

# Eye Tracking Research on Cinemagraph e-Magazine

Ji Seob Park · Jin Hwa Bae · Kwang Su Cho

**Abstract** This study has performed a comparative analysis between groups based on Time To First Fixation, Fixation Duration, Fixation Count and Total Visit Duration, which are eye-tracking analysis indicators on what visual attention is shown compared to the e-magazine produced as regular images related to e-magazines in which experiment subjects have applied cinemagraph images as eye tracking research on the e-magazine produced with cinemagraph images and e-magazines produced with regular images. The experiment sample used e-magazines composed of nine pages while AOI (area of interest) has been set up on each page by classifying image and text regions. A combined 30 people took part in the experiment, which was performed by randomly assigning 15 to the experiment group and 15 to the control group. According to the results of the analysis, the experiment group recorded a shorter time than the control group on the e-magazine produced with cinemagraph images through Time To First Fixation. Though no significant difference was found between the experiment and control groups in Fixation Duration, a substantial difference did appear between Fixation Duration and Total Visit Duration.

**Keywords** Cinemagraph, e-Magazine, Visual Attention, Tobii, Eye-tracker, Eye-tracking

## 1 Introduction

The term cinemagraph started being used in 2011 through the cinemagraph work produced by fashion photographers Jamie Beck and Kevin Burg of New York, and later became known to the public through Huffington Post, Gizmodo and Instagram of the U.S. Many people started sharing their own works through SNS using cinemagraph technique from 2012, offering an opportunity to become widely known, and the unique effect of cinemagraph in infinitely repeating only one region of a photograph drew much attention. Park Ji Seob (2014) researched the reactions of people after applying marketing by focusing on this cinemagraph effect [1][2][3][4]. The cinemagraph images' effect, especially on food, was verified and the scope of research was extended through applications on various places related to food. As the previous research of this study is follow-up research on the emotional reaction to the e-magazine performed by Park Ji Seob (2015)[3], this study has attempted to find out the differences in visual attention in e-magazines in which people applied cinemagraph images.

## 2 Theoretic Background and Setup of Hypothesis

### 2.1 Cinemagraph e-Magazine and Visual Attention

While a video temporarily and procedurally provides auditory and visual information due to the characteristics of Multimodal, a photograph expresses a message silently indicating the spatial location relationship (Sung J. & Cho K., 2012). Cinemagraph can show the dynamic information of video and silent message possessed by photographs by combining them as the intermediate stage be-

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tween video and photographs, while such feature can provide a unique experience to people.

In the research of Park Ji Seob (2014), eye tracking research was performed by producing an image with detailed description of a shopping mall as a cinemagraph image[4]. The results showed participants who saw the cinemagraph image of the shopping mall as having longer Fixation Duration on average than those who saw the detailed description of the shopping mall made with a regular image, and also recording greater frequency even in the Fixation Count. In the research on emotional reaction evaluation related to the e-magazine produced as a cinemagraph image by Park Ji Seob (2015), various emotional reactions could be expected because cinemagraph images cause higher evocativeness in people. According to the research results, participants who saw the e-magazine produced as a cinemagraph image had emotional reactions such as love, cheerfulness, sense of refreshment, sense of activity, attractiveness, powerfulness, satisfaction, pleasure, interest, excitement, vigor, humor or surprise more than those who saw the e-magazine produced as a regular image [3]. So based on the research on the visual attention of cinemagraph images and that related to the e-magazine produced as a cinemagraph image, this research performed a statistical analysis by mainly dividing image and text regions after setting the AOI (area of interest) that can derive the attention and concentration levels of the set area on what effect the e-magazine produced as a cinemagraph image had on the e-magazine produced as a regular image and visual attention.

## 2.2 Understanding of Eye Tracker

Eye tracking research, also called the eye tracking technique, tracks the movement of the human eyeball to directly measure which subject people focus visual attention on [5]. This method is widely used in cognitive science, psychology, medical science, neurology and pharmacology as a fundamental way to analyze the data of reflecting infrared rays coming from eye tracking equipment on the cornea on the eyeball's surface[5]. Among analysis methods used in eye tracking analysis, Scan Path analyzes the path of eye movement and AOI (area of interest) can analyze attention/concentration level on the set region, as the user sets a specific region on the content while Heat Map and Focus Map could be reckoned as typical. While research has been performed in various fields on eye tracking, Goldberg and Kotval (1999) mentioned a tendency of performing ineffective exploration on the meaning of the number of fixations overall, and Just and Carpenter (1976) said that if

Fixation Duration is recorded, this instance makes extraction of information difficult or the corresponding object captures the surroundings in a certain form. Also, Byrne et al. (1999) said Time to First Fixation, which is faster on a certain object or region, is because the factors that draw attention better exist. If more attention is placed on AOI, this was perceived as something a little more worthy of note and importance (Poole et al.).

Since this study classified the part applying a cinemagraph image and a part not put in either the experiment or control group, the eye tracking analysis method of setting up AOI on the content was used. Then Time To First Fixation, Fixation Duration, Fixation Count and Total Visit Duration were measured. Since Time To First Fixation refers to the time it took for experiment participants to discover content for the first time, recording a shorter time was determined as better. Total Fixation Duration is the time for gaining information without relative movement in a certain place and presented by analyzing the overall average of the entire AOI Region. Fixation Count is the frequency of fixation and what content drew people's attention, how interesting the content was or whether the sentence was hard to make out. Total Visit Duration is defined as the period when a person's attention moves from one part to another.

## 2.3 Setup of Hypothesis

This study will clarify the differences between the experiment and control groups using four types of eye tracking index values -- Time To First Fixation, Fixation Duration, Fixation Count and Total Visit Duration -- to present the following hypotheses based on research of existing cinemagraph images.

*Hypothesis 1: The e-magazine produced as a cinemagraph image will have significant difference in Time to First Fixation compared to the e-magazine produced as a regular image.*

*Hypothesis 2: The e-magazine produced as a cinemagraph image will have significant difference in Total Fixation Duration compared to the one produced as a regular image.*

*Hypothesis 3: The e-magazine produced as a cinemagraph image will have significant difference in Total Fixation Count compared to the e-magazine produced as a regular image.*

*Hypothesis 4: The e-magazine produced as a cinemagraph image will have significant difference in Total Visit Duration compared to the e-magazine produced as regular image.*

### 3 Experiment and Analysis

#### 3.1 Experiment Design and Procedure

##### Participants

For this research, 30 university students and graduate students from Yonsei University in Seoul participated in this experiment. Forty-three percent were male (13 people) and 56 percent female (17). Among the participants, those who read e-magazines with smartphones comprised 44 percent while those who did so on their desktop or laptop PCs made up 38 percent, tablet PCs 11 percent, other personal portable devices 3.2 percent, exclusive e-book devices 2 percent and others 1.8 percent, so most read e-magazines on their smartphones. On how often they read e-magazines per month, 67.3 percent, or 24 participants, said one to three times.

##### Stimulants of Experiment

An e-magazine sample was produced for this research using Adobe InDesign CC version, with a resolution designed for a display size of 2048 x 1536 and 7.9 inches to be seen on the Apple iPad 4. The sample was produced in the style of a food magazine, exposed to the experiment group by applying a cinemagraph image to explain the article among contents going into the e-magazine, while the sample using the regular image was exposed to the control group. The e-magazine sample used in this experiment had nine pages organized as the cover on Page 1, table of contents on Page 2, editor’s greetings on Page 3, advertisement on Page 4, special edition on Page 5, restaurant/food coverage on Page 6, introduction of restaurant(s) on Page 7, introduction to cooking on Page 8 and rising issues on Page 9. The layout was the same as the e-magazine. The produced sample is shown in <Table 1>.

##### Experiment Procedure

After giving an adequate explanation on the experiment to the participants, the experiment was performed by randomly assigning an experiment group and control group. The participants looked at the tablet PC in the front by sitting on a desk with an eye tracker installed, and watched the prepared sample e-magazine with guidance from an experimenter after completing the collaboration procedure of the eye tracker. If the participant told the experimenter that he or she had adequately read the e-magazine, the former turned to the next page and the experiment was completed after nine pages had been read. After the experiment, a fee of 3,000 won was paid to each participant.

### 4 Result and Analysis of Research

#### 4.1 Analysis of Visual Attention Statistics on AOI

In this study, AOI was set up mainly on the Image Region and Text Region from pages 1-9 while performing t-test between the experiment and control groups on Time to First, Total Fixation Duration, Fixation Count and Total Visit Duration.

##### Cover (Page 1)



Table 2 T-test Results between Groups on Cover (Page 1)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	0.47	0.67	-0.94	28	.36
		Control	0.81	1.27			
	Total Fixation Duration	Experiment	5.41	3.12	1.67	28	.11
		Control	3.71	2.43			
	Fixation Count	Experiment	15.53	7.97	1.52	28	.14
		Control	11.13	7.85			
	Total Visit Duration	Experiment	5.84	3.28	1.99	28	.06*
		Control	3.52	3.11			

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
TEXT_1 Region	Time to First Fixation	Experiment	0.99	2.89	.87	28	.39
		Control	0.33	0.53			
	Total Fixation Duration	Experiment	2.37	2.46	-2.65	28	.01***
		Control	4.88	2.72			
	Fixation Count	Experiment	8.47	8.25	-2.17	28	.04**
		Control	14.87	7.93			
Total Visit Duration	Experiment	2.47	2.52	-2.60	28	.01***	
	Control	5.16	3.13				
TEXT_2 Region	Time to First Fixation	Experiment	4.57	1.59	.38	19.24	.71
		Control	4.19	3.61			
	Total Fixation Duration	Experiment	4.83	3.71	.33	28	.74
		Control	4.38	3.68			
	Fixation Count	Experiment	13.53	12.06	1.86	17.38	.08*
		Control	7.40	4.22			
	Total Visit Duration	Experiment	5.09	3.86	-2.5	28	.81
		Control	5.42	3.54			

\*p<.1, \*\*p<.05, \*\*\*p<.01

On the cover (Page 1), the top title Region (TEXT\_1), center cover photo Region (IMAGE) and bottom article introduction Region (TEXT\_2) were set up as AOI to perform a t-test between groups. As a result, significant differences were shown in the Total Visit Duration of IMAGE Region (t=1.99, p<.1), Total Fixation Duration(t=-2.65, p<.01)/Fixation Count(t=-2.17, p<.05)/Total Visit Duration of TEXT\_2 Region (t=-2.60, p<.01) and Fixation Count of TEXT\_2 Region(t=1.86, p<.1).

Contents (Page 2)

Table 3 T-test Results between Groups in Table of Contents (Page 2)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	2.58	3.71	-1.10	18.05	0.28
		Control	5.53	9.65			
	Total Fixation Duration	Experiment	6.81	7.30	1.43	23.66	0.16
		Control	3.61	4.62			
	Fixation Count	Experiment	12.93	15.93	0.65	28	0.52
		Control	9.60	12.00			
Total Visit Duration	Experiment	7.35	8.34	1.30	28	0.20	
	Control	4.04	5.30				
TEXT Region	Time to First Fixation	Experiment	.05	.10	-1.17	14.98	0.26
		Control	.20	.51			
	Total Fixation Duration	Experiment	6.81	7.30	-1.25	18.18	0.23
		Control	3.61	4.62			
	Fixation Count	Experiment	8.39	3.44	1.50	24.93	0.15
		Control	11.44	8.81			
	Total Visit Duration	Experiment	12.93	15.93	-1.24	17.79	0.23
		Control	9.60	12.00			

\*p<.1, \*\*p<.05, \*\*\*p<.01

In the table of contents (Page 2), the right image Region (IMAGE) and left contents Region (TEXT) were set up as AOI to perform analysis. As a result, no significant difference was shown between both regions.

Editor's Greetings (Page 3)



**Table 4** T-test Results between Groups in Editor’s Greetings (Page 3)

AOI Region	Eye Tracking Index Value	Group	Average	Standard Deviation	t	df	sig
TEXT_1 Region	Time to First Fixation	Experiment	1.18	3.62	1.09	28.00	0.29
		Control	.15	.42			
	Total Fixation Duration	Experiment	5.66	3.82	-0.70	28.00	0.49
		Control	7.07	6.79			
	Fixation Count	Experiment	17.00	10.32	0.51	28.00	0.61
		Control	14.47	16.07			
	Total Visit Duration	Experiment	6.04	3.94	-0.71	28.00	0.48
		Control	7.55	7.22			
TEXT_2 Region	Time to First Fixation	Experiment	2.83	2.48	-1.66	18.26	0.11
		Control	5.73	6.29			
	Total Fixation Duration	Experiment	1.07	1.01	-2.54	18.23	0.02**
		Control	2.88	2.57			
	Fixation Count	Experiment	3.53	3.04	-1.23	28.00	0.23
		Control	6.27	8.03			
	Total Visit Duration	Experiment	1.13	1.08	-2.47	18.17	0.02**
		Control	3.02	2.76			
IMAGE_1 Region	Time to First Fixation	Experiment	4.93	4.63	2.99	22.51	0.01***
		Control	.79	2.70			
	Total Fixation Duration	Experiment	3.72	2.86	3.21	28.00	0.00***
		Control	.64	2.36			
	Fixation Count	Experiment	11.40	7.89	4.11	24.10	0.00***
		Control	1.40	5.15			
	Total Visit Duration	Experiment	3.88	2.90	3.35	28.00	0.00***
		Control	.64	2.36			
TEXT_3 Region	Time to First Fixation	Experiment	10.72	9.17	1.97	28.00	0.06*
		Control	5.03	6.42			
	Total Fixation Duration	Experiment	1.05	1.12	0.64	28.00	0.53
		Control	.80	1.03			
	Fixation Count	Experiment	2.67	2.38	1.53	28.00	0.14
		Control	1.53	1.60			
	Total Visit Duration	Experiment	1.07	1.14	3.35	28.00	0.00***
		Control	.85	1.09			
IMAGE_2 Region	Time to First Fixation	Experiment	10.88	8.79	0.65	28.00	0.52
		Control	8.32	12.33			
	Total Fixation Duration	Experiment	2.09	2.57	-0.35	28.00	0.73
		Control	2.85	7.89			
	Fixation Count	Experiment	5.80	5.80	0.35	28.00	0.73
		Control	4.73	10.48			
	Total Visit Duration	Experiment	2.15	2.62	-0.41	28.00	0.68
		Control	3.12	8.77			
TEXT_4 Region	Time to First Fixation	Experiment	1.25	3.31	-3.38	18.33	0.00***
		Control	9.05	8.32			
	Total Fixation Duration	Experiment	.36	.97	-2.74	20.82	0.01***
		Control	1.87	1.91			
	Fixation Count	Experiment	.67	2.09	-2.53	22.88	0.02**
		Control	3.33	3.50			
	Total Visit Duration	Experiment	.37	1.03	-2.72	20.17	0.01***
		Control	2.03	2.13			

\*p< .1, \*\*p< .05, \*\*\*p< .01

In the editor’s greetings (Page 3), four test regions -- (TEXT\_1, TEXT\_2, TEXT\_3 and TEXT\_4) -- and two image regions -- IMAGE\_1 and IMAGE\_2 -- were set up as AOI to perform analysis. According to the results, while significant differences between groups were not discovered in TEXT\_1 Region, Total Fixation Duration (t=-2.54, p<.05)/Total Visit Duration(t=-2.47, p<.05) of TEXT\_2 Region, Time to First Fixation(t=1.97, p<.1)/Total Visit Duration(t=3.35, p<.01) of TEXT\_3 Region and Time to First Fixation(t=-3.38, p<.01)/Total Fixation Duration(t=-2.74, p<.01)/ Fixation Count(t=-2.53, p<.05)/Total Visit Duration(t=-2.72, p<.01) of TEXT\_4 Region had significant differences. In the image region, while significant differences were discovered in Time to First Fixation(t=2.99, p<.01)/Total Fixation Duration(t=3.21, p<.01)/Fixation Count(t=4.11, p<.01)/Total Visit Duration(t=3.35, p<.01) of IMAGE\_1, none were discovered in IMAGE\_2.

**Advertisement (Page 4)**

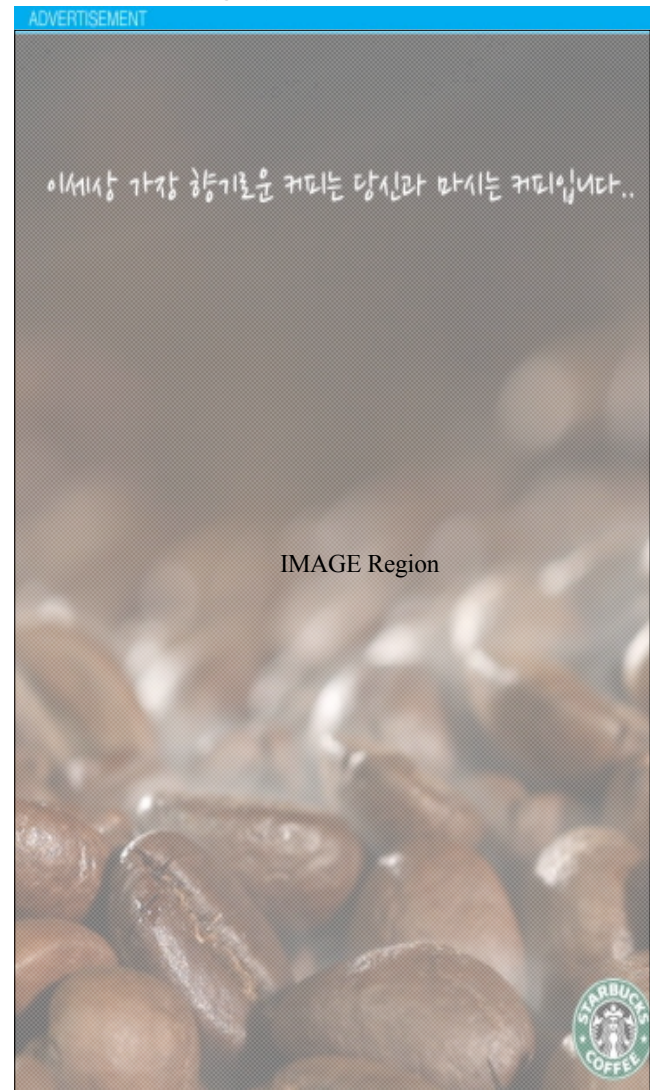


IMAGE Region

**Table 5** T-test Results between Groups in Advertisement (Page 4)

AOI Region	Eye Tracking Index Value	Group	Average	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	.01	.05	-1.12	28.00	.91
		Control	.02	.04			
	Total Fixation Duration	Experiment	4.92	3.48	1.46	21.46	.16
		Control	3.43	1.87			
	Fixation Count	Experiment	17.80	9.98	1.23	28.00	.23
		Control	13.67	8.31			
Total Visit Duration	Experiment	5.93	3.22	1.77	28.00	.09*	
	Control	4.12	2.28				

\*p<.1, \*\*p<.05, \*\*\*p<.01

In advertisement (Page 4), one advertisement display Region (IMAGE) was set as AOI to perform analysis. As a result, significant differences were shown in Total Visit Duration(t=1.77, p<.1) of the IMAGE Region.

**Special Edition (Page 5)**

In the special edition (Page 5), analysis was performed by setting the top article image Region (IMAGE) and bottom article Region (TEXT) as AOI to perform analysis. As a result, significant differences were shown in Total Fixation

**Table 6** T-test Results between Groups in Special Edition (Page 5)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	1.17	2.61	-0.66	28.00	0.52
		Control	2.39	6.71			
	Total Fixation Duration	Experiment	2.44	1.87	2.30	19.45	0.03**
		Control	1.22	0.84			
	Fixation Count	Experiment	6.20	5.05	0.90	28.00	0.38
		Control	4.87	2.77			
Total Visit Duration	Experiment	2.77	1.99	2.41	20.24	0.03**	
	Control	1.39	0.97				
TEXT Region	Time to First Fixation	Experiment	1.29	2.15	-0.01	28.00	0.99
		Control	1.30	2.15			
	Total Fixation Duration	Experiment	11.43	4.70	-0.67	20.19	0.51
		Control	13.31	9.73			
	Fixation Count	Experiment	33.47	10.08	1.12	28.00	0.27
		Control	26.53	21.70			
Total Visit Duration	Experiment	12.17	4.37	-1.00	19.25	0.33	
	Control	14.96	9.90				

\*p<.1, \*\*p<.05, \*\*\*p<.01

Duration(t=2.30, p<.05) and Total Visit Duration(t=2.41, p<.05) of IMAGE Region but none in the TEXT Region.

**Restaurant/Food Coverage (Page 6)**



**Table 7** T-test Results between Groups in Restaurant/Food Coverage (Page 6)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
TEXT_1 Region	Time to First Fixation	Experiment	2.27	5.03	-.950	28.00	0.35
		Control	0.94	2.06			
	Total Fixation Duration	Experiment	0.31	0.62	-4.823	15.46	0.00***
		Control	3.75	2.69			
	Fixation Count	Experiment	1.47	2.39	-2.592	14.60	0.02**
		Control	12.53	16.36			
	Total Visit Duration	Experiment	0.33	0.63	-5.214	15.47	0.00***
		Control	4.10	2.73			
IMAGE Region	Time to First Fixation	Experiment	1.22	2.08	-.613	28.00	0.54
		Control	1.94	4.08			
	Total Fixation Duration	Experiment	3.74	1.83	2.327	28.00	0.03**
		Control	1.21	3.79			
	Fixation Count	Experiment	14.07	5.76	3.537	28.00	0.00***
		Control	3.13	10.49			
	Total Visit Duration	Experiment	4.24	1.80	2.361	28.00	0.03**
		Control	1.37	4.35			
TEXT_2 Region	Time to First Fixation	Experiment	6.07	3.44	3.674	28.00	0.00***
		Control	1.24	3.76			
	Total Fixation Duration	Experiment	2.82	2.77	2.550	24.22	0.02***
		Control	0.64	1.82			
	Fixation Count	Experiment	7.53	5.29	3.109	28.00	0.00***
		Control	1.87	4.67			
	Total Visit Duration	Experiment	2.91	2.77	2.639	24.27	0.01***
		Control	0.65	1.83			
TEXT_3 Region	Time to First Fixation	Experiment	5.99	7.36	1.111	28.00	0.28
		Control	3.16	6.57			
	Total Fixation Duration	Experiment	0.55	1.11	-.527	28.00	0.60
		Control	0.37	0.67			
	Fixation Count	Experiment	1.87	3.64	1.300	28.00	0.20
		Control	0.60	0.99			
	Total Visit Duration	Experiment	0.55	1.11	.465	28.00	0.65
		Control	0.39	0.73			
TEXT_4 Region	Time to First Fixation	Experiment	1.53	3.17	-3.454	28.00	0.00***
		Control	6.22	4.19			
	Total Fixation Duration	Experiment	0.50	0.89	-2.981	14.88	0.01***
		Control	4.44	5.03			
	Fixation Count	Experiment	0.93	1.33	-2.850	14.52	0.01***
		Control	8.20	9.78			
	Total Visit Duration	Experiment	0.54	0.89	-3.027	14.78	0.01***
		Control	4.77	5.34			
TEXT_5 Region	Time to First Fixation	Experiment	4.24	4.50	-.064	28.00	0.95
		Control	4.43	10.83			
	Total Fixation Duration	Experiment	0.40	0.55	.035	28.00	0.97
		Control	0.39	0.79			
	Fixation Count	Experiment	0.87	0.92	.714	28.00	0.48
		Control	0.60	1.12			
	Total Visit Duration	Experiment	0.40	0.55	.035	25.03	0.97
		Control	0.39	0.79			

\*p< .1, \*\*p< .05, \*\*\*p< .01

In restaurant/food coverage (Page 6), five Text Regions -- TEXT\_1, TEXT\_2, TEXT\_3, TEXT\_4 and TEXT\_5 -- and one Image Region, IMAGE, were set up as AOI to perform analysis. As a result, significant differences were shown in Total Fixation Duration( $t=-4.82, p<.01$ )/Fixation Count( $t=-2.59, p<.05$ )/Total Visit Duration( $t=-5.21, p<.01$ ) of TEXT\_1 Region, Time to First Fixation( $t=3.67, p<.01$ ), Total Fixation Duration( $t=2.56, p<.05$ ), Fixation Count( $t=3.11, p<.01$ ), Total Visit Duration( $t=2.64, p<.01$ ) of TEXT\_2 Region and Time to First Fixation ( $t=-3.45, p<.01$ ), Total Fixation Duration ( $t=-2.981, p<.01$ ), Fixation Count ( $t=-2.85, p<.01$ ), Total Visit Duration( $t=-3.03, p<.01$ ) of TEXT\_4 Region with the exclusion of TEXT\_3 and TEXT\_5.

**Introduction of Restaurant (Page 7)**



**Table 8** T-test Results between Groups in Introduction of Restaurant (Page 7)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
IMAGE_1 Region	Time to First Fixation	Experiment	.23	.34	.57	28.00	.58
		Control	.15	.48			

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
	Total Fixation Duration	Experiment	3.57	2.01	-1.03	28.00	.31
		Control	4.43	2.53			
	Fixation Count	Experiment	9.00	5.22	-.05	28.00	.96
		Control	9.13	8.75			
	Total Visit Duration	Experiment	4.21	2.56	-.83	28.00	.41
		Control	4.99	2.60			
IMAGE_2 Region	Time to First Fixation	Experiment	4.18	2.99	-.83	28.00	.41
		Control	5.21	3.83			
	Total Fixation Duration	Experiment	4.27	2.10	.03	22.25	.98
		Control	4.24	3.68			
	Fixation Count	Experiment	10.40	5.37	2.42	28.00	.02***
		Control	5.80	5.03			
	Total Visit Duration	Experiment	4.84	2.40	.32	23.22	.75
		Control	4.46	3.92			
TEXT_1 Region	Time to First Fixation	Experiment	.40	1.09	-.63	28.00	.54
		Control	.93	3.10			
	Total Fixation Duration	Experiment	.97	2.29	.57	28.00	.57
		Control	.55	1.71			
	Fixation Count	Experiment	2.00	3.38	1.08	28.00	.29
		Control	.87	2.23			
Total Visit Duration	Experiment	1.02	2.36	.63	28.00	.54	
	Control	.55	1.71				
TEXT_2 Region	Time to First Fixation	Experiment	.00	.00	-2.34	14.00	.03***
		Control	1.30	2.16			
	Total Fixation Duration	Experiment	.00	.00	-1.78	14.00	.10*
		Control	1.26	2.74			
	Fixation Count	Experiment	.00	.00	-1.61	14.00	.13
		Control	2.27	5.46			
Total Visit Duration	Experiment	.00	.00	-1.76	14.00	.10*	
	Control	1.29	2.83				

\*p<.1, \*\*p<.05, \*\*\*p<.01

In the introduction of restaurant (Page 7), two Image Regions -- IMAGE\_1 and IMAGE\_2 -- and two Text Regions -- TEXT\_1 and TEXT\_2 -- have been set up as AOI to perform analysis. As a result, no significant differences were shown in IMAGE\_1 and TEXT\_1 regions but significant differences were shown in Fixation Count (t=2.42, p<.05) of IMAGE\_2 and Time to First Fixation (t=-2.34, p<.05)/Total Fixation Duration (t=-1.78, p<.1)/Total Visit Duration (t=-1.76, p<.1) of TEXT\_2.

Introduction of Cooking (Page 8)

The image shows a page titled 'COOKING TIME' with a recipe for '안심스테이크' (Steak). It includes several photographs: a person cutting mushrooms, mushrooms being sautéed in a pan, a pan with a sauce, and a finished steak on a plate. There are two text regions: 'TEXT Region' containing the recipe instructions and ingredients, and 'IMAGE Region' showing a close-up of the steak.

Table 9 T-test Results between Groups in Introduction of Cooking (Page 8)

AOI Region	Eye Tracking Index Value	Group	Average	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	3.59	3.49	3.04	16.36	.01***
		Control	0.73	1.02			
	Total Fixation Duration	Experiment	1.60	1.21	-3.29	14.78	.01***
		Control	7.85	7.26			
	Fixation Count	Experiment	4.53	4.79	-1.76	28.00	.09*
		Control	15.20	22.96			
Total Visit Duration	Experiment	1.97	1.49	-3.11	15.01	.01***	
	Control	8.40	7.86				
TEXT Region	Time to First Fixation	Experiment	0.60	1.24	-2.26	14.43	.04**
		Control	6.53	10.07			
	Total Fixation Duration	Experiment	5.76	4.69	2.78	28.00	.01***
		Control	1.37	3.93			
	Fixation Count	Experiment	12.31	9.21	2.55	28.00	.02**
		Control	3.40	9.88			
Total Visit Duration	Experiment	5.67	5.09	2.39	28.00	.02**	
	Control	1.50	4.43				

\*p<.1, \*\*p<.05, \*\*\*p<.01



In the introduction of cooking (Page 8), the bottom article image Region (IMAGE) and the top article Region (TEXT) were set up as AOI to perform analysis. As a result, significant differences were shown in all four regions: Time to First Fixation ( $t=3.04, p<.01$ )/Total Fixation Duration ( $t=-3.29, p<.01$ )/Fixation Count ( $t=-1.76, p<.1$ )/Total Visit Duration ( $t=-3.11, p<.01$ ) of IMAGE Region and all four regions of Time to First Fixation( $t=-2.26, p<.05$ )/Total Fixation Duration( $t=2.78, p<.01$ )/Fixation Count( $t=2.55, p<.05$ ) and Total Visit Duration( $t=2.39, p<.05$ ) of the TEXT region.

**Rising Issue (Page 9)**



**Table 10** T-test Results between Groups in Rising Issue (Page 9)

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
IMAGE Region	Time to First Fixation	Experiment	1.62	4.03	-1.04	20.32	0.31
		Control	4.10	8.26			
	Total Fixation Duration	Experiment	3.05	2.61	2.09	21.02	0.05**
		Control	1.46	1.36			
	Fixation Count	Experiment	8.73	6.47	1.15	28.00	0.26
		Control	6.00	6.56			

AOI Region	Eye Tracking Index Value	Group	Avg.	Standard Deviation	t	df	sig
	Total Visit Duration	Experiment	3.34	2.71	2.16	20.74	0.04**
		Control	1.65	1.37			
TEXT Region	Time to First Fixation	Experiment	0.49	1.15	-0.17	28.00	0.87
		Control	0.55	0.73			
	Total Fixation Duration	Experiment	9.05	6.31	-1.38	28.00	0.18
		Control	13.36	10.31			
	Fixation Count	Experiment	23.53	12.92	0.27	28.00	0.79
		Control	22.13	15.50			
Total Visit Duration	Experiment	10.04	6.20	-1.38	21.58	0.18	
	Control	14.66	11.44				

\* $p<.1$ , \*\* $p<.05$ , \*\*\* $p<.01$

In rising issue (Page 9), the top article image Region (IMAGE) and bottom article Region (TEXT) were set up as AOI to perform analysis. As a result, significant differences were shown in Total Fixation Duration ( $t=2.09, p<.05$ ) and Total Visit Duration ( $t=2.16, p<.05$ ) of the IMAGE region but none in the TEXT Region.

**4.2 Result of Statistics Analysis per Type of Eye Tracking Index Value**

**Table 11** Verification of Difference between Groups per Type of Eye Tracking Index Value

Category	Classification Group	Avg.	Standard Deviation	df	t	sig	
Time to First Fixation	IMAGE Region	Experiment	2.31	3.84	-3.8	268.00	.70
		Control	2.53	5.58			
	TEXT Region	Experiment	1.49	2.11	-1.80	194.19	.07*
		Control	2.24	4.34			
Total Fixation Duration	IMAGE Region	Experiment	3.87	3.55	1.47	268.00	.14
		Control	3.18	4.11			
	TEXT Region	Experiment	4.63	5.18	-1.17	234.36	.24
		Control	5.57	7.72			
Fixation Count	IMAGE Region	Experiment	10.90	8.88	2.17	268.00	.03**
		Control	8.24	11.16			
	TEXT Region	Experiment	12.78	13.56	1.34	268.00	.18
		Control	10.53	14.01			
Total Visit Duration	IMAGE Region	Experiment	4.33	3.85	1.71	268.00	.09*
		Control	3.46	4.54			
	TEXT Region	Experiment	4.94	5.45	-1.39	229.33	.17
		Control	6.14	8.43			

\* $p<.1$ , \*\* $p<.05$ , \*\*\* $p<.01$

As a result of examining the differences between groups according to eye tracking types, the following were studied. First, the TEXT region of Time to First Fixation had a shorter time in the experiment group than in the control group and showed significant differences ( $t=194.19$ ,  $p<.1$ ) to support the first hypothesis. Second, no significant differences between both groups were discovered in Total Fixation Duration, invalidating the second hypothesis. Third, as Fixation Count was investigated as having significant differences in IMAGE Region ( $t=268$ ,  $p<.05$ ), the third hypothesis was supported. Fourth, since significant differences were also discovered in the IMAGE region of Total Visit Duration ( $t=229.33$ ,  $p<.1$ ), the fourth hypothesis was also supported.

## 5 Discussion and Results

In this study, a comparative analysis was performed on the visual attention of people between the e-magazine produced as a cinemagraph image and the other produced as a regular image. To make this possible, an e-magazine type sample was prepared to set up the AOI by mainly classifying image and text regions by changing the layout of e-magazines spanning nine pages.

As a result of the analysis, differences were seen according to the e-magazine's layout type, but the experiment group ( $M=1.49$ ,  $SD=4.34$ ) was found to have a shorter mean value of 0.74 second than the control group ( $M=2.24$ ,  $SD=4.34$ ) in the TEXT region on the Time to First Fixation part. So the text on the details related to a cinemagraph image that would have applied the latter could be said to be recognized earlier than the control group. Second, Total Fixation Duration was found to have no significant difference between the experiment and control groups. So the subjects of both groups could verify no difference in overall observation time when the e-magazine applying the cinemagraph image was compared with the one without the image in the region and text regions. Third, in the image region of Fixation Count, the experiment ( $M=10.90$ ,  $SD=8.88$ ) and control groups ( $M=8.24$ ,  $SD=11.16$ ) had an average difference of 2.66 times. This meant more people read the e-magazine with the cinemagraph image than the one with a regular image. Fourth, significant differences were discovered in the image region in case of Total Visit Duration, while the experiment ( $M=4.33$ ,  $SD=3.85$ ) and control groups ( $M=3.46$ ,  $SD=4.54$ ) had visits to the cinemagraph image AOI 0.87 second more on average. In other words, this meant people's eyes went more to the image region produced as a

cinemagraph image than the one produced as a regular image. The result of analysis of various layout types from pages 1-9 of the e-magazine also showed similar aspects as above. As the study results could be interpreted as showing people's tendency to discover text on an article image first on the e-magazine produced as a cinemagraph image than the one produced as a regular image and to read the cinemagraph image more frequently and longer, it could also mean the e-magazine produced as a cinemagraph image can make readers focus on images and text. Also, since the e-magazine produced as a cinemagraph image was found to evoke emotions such as love, cheerfulness, sense of refreshment or activity, attractiveness, powerfulness, satisfaction, pleasure, interest, excitement, vigor, humor or surprise[3] the e-magazine produced as a cinemagraph image can deliver positive effects such as creating emotional reactions for readers to keep their eyes on the article's photographs and text. And as eyes move faster on the article than on the e-magazine with the regular image if a cinemagraph image is applied, this means the cinemagraph image also has a direct effect on the article. This research found that the cinemagraph image can be applied in various fields in addition to e-magazines, so this study can be considered practical. The research also prepared a theoretical foundation for visual attention research on cinemagraphs. In future research, cinemagraph images can be applied to news article websites of the webzine type that are not e-magazine type to extend research on what impact cinemagraph images have on interaction with content, such as sense of immersion or level of understanding of the article. So the research should be performed as cinemagraph images is more widely applied.

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