relatively low impression degree and a relatively high attention degree. This is because the ad in this layout is located at the under of the article and such location promotes users to watch the ad after reading the negative news articles, which contributes to keeping the





**Figure 4.** Total scores of the six layouts

(1: the number of times of the eye fixation, 2: the times of the eye fixation, 3: the rate of subject’s watching ads, 4: impression scale, 5: trustful scale, 6: conscientious scale, 7: purchase intent scale)

attention degree relatively high and to keeping the impression degree relatively low.

4) *Left-up layout*

This layout dominates three layouts, *i.e.*, the right-up layout; the right-down layout; the left-down layout, and has a high score of both of attention degree and impression degree in the two objective functions. In particular, the ad located at the left-up layout provides a high attention degree because users start to read from left side in most language including Japanese and English and read the article’s title first. On the other hand, the ad in this layout also provides a high impression degree because users read the negative news articles after watching the ad, which does not give a large bad influence to the impression of the ad.

What should be noted that the right-up and inner-right layouts, which are the current standard layout, do not become the Pareto front solutions. This indicates that the ads in the current standard layout are directly affected by the negative news articles, which means that these standard layouts are not good layout when the negative news articles are posted in the website.

C. *Analysis of seven objective functions*

Since the previous section analyzed the eight types of the web layouts from the viewpoint of the “attention degree” and “impression degree”, we then analyzed them from the viewpoint of seven scales, which consist of the three eye fixation data and the four impression data, with respect to objective functions. As a result, the six types of layouts as shown in Figure 4 became Pareto front solutions, represented by the heptagon, each of which vertex indicates 1: the number of times of the eye fixation, 2: the times of the eye fixation, 3: the rate of subject’s watching the ads, 4: the impression scale, 5: the trustful scale, 6: the conscientious scale, and 7: the purchase intent scale, respectively.

From Figure 4, we can find that (1) the four layouts (*i.e.*, the up, left-up, down, and inner-left layouts) as the Pareto front solutions in Figure 3 are included in Figure 4; and (2) three layouts (*i.e.*, the right-down, right-up, and the left-up layouts)

which are dominated by one of the Pareto front solutions in Figure 3 are excluded in Figure 4. Furthermore, the characteristics of the four layouts as the Pareto front solutions in Figure 3 are also shown in Figure 4. For example, the up and left-up layouts show the low attention degree and high impression degree due to the fact the scores from 1 to 3 (related to the attention degree) are low and those from 4 to 7 (related to the impression degree) are high, while the inner-left and down layouts show the high attention degree and low impression degree due to the fact some of scores from 1 to 3 (related to the attention degree) are high and those from 4 to 7 (related to the impression degree) is not high in comparison with the up and left-up layouts.

Among the four layouts (*i.e.*, the up, left-up, down, and inner-left layouts) as the Pareto front solutions in Figure 3, the left-up layout dominates the up layout in Figure 4 and the inner-left layout dominates the down layout expect for the vertex 6 (*i.e.*, the conscientious scale). By comparing these two layouts from the total score viewpoint, the left-up layout has the highest score in comparison with the inner-left layout. This suggests that the left-up layout achieved the better performance, which gives the best impression and gets the most attention at the same time even the negative news articles are included in the news website.

**V. Conclusion**

Our research explored the effective layouts of the advertisement in the negative news article related to the contents of ads. For this purpose, we conducted the experiments to investigate the eight types of web layouts of the advertisements from the viewpoint of the attention degree and the impression degree. Through the intensive experiments, we revealed that the layout inserting advertisement into the left-up layout achieved the better performance than those in the right-up layout and inner-right layout, which are the current standard layout. This indicates that the left-up layout is the best in terms of giving the best impression and getting the most attention at the same time even the negative news articles are included in the news website.

What should be noted here is that the results have only been obtained from eight types of the web layouts. Therefore, further careful qualifications and justifications, such as analysis of other types of the web layouts, are needed to generalize our results from the viewpoint of multi-objective optimization. Such important directions must be pursued in the near future in addition to the following future research: (1) an evaluation of other advertisements; (2) optimization of the layouts by utilizing the Pareto front solutions through Genetic Algorithm.

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