

## **Opportunity in Pandemic: Understand how Customers Look at your Banner Ads**

*(Full Paper)*

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### **ABSTRACT**

The importance of e-business is constantly increasing and it becomes even more essential during the time of COVID-19 outbreak. Although internet vendors are less affected by the pandemic than others, they all have to be careful with their spending during this delicate time. Effective spending on digital marketing undoubtedly can increase customers and profits of the business. The objective of this study is to examine how people look at banner ads displayed on a web page in four different positions (top, bottom, left, and right). The study used an eye-tracking tool, Mirametrix S2 Eye Tracker, to collect eye gaze data from 320 volunteer participants. The collected data were used to calculate (1) banner ads' time to first fixation, (2) banner ads' first fixation duration, (3) banner ads' total fixation duration, and (4) banner ads' fixation count of each participant. Statistical analyses on the data indicate that the banner ads' positions have a significant impact on banner ads' time to first fixation. This result can be beneficial to internet vendors in deciding on where to place banner ads to attract the most attention from their potential customers.

*Keywords:* Banner ads, time to first fixation, first fixation duration, total fixation duration, fixation count.

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### **INTRODUCTION**

Albert Einstein said, "In the middle of a difficulty lies opportunity". This statement has never been so true for e-businesses especially during the time of COVID-19 pandemic. According to the report by Adobe, COVID-19 has massively accelerated the growth of e-commerce (Koetsier, 2020). Retail e-commerce sales worldwide grew from US\$3,535 billion in 2019 to US\$4,206 billion in 2020 (Statista.com, 2020).

Currently, businesses focus deeply on using digital advertising to reach their target groups or their potential customers. According to Statista.com, the global banner advertising market size is about US\$52.8 billion in 2020 and will reach US\$71.6 billion in 2024 (Lindlahr, 2020). However, because of the COVID-19 outbreak, businesses worldwide are more cautious in their spending. Their advertising spending in 2019 was revised from US\$662.99 billion to US\$646.71 billion, and in 2020, it was revised from US\$712.02 billion to US\$691.72 billion (Statista.com, 2020). To effectively utilize business spending on digital advertising, especially on banner advertising, businesses need to understand how potential customers look at banner ads.

### **LITERATURE REVIEW**

#### **Position of Banner Ads**

Banner advertising or banner ad is one of the most common forms of digital advertising. There are previous studies concerning banner ad positions. Heinz and Mekler (2012) found that banner ads at the top and bottom positions did not have an impact on viewers' recognition. Ryu *et al.* (2007) indicated that a banner ad that was placed at the right position on a web page would be evaluated more positively than a banner ad that was placed at the left position on a web page. John and Sathiyaseelan (2014) studied four positions of banner ads and suggested that, in terms of explicit memory, the top and right positions were the most and the least effective positions, respectively.

#### **Eye Tracking**

In e-commerce studies, there are many ways to measure customer interest, or to be more specific, customers' interest in banner ads, including the use of an eye-tracking device (Hervet *et al.*, 2011; Saowwapak-adisak, Mongkolnavin, & Rattanawicha, 2015; Tangmanee, 2016). It is expected that when customers notice a banner ad, if they are interested in the advertised products or services, they would spend time looking at the banner ad and eventually click on it to obtain additional information. Lee and Ahn (2012) indicate that static banner ads are more effective than animated ones. Animation in banner ads attracts less attention and reduces the positive effect of attention on memory. Porta, Ravarelli, and Spaghi (2013) find that congruity between web content

and banner ads subject makes a difference to the way banner ads are looked at and emphasize that the design of banner ads for web content is very important.

In this study, we are investigating how viewers look at the banner ads that are placed at different positions on a web page in terms of time to first fixation (the amount of time it takes viewers to look at the banner ad for the very first time), first fixation duration (how long their first look at the banner ad lasts), total fixation duration (the total amount of time they look at the banner ad), and fixation count (the number of times they look at the banner ad).

### RESEARCH QUESTION

This research aims to study four positions of banner ads on a web page: top, bottom, left, and right. The main research question is whether four different positions of banner ads on a web page have different impacts on how potential customers look at the banner ads in terms of (1) time to first fixation, (2) first fixation duration, (3) total fixation duration, and (4) fixation count.

### Research Hypothesis

In order to answer the research question, four hypotheses listed below are tested.

H1: Banner ad positions in a web page impact banner ads' time to first fixation

H2: Banner ad positions in a web page impact banner ads' first fixation duration

H3: Banner ad positions in a web page impact banner ads' total fixation duration

H4: Banner ad positions in a web page impact banner ads' fixation count

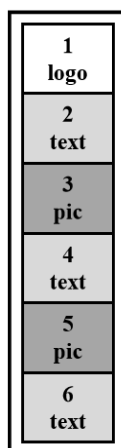
### RESEARCH METHODOLOGY

#### Research Tools

The research tools used in our empirical study were the same ones used in our previous work (Saowwapak-adisak, Mongkolnavin, & Rattanawicha, 2015). Four experiment web pages with one inserted banner ad on each page, together with an eye-tracking device were employed to collect participants' eye gaze. A questionnaire was used to collect additional data. Details of each research tool are given as follows.

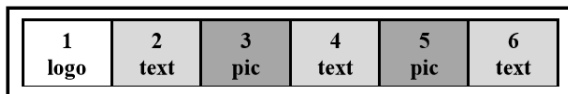
#### Static banner ads

Static or non-animated banner ads were employed in the study. To ensure that the total area (in pixels) of each banner ad is approximately equal, each banner is designed to consist of six small parts as shown in Figure 1 and Figure 2. Each of these small parts has a size of 160 x 100 pixels. The first part is the advertising company logo. The second, fourth, and sixth parts present advertising text. Advertising pictures are displayed in the third and the fifth part of the banner. Two styles of banner ads were used in the study. The vertical style (as shown in Figure 1) is for display at the left and right position, while the horizontal style (as shown in Figure 2) is for display at the top and bottom positions. The vertical banner ad has a total size of 160 x 600 (or 96,000 pixels), which is the size of a Skyscraper banner ad (Myers, 2020). The horizontal banner has a total size of 960 x 100 (also 96,000 pixels), which is closest to 970 x 90, the size of a Large Leaderboard banner ad (Myers, 2020).



Source: This study.

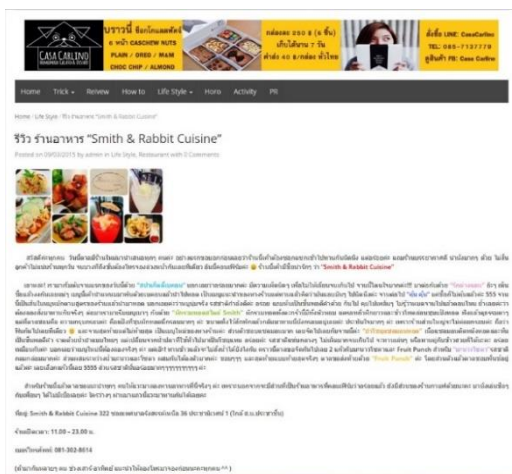
Figure 1: Vertical style banner ad.



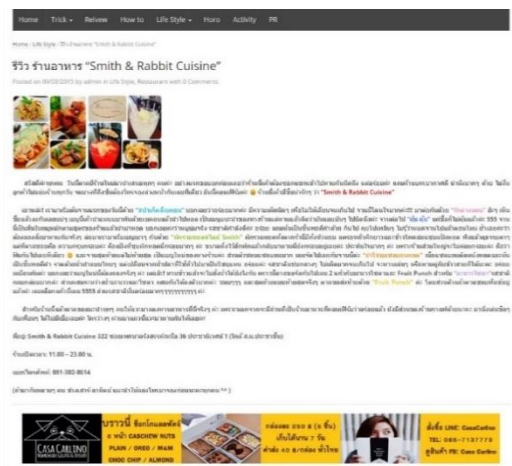
Source: This study.  
Figure 2: Horizontal style banner ad.

**Web pages**

A restaurant review web page was used in the empirical study. The web page is designed to compose of two main areas to display the web content and the banner ad, respectively. Four web pages that display the banner ads in different areas are shown in Figure 3 to Figure 6.



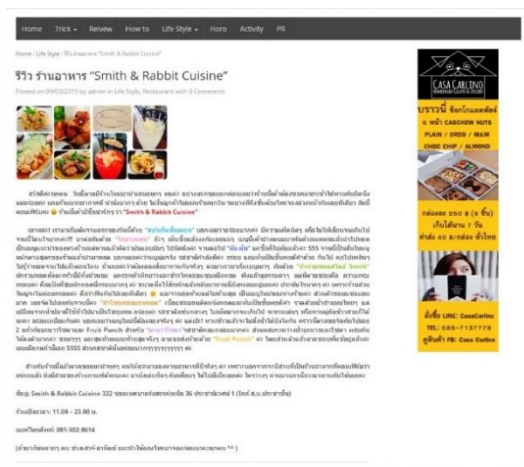
Source: This study.  
Figure 3: Web page with the banner ad at the top position.



Source: This study.  
Figure 4: Web page with the banner ad at the bottom position.



Source: This study.  
Figure 5: Web page with the banner ad at the left position.



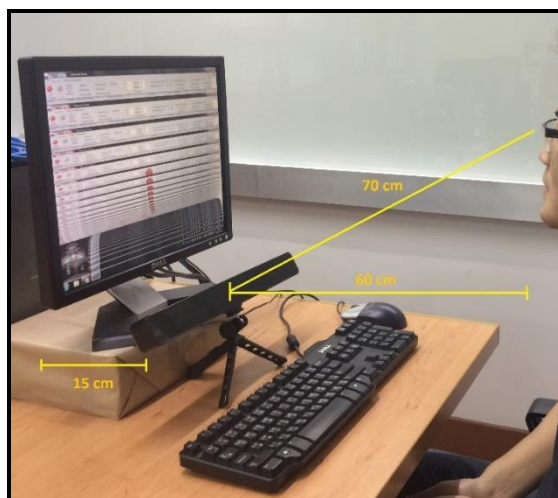
Source: This study.  
Figure 6: Web page with the banner ad at the right position.

**Eye-tracking device**

The Miramatrix S2 Eye Tracker in Figure 7, is an eye-tracking device that is used to detect and collect the eye gaze of each participant during the experiment, as shown in Figure 8. The Miramatrix S2 Eye Tracker has a hardware part, which tracks the participant's eye movements and collects eye-gaze data. A software part, the eye-tracking viewer, is used to interface with the device. The software saves eye-gaze data as a CSV document. These collected eye-gaze data were later used to calculate (1) time to first fixation, (2) first fixation duration, (3) total fixation duration, and (4) fixation count for the study.



Source: <http://imotions.com/hardware/miramatrix-s2/>.  
Figure 7: Miramatrix S2 Eye Tracker.



Source: This study.

Figure 8: Eye tracking experiment setup with Mirametrix S2 Eye-Tracker.

### Questionnaire

A questionnaire was used to collect demographic data of each participant and his/her answers to questions about restaurant review, the assigned task. The collected demographic data include gender, age, education, handedness, Internet usage experience, and interest in banner ads in general. The restaurant review questions concern, for example, restaurant name, menu, name of the reviewer, and interest in restaurants.

### Research Procedure

The research background and objectives were explained to students at Chulalongkorn Business School, Chulalongkorn University, Thailand. Volunteer participants wrote down the date and time they wished to participate in the experiment. Each participant came to his/her appointment that was arranged individually. The participant was then informed about the data collection procedure. To simulate the situation of using a restaurant review website, the participant was instructed to assume that he/she was looking at the review web page to find information about a restaurant. For the fixation data collection, the researcher adjusted the Mirametrix S2 Eye Tracker for each participant and conducted the device calibration process. The researcher started recording eye gaze data when the restaurant review web page was shown to the participant. The participant was instructed to close the web page immediately after he/she finished with the web page. Then, the researcher stopped recording his/her eye gaze. After that, the participant answered questions about the restaurant review and filled in his/her demographic data in the questionnaire.

Table 1: Participants' demographic information.

Demographics	Distribution
Gender	35.00% male 65.00% female
Age	93.75% 18-25 years old 6.25% 26-30 years old
Education	93.13% undergraduate 6.87% graduate
Handedness	4.38% left 94.06% right 1.56% both
Internet usage experience	3.44% Less than 5 years 28.12% 5-7 years 68.44% More than 7 years
Interest in banner ads	61.25% Interested 38.75% Uninterested

Source: This study.

## Participants

In total, 320 undergraduate and graduate students from Chulalongkorn Business School, Chulalongkorn University, Thailand, participated in the study. The demographics of these 320 volunteer participants are presented in Table 1. The participants are 35% male and 65% female. They are mostly undergraduate students, 18 to 25 years old. 94% of them are right-handed. 68% of them have more than 7 years of Internet usage experience, and 61% of them are interested in banner ads in general.

## RESEARCH RESULTS

There are two sections of the study results. The first section presents descriptive statistics of the collected data, and the second section demonstrates the hypothesis testing results.

### Descriptive Statistics

#### *Participants and banner ads*

A total of 320 participants were randomly assigned to four different web pages (as shown in Figure 3 to Figure 6) equally, 80 participants each. However, 37 participants (11.56%) did not have any fixation on the banner ads. In other words, they did not look at the banner ads at all. Table 2 presents numbers and percent values of participants who look/do not look at the banner ads at each position of the web page. It is found that most participants (more than 90%) looked at the banner ad at the left or right position. However, almost 20% of the participants did not look at the banner ad at the top or bottom position at all.

Table 2: Participants who look/do not look at banner ads.

Banner Ad Position	Participants Who Look at Banner Ads	Participants Who Do Not Look at Banner Ads	Total Participants
Top	67	13	80
	83.75%	16.25%	
Bottom	66	14	80
	82.50%	17.50%	
Left	76	4	80
	95.00%	5.00%	
Right	74	6	80
	92.50%	7.50%	
Total	283	37	320
	88.44%	11.56%	

Source: This study.

After discarding data of 37 participants who did not look at the banner ads at all, the descriptive statistics of time to first fixation, first fixation duration, total fixation duration, and fixation count of the remaining participants are presented in Table 3. Figures 9, 10, 11, 12 show density distributions of time to first fixation, first fixation duration, total fixation duration, and fixation count, respectively.

#### *Time to first fixation*

Table 3 and Figure 9 indicate that, on average, it took about 13 seconds for participants to take a first look at the banner ads on the web page. It took longer, about 28 seconds on average, for them to take a first look at the banner ad at the top position. On the other hand, the banner ad at the right position seemed to get immediate attention from participants, about 6.5 seconds on average. The results show that all participants took the first look at the banner ad in the left position within the first 2 minutes. However, it took some participants almost 4 minutes to notice the banner ad at the top position.

#### *First fixation duration*

From Table 3 and Figure 10, it is found that, on average, participants spent around 0.18 seconds looking at the banner ads for the very first time. There is not much difference in the average time spent looking at the banner ads for the first time among different banner ad positions. However, some participants spent almost 1 second in their first look at the banner ad at the bottom position.

Table 3: Descriptive statistics of the results of each banner ad position.

Banner Ad Position		Time to First Fixation (Sec.)	First Fixation Duration (Sec.)	Total Fixation Duration (Sec.)	Fixation Count (Number of Times)	N
<b>Top</b>	Min	1.000	0.009	0.013	1	67
	Max	237.000	0.777	12.510	103	
	Mean	27.760	0.190	1.980	15.030	
	Std. Deviation	57.640	0.170	2.510	18.450	
<b>Bottom</b>	Min	1.000	0.005	0.041	1	66
	Max	195.000	0.914	21.863	58	
	Mean	10.450	0.180	1.590	12.020	
	Std. Deviation	30.210	0.210	2.890	9.600	
<b>Left</b>	Min	1.000	0.004	0.016	1	76
	Max	120.000	0.723	4.153	63	
	Mean	8.390	0.160	1.080	9.830	
	Std. Deviation	20.360	0.160	0.900	8.700	
<b>Right</b>	Min	1.000	0.005	0.033	1	74
	Max	144.000	0.655	4.590	29	
	Mean	6.590	0.190	1.260	8.960	
	Std. Deviation	20.150	0.170	1.080	6.160	
<b>Total</b>	<b>Min</b>	<b>1.000</b>	<b>0.004</b>	<b>0.013</b>	<b>1</b>	<b>283</b>
	<b>Max</b>	<b>237.000</b>	<b>0.914</b>	<b>21.863</b>	<b>103</b>	
	<b>Mean</b>	<b>12.990</b>	<b>0.180</b>	<b>1.460</b>	<b>11.340</b>	
	<b>Std. Deviation</b>	<b>35.680</b>	<b>0.170</b>	<b>2.010</b>	<b>11.680</b>	

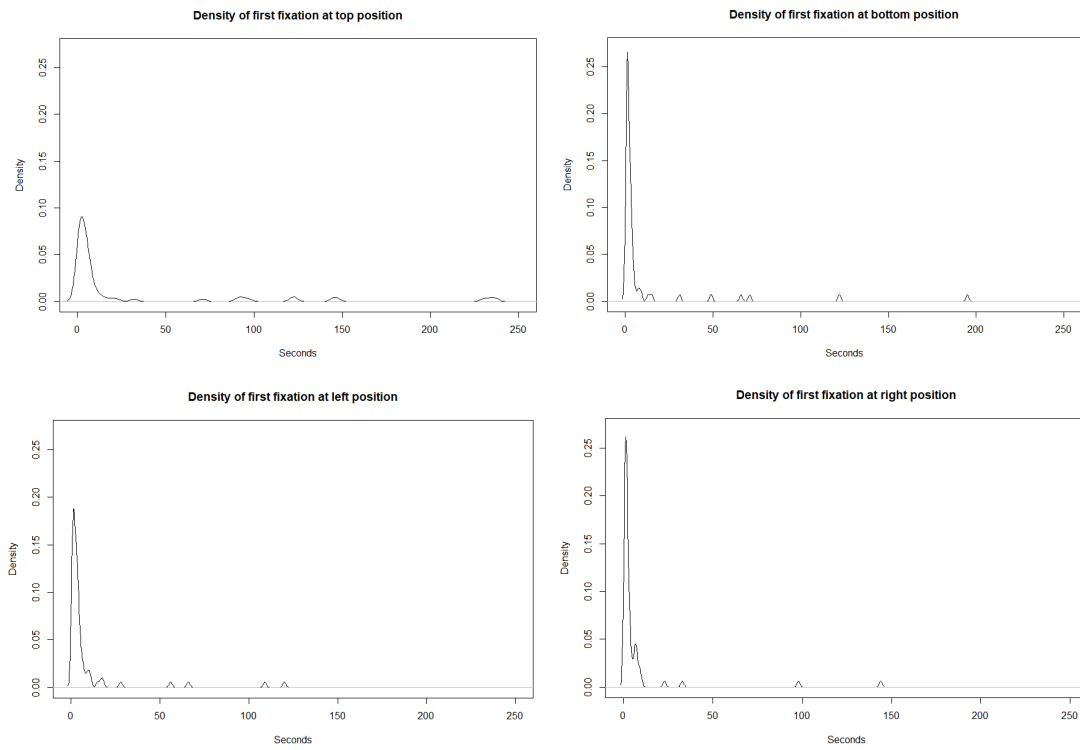
Source: This study.

#### **Total fixation duration**

From Table 3 and Figure 11, on average, participants spent about 1.5 seconds in total to look at the banner ads. The banner ad at the top position gained the most attention, on average of almost 2 seconds in total. Some of the participants spent more than 12 seconds looking at the banner ad at the top position. However, interestingly, some participants spent up to 22 seconds looking at the banner ad at the bottom position. The banner ads at the left and right positions gained similar attention from the participants.

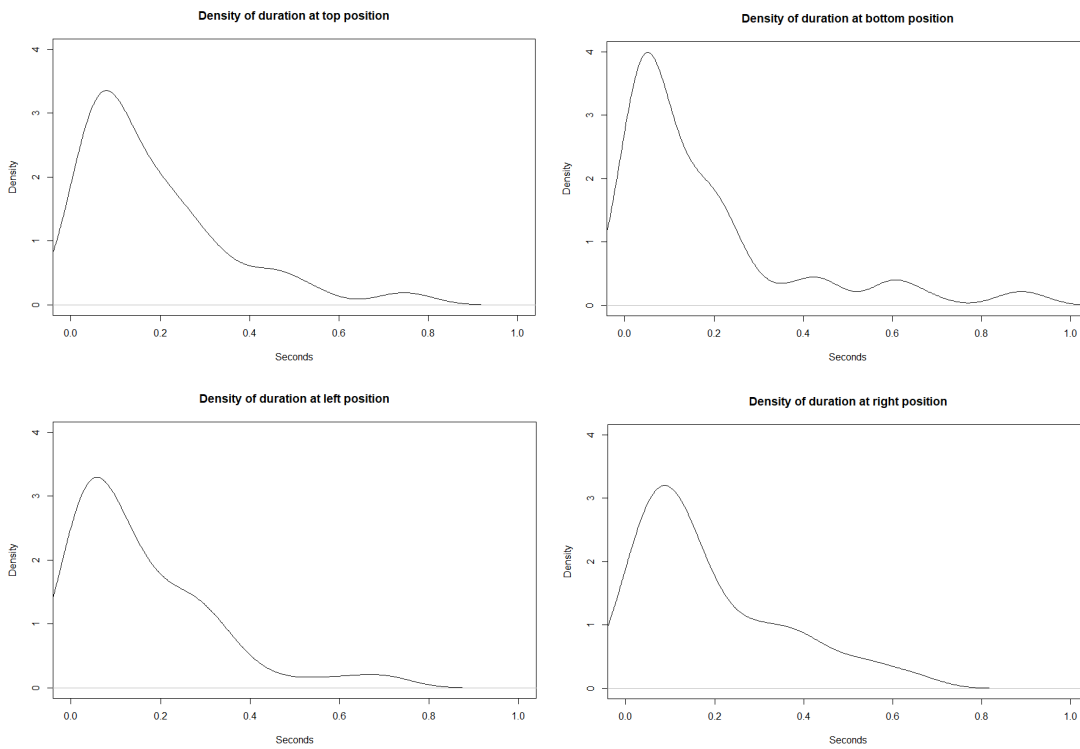
#### **Fixation count**

Relating to the number of times people look at banner ads, or fixation count, it is found from Table 3 and Figure 12 that participants looked at banner ads around 11 times on average. Participants looked at the banner ads at the top position on average 15 times and up to more than 100 times, more often than the banner ads at other positions on the web page.



Source: This study.

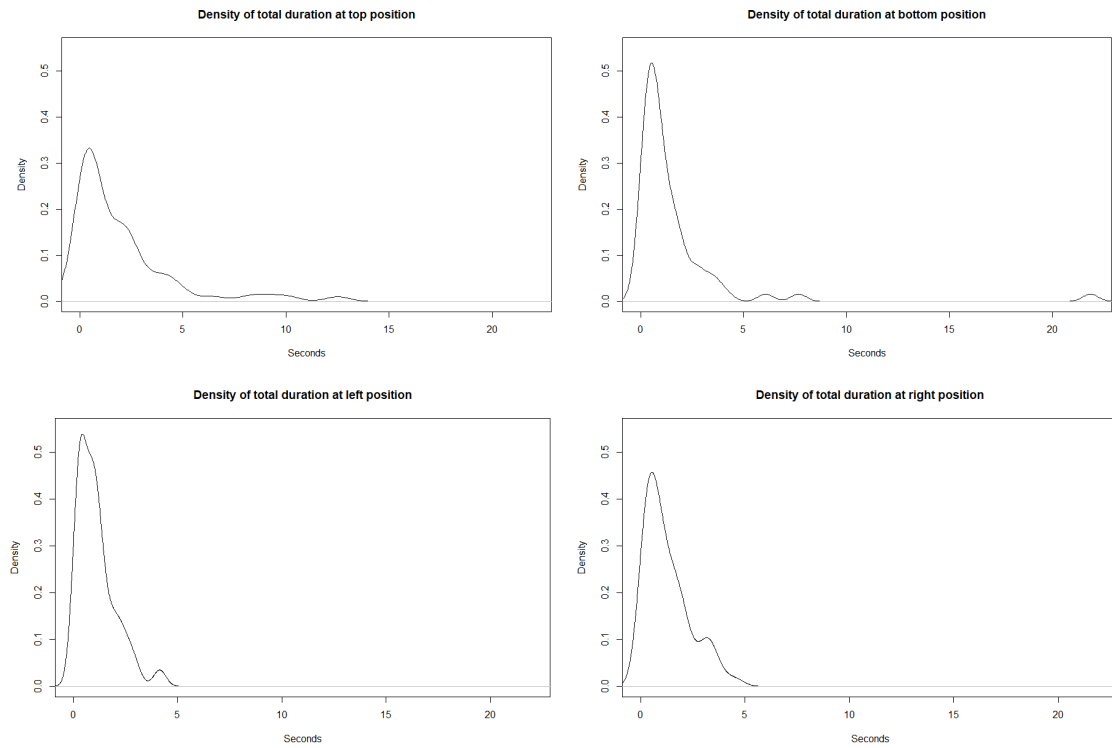
Figure 9: Distributions of time to first fixation of each banner ad position.



Source: This study.

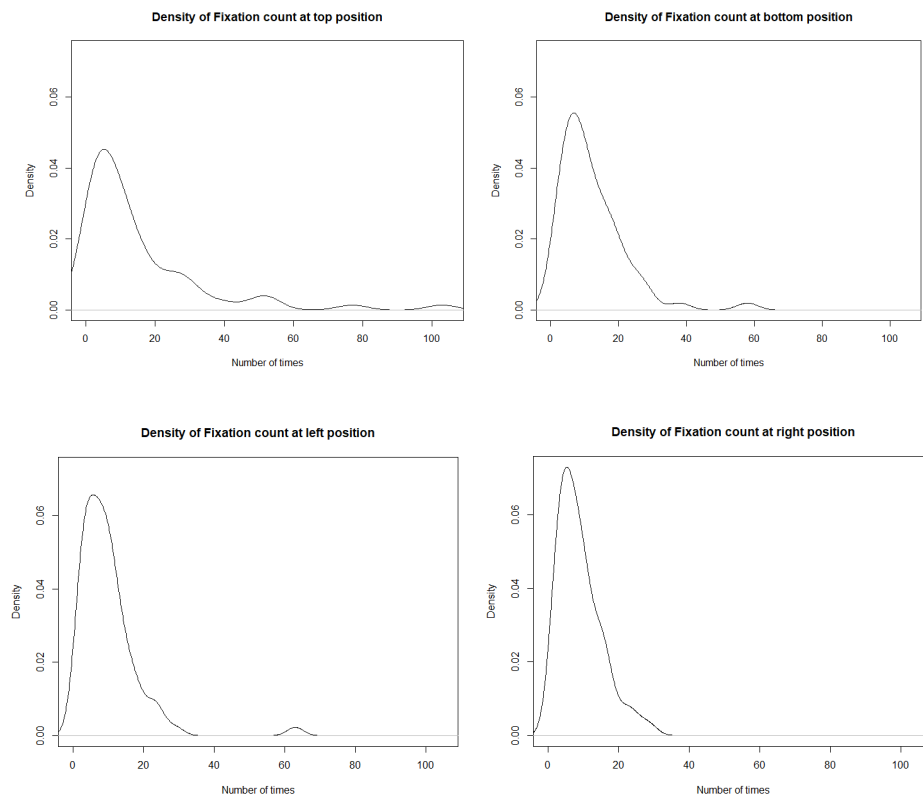
Figure 10: Distributions of first fixation duration for each banner ad position.





Source: This study.

Figure 11: Distributions of total fixation duration for each banner ad position.



Source: This study.

Figure 12: Distributions of fixation count for each banner ad position.

### Hypothesis Testing Results

Hypothesis testing is performed to answer our research question whether different banner ad positions in a web page impact time to first fixation, first fixation duration, total fixation duration, and fixation count. Since distributions of the data are not normal, non-parametric tests are employed. Kruskal-Wallis test results are presented in Table 4.

Table 4: Kruskal-Wallis test results when banner ad positions are different.

	Time to First Fixation	First Fixation Duration	Total Fixation Duration	Fixation Count
<b>Kruskal-Wallis Chi-square</b>	14.9700	3.5068	1.7907	3.7994
<b>df</b>	3	3	3	3
<b>p-value</b>	0.0018**	0.3199	0.6170	0.2840

Source: This study.

\*\* significant at 95% confidence interval

From Table 4, at a 95% confidence interval, Kruskal-Wallis test results indicate that there are significant differences of time to first fixation among the four banner ad positions. However, the test results show no significant difference in first fixation duration, total fixation duration, and fixation count among the four banner ad positions. Hence, further analysis is performed on time to first fixation. Pairwise comparison using Wilcoxon Rank Sum tests in Table 5 and descriptive statistics in Table 3 suggest that it takes significantly longer for people to take a first look at the banner ad at the top position of a web page, at a 95% confidence interval.

Table 5: Wilcoxon Rank Sum Pairwise comparison test on time to first fixation.

Pairwise Comparison	p-value
<b>Top &amp; Bottom</b>	0.0016**
<b>Top &amp; Left</b>	0.0460**
<b>Top &amp; Right</b>	0.0013**
<b>Bottom &amp; Left</b>	0.0931
<b>Bottom &amp; Right</b>	0.9983
<b>Left &amp; Right</b>	0.0850

Source: This study.

\*\* significant at 95% confidence interval

### DISCUSSION AND CONCLUSION

It can be concluded from this study that there are differences in how people look at banner ads placed at different positions on a web page. A significant difference is especially found in time to first fixation or the amount of time it took the volunteers to look at the banner ads for the very first time. Statistical analyses indicate that it took significantly longer for people to take a first look at the banner ad at the top position than the other three positions on the web page. From the mean value of time to the first fixation, it took a much shorter time for people to take a first look at the banner ad in the right position. Moreover, it is also found that more than 90% of the participants noticed the banner ad placed at the left or the right position of the web page. On the other hand, almost 20% of the participants did not look at the banner ad placed at the top or the bottom position at all. However, for those who noticed banner ads, when we consider the number of times people look at them (or fixation count) as well as total time spent looking at them (or total fixation duration), the banner ad at the top position gained more attention from participants than the banner ads placed at the other positions.

These conclusions can help internet vendors in deciding where to place banner ads on a web page. Banner ads at the top position seem to gain more attention from audiences even though it takes a much longer time for people to notice them. However, placing banner ads at the top position usually costs more than other positions on a web page. Therefore, it is interesting to consider alternative positions to place banner ads, for example, the right position on a web page. With the lower cost to advertise and the reason that people seem to notice the banner at this position immediately. If internet vendors make the banner ads more attractive, people might spend more time looking at the banner ads placed at this position.

### FURTHER WORK

We observe that the empirical results obtained from horizontal banner ads (banner ads placed at the top and bottom positions) are rather different from the results obtained from vertical banner ads (banner ads placed at the left and right positions). The vertical banner ads seemed to be more attractive to the participants. It took a shorter time for the participants to take a first look at them than the horizontal banner ads. However, in terms of total fixation duration and fixation count, the horizontal banner ads seemed to get more attention from the participants than the vertical ones. We plan to conduct further analyses of this observation because it can lead to a clearer recommendation for internet vendors on the choices of banner ads. For example, if people do not spend much time on the vertical banner ads because an alignment of text is not in the direction that they are accustomed to, a banner ad of larger size that is placed on the left or, in particular, the right position may be more attractive and attentive for the web audience. Also, if the horizontal and vertical banner ads are significantly different in terms of time to first fixation and total fixation duration, both types of banner ads can be designed such that internet vendors can benefit most from their choices of banner ad positions. Furthermore, it is interesting to study effective banner ads' position on screens of mobile devices especially smartphones, the main devices used to access websites these days. This is because they are usually held in portrait orientation, which limits the display of banner ads in the left and right positions.

### ACKNOWLEDGEMENT

The authors acknowledge “Chulalongkorn Academic Advancement into Its 2nd Century Project (CUAASC)” for financial support and the Business Visualization Research Group, Chulalongkorn Business School, Chulalongkorn University for the Mirametrix S2 Eye-tracker used in this study.

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