

# INFLUENCES OF STRAIGHT LINE EXPRESSION ELEMENTS IN ABSTRACT PAINTINGS ON IMPRESSION EVALUATION AND EYE MOVEMENT

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## ABSTRACT

This paper has the purpose to inspect differences regarding impression evaluation and eye movement by comparing straight line expression elements in abstract paintings. Malewitsch's paintings which emphasize oblique lines and inclined rectangles elicited impression evaluations such as "hard", "irritable", "dynamic" and "exciting". Mondrian's paintings which emphasize vertical line and horizontal line elicited impression evaluations such as "cheerful" and "light". Paintings which emphasize oblique lines and inclined rectangles elicited high frequency of long gaze. Paintings which emphasize vertical line and horizontal line elicited fast mean gazing speed. Paintings which do not emphasize boundaries elicited slow mean gazing speed. From this study result, it was indicated that vertical, horizontal, and oblique lines in abstract paintings were influencing factors for impression evaluation and eye movement. This study is inspection of common impression and perception caused by looking at paintings.

*Keywords: Straight Line Expression Elements, Impression Evaluation, Eye Movement*

## 1. INTRODUCTION

Studies on visual information processing and mechanisms involved in appreciation of paintings have revealed that the low-order neurophysiological reactions within the visual cortex of the brain while viewing paintings are common to all people [1-3]. Many neurons (orientation-selective cells) in the primary visual cortical areas V1, V2 and V3 were found to be activated when people look at abstract paintings that emphasize lines, such as those of Mondrian, Malewitsch, and Newman. Perception experiments have also shown that vertical and horizontal lines are easiest to detect among lines of all orientations. Although various investigations have been made based on the study by S. Zeki on the reactions of the brain while people enjoy paintings [4-7], no study has been performed on the relationship between the brain reactions and the straight line expression elements in the abstract paintings. Investigating the relationship between the impression evaluation and eye movement of people when they enjoy abstract paintings that emphasize straight line expression should give us a clue for understanding the relationships between straight line expression elements and human psychological and physiological reactions.

Factors of viewing paintings have been extracted by psychological studies on painting appreciation [8-10]. All paintings have shown to have psychological relaxing effect irrespective of impression and taste [11]. In studies on impression evaluation of abstract paintings, components (straight lines, shapes and colors) of the paintings affected the impression evaluation of viewers [12-13].

In studies on eye movement, eye movement recorders have been used to quantify information on eye movement, enabling the use in various application fields. People have been found to view a painting by scanning the entire painting by making quick gaze on scattered points and then staring long at specific points to collect specific information [14]. In an experiment that monitored the points of gaze, the frequency and duration of gaze were large at conspicuous points, and the points of gaze were dispersed on abstract paintings [15]. Eye movement has also been found to vary depending on the style of painting [16]. Monitored points of gaze were in conformity with the parts that attracted the interest and attention of the viewer, which were mentioned after the monitoring experiment [17].

These investigations have suggested that common mechanisms of enjoying paintings, which is a subjective act, can be investigated by understanding the characteristics of eye movement. Sensitivity, which is inborn [18], can also be investigated by clarifying the relationship between the reactions of primary visual cortical areas to stimuli, which are common to all people, and impression evaluation. This study provides grounds that would lead to the understanding of the effects of emphasize straight line expressions in abstract paintings on impression evaluation and eye movement of viewers.

## **2. OBJECTIVES OF THE STUDY**

This study investigates the effects of straight line expression elements in abstract paintings on impression evaluation and eye movement of viewers. Evaluation components of abstract paintings of different straight line expressions were extracted by principal component analysis, and trends in impression evaluation were analyzed by cluster analysis. Differences in impression evaluation by differences in straight line expression were also investigated for each evaluation item by analysis of variance. It also comparatively investigated the differences in gaze and eye movement speed caused by differences in straight line expression by collecting gaze information using an eye movement recorder.

## **3. INVESTIGATING IMPRESSION EVALUATION OF ABSTRACT PAINTINGS**

### **3.1. EXPERIMENTAL METHODS**

#### **Dates, Place, and Subjects**

The experiment was conducted on 9 days during July 29 to September 17, 2008. The experiment was conducted at Laboratory B239 of the Building of the School of Art and Design, University of Tsukuba. The space was about 25 m<sup>2</sup>, calm and dark without natural light and had no light source except for the projector that projected experimental pictures on a screen installed on a white wall. Subjects were 30 university students (male: 12, female: 18) between the ages of 20 and 43.

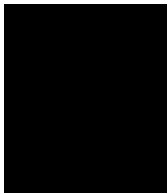
#### **Investigation methods**

Images of paintings were projected on the screen, and viewers were asked to fill the answer sheets on impression evaluation of each experimental image. The experimental images were displayed in a random order, which were decided by considering the order effect. An image that canceled previous visual stimuli was projected for 10 sec between images (Stimuli were canceled by looking at the center of a gray image). The first experimental image was a preparatory stimulating image. Subjects viewed the images 4 m from

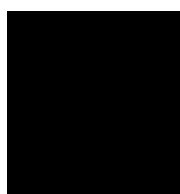
the front of the screen, on which the images were projected. It took 25 to 40 min for each subject for complete the experiment.

### Paintings used as experimental samples

Nine abstract paintings, which were grouped by straight line expression, were used: 3 Piet Mondrian's paintings, in which vertical and horizontal lines are emphasized (Figs. 1 to 3), 3 Kasimir Malewitsch's paintings, in which oblique lines and inclined rectangles are emphasized (Figs. 4 to 6), and 3 Mark Rothko's paintings, in which boundaries are not emphasized (Figs. 7 to 9). The images of the paintings were scanned from pictorials at a resolution of 350 pixel and were projected so as to be 1450 to 1400 mm the longer side and 850 to 1380 mm the shorter side. The dimensions of the entire image were 1500 mm high and 2000 mm wide, and the painting images were projected 900 mm above the floor. The size of the painting images and the entire image and the positions of subjects were decided by conducting preliminary experiments so that all subjects could view the entire image easily.



**Figure 1:**  
MONDRIAN 1  
「Composition  
No.11; LONDON」  
[19]



**Figure 2:**  
MONDRIAN 2  
「Composition  
with Yellow, Blue,  
and Red」 [20]



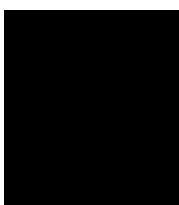
**Figure 3:**  
MONDRIAN 3  
「NEW YORK  
CITY; New York  
City 1」 [21]



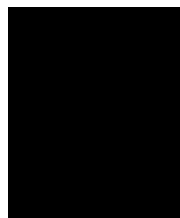
**Figure 4:**  
MALEWITSCH 1  
「Suprematism」  
[22]



**Figure 5:**  
MALEWITSCH 2  
「Suprems No.50」  
[23]



**Figure 6:**  
MALEWITSCH 3  
「Suprematism」  
(Suprems No.58)[24]



**Figure 7:**  
ROTHKO 1  
「Untitled」[25]



**Figure 8:**  
ROTHKO 2  
「Untitled」[26]



**Figure 9:**  
ROTHKO 3  
「Number18」[27]

### Constitution and contents of answer sheets

Nine pairs of adjectives were selected based on studies on psychological evaluation in painting appreciation [4-8, 13]. Viewers were to answer each question in five grades on random scale. The pairs of adjectives were “cheerful - gloomy”, “light - heavy” and “tedious - exciting”, which were potential factors, “mild - hard”, “static - dynamic”, “relaxing - tense” and “lively - tired” which were active factors, and “comfortable - irritable” and “pleasant - unpleasant”, which were evaluation factors.

### 3.2. RESULTS

Of the 9 paired adjectives, 5 points were given to cheerful, light, tedious, mild, static, relaxing, lively, comfortable and pleasant; and 1 point were given to gloomy, heavy, exciting, hard, dynamic, tense, tired, irritable and unpleasant. For each evaluation item, the mean, variance and standard deviation were calculated (Table 1).

To extract components related to impression evaluation of the 9 paintings, principal component analysis was conducted. From the loads and contributions of principal components, which were determined using the varimax rotation method, primary (mild, comfortable, relaxing, static and tedious) and secondary (lively, cheerful, light and pleasant) components were extracted (Table 2). Lower scores of the first principal components meant stronger impression of being mild, comfortable, relaxing, static, and tedious. Higher scores meant stronger impression of being hard, irritable, tense, dynamic and exciting. For the second principal components, lower scores meant stronger impression of being tired, gloomy, heavy and unpleasant; and higher scores correlated to stronger impression of being lively, cheerful, light and pleasant (Fig. 10).

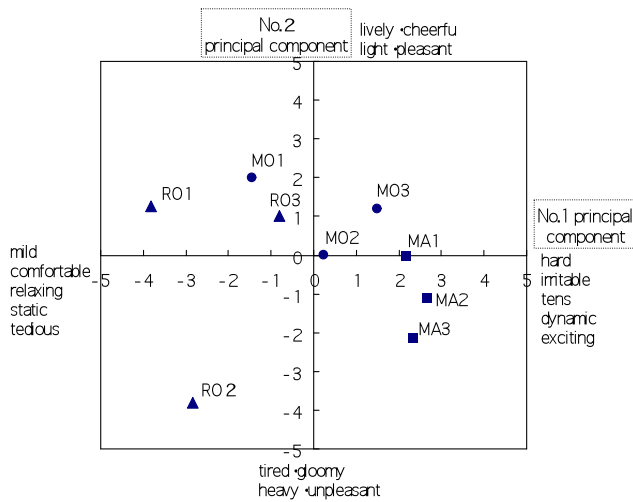
Cluster analysis (Ward method) on the mean scores of each evaluation item of the 9 paintings showed a trend of grouping by painter: Mondrian, Malewitsch and Rothko. Similarity was found in impression evaluation between MONDRIAN 1 and ROTHKO 3. The impression evaluation of ROTHKO 2 was different from the other paintings (Fig. 11).

**Table 1:** Mean, Variance, and Standard deviation

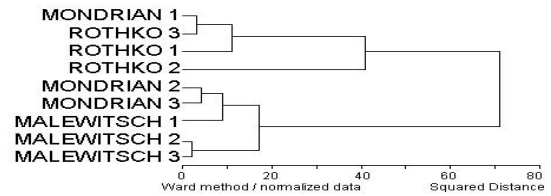
	mean	variance	standard deviation
mild – hard	3.09	0.65	0.80
comfortable – irritable	3.19	0.40	0.63
relaxing – tens	3.02	0.34	0.58
static – dynamic	3.00	1.05	1.02
tedious – exciting	2.59	0.29	0.54
lively – tired	3.11	0.08	0.29
cheerful – gloomy	3.45	0.42	0.65
light – heavy	3.10	0.42	0.65
pleasant – unpleasant	3.43	0.15	0.39

**Table 2:** Principal component analysis

	No.1 principal component	No.2 principal component	contribution ratio
mild	-1.00	-0.01	0.99
comfortable	-0.99	0.07	0.98
relaxing	-0.93	0.00	0.87
static	-0.92	-0.12	0.85
tedious	-0.92	-0.38	0.98
lively	-0.03	0.95	0.90
cheerful	0.26	0.91	0.90
light	0.40	0.88	0.93
pleasant	-0.46	0.87	0.97
sum square of load amount	4.97	3.42	
contribution ratio accumulated	55.19	38.05	
contribution ratio	55.19	93.24	



**Figure 10:** Scatter diagram of scores of the primary components (MONDRIAN 1~3 : ●MO1~3, MALEWITSCH 1~3 : ■MA1~3, ROTHKO 1~3 : ▲RO1~3)



**Figure 11:** Cluster analysis on the mean scores of each evaluation item

The mean evaluation scores of the 9 paintings were compared. On being mild, comfortable and static, the scores of MALEWITSCH 1 to 3 were all lower than those of the other paintings, showing that his paintings gave the strongest impression of being hard, irritable and dynamic. On being relaxing, ROTHKO 1 to 3 were all higher than those of the other paintings, showing they were most relaxing. On being cheerful and light, the score of ROTHKO 2 was particularly low, revealing a strong impression of being gloomy and heavy (Fig. 12, Table 3).

The mean evaluation scores of Mondrian's paintings, Malewitsch's paintings and Rothko's paintings, which were classified by straight line expression, were investigated by analysis of variance. A multiple comparison of major effects between the paintings are shown (Fig. 13). The results were: mild - hard ( $F(2, 87) = 55.48, p < .001$ ), comfortable - irritable ( $F(2, 87) = 34.33, p < .001$ ), relaxing - tense ( $F(2, 87) = 25.07, p < .001$ ), static - dynamic ( $F(2, 87) = 70.13, p < .001$ ), tedious - exciting ( $F(2, 87) = 23.56, p < .001$ ), cheerful - gloomy ( $F(2, 87) = 9.18, p < .001$ ), light - heavy ( $F(2, 87) = 15.67, p < .001$ ), and pleasant - unpleasant ( $F(2, 87) = 4.73, p < .05$ ). There were significant differences in mean evaluation scores except for lively - tired. Rothko's paintings were significantly high in being mild, comfortable, relaxing, static and tedious. Malewitsch's paintings were significantly high in being hard, irritable, dynamic and exciting. Mondrian's paintings were significantly high in being cheerful and light.

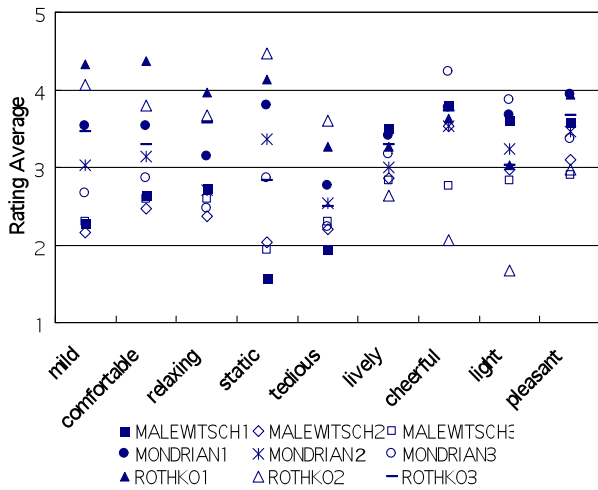


Figure 12: Mean evaluation scores were compared

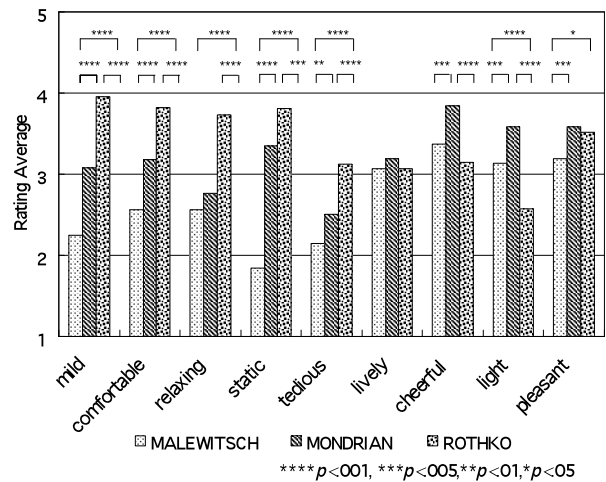


Figure 13: Mean evaluation scores of classified by straight line expression

### 3.3. DISCUSSION

The principal component analysis of the abstract paintings of different straight line expressions (Malewitsch's paintings, which emphasize oblique lines and inclined rectangles, Mondrian's paintings which emphasize vertical and horizontal lines, and Rothko's paintings which do not emphasize boundaries) showed similarity in impression evaluation. The cluster analysis showed a grouping trend in impression evaluation and similarity in impression evaluation of paintings of similar straight line expressions. The similarity in impression evaluation of MONDRIAN 1 and ROTHKO 3 was possibly attributable to MONDRIAN 1 having less vertical and horizontal lines than other Mondrian's paintings and also to ROTHKO 3 having more figurative elements than the other Rothko's paintings. The impression evaluation of ROTHKO 2 was different from the other Rothko's paintings as many viewers mentioned peculiar impression on the colors in the questionnaire survey conducted after filling in the answer sheets, suggesting that the low saturation and brightness affected their impression evaluation.

Malewitsch's paintings were significant high in being hard, irritable, dynamic and exciting. Rothko's paintings were significant high in being mild, comfortable, relaxing, static and tedious. Mondrian's paintings were found to be significantly high in being cheerful and light. From the results, it can be deduced that straight line expression elements, such as vertical, horizontal and oblique lines, give characteristic impression to viewers.

## 4. EYE MOVEMENT ANALYSIS WHILE VIEWING ABSTRACT PAINTINGS

### 4.1. EXPERIMENTAL METHODS

#### Dates, Place, and Subjects

The experiment was conducted on 8 days during April 22 to May 8, 2009. The experiment was conducted at a measuring laboratory in Building D of the University of Tsukuba. Subjects were 16 students and graduates of the University of Tsukuba (male: 4, female 12) between the ages of 20 and 44. All had normal naked vision of at least 0.7.

### **Measuring methods**

Eye movement was measured using a non-contact type monocular eye movement recorder (Free View Desk Top System, Takei Scientific Instruments Co., Ltd.). The system ran on Microsoft Windows 98, and the display had a resolution of 800 × 600 pixels High Color (16 bits) and dimensions of 195 mm and 270 mm. The sampling rate for detecting eye movement was 30 Hz, and gazing was detected with a precision not exceeding 5 deg/sec. The display for presenting stimulus and the eye movement detector were placed on a table, and a chin rest was positioned about 920 mm from the monitor to restrict the movement of the head of subjects and fix the measurement distance. To shield the light from outside, the system was covered by a black box with a window at the position of subjects' eyes. The 9 paintings used in the impression evaluation experiment and a preliminary stimulating image were displaced on the display for presenting stimulus. The stimulating images were displayed 30 second each in a random order, which were decided by considering the order effect. An image that canceled previous visual stimuli was projected for 30 sec between the images.

### **Data processing**

From the eye movement data monitored at a sampling rate of 30 Hz, those of X and Y angles of 15 deg or larger, those during blinking and those of 100 msec after blinking were excluded. When 50% or more data were excluded for a single stimulating image, all measurement data of the image were excluded from the analysis.

## **4.2. RESULTS**

Eye movement while viewing the nine stimulating paintings was investigated regarding the mean gazing speed (deg/sec), mean duration of gaze (msec), and frequency of gazing (points/sec). In this study, the mean gazing speed is the mean in 1 second made by the subjects during 1 second of the effective measuring time. The mean duration of gaze is the mean of gazes (of at least 33.3 msec detected at 5 deg/sec or less) made by the subjects during the effective measuring time. The frequency of gazing is the number of points gazed in 1 second and was calculated by dividing the number of points gazed during the effective measuring time by the effective measuring time. The mean gazing speed was the fastest in MONDRIAN 1 and was the slowest in ROTHKO 2. The mean duration of gaze was the longest in MALEWITSCH 3 and was the shortest in MONDRIAN 3. The frequency of gazing was the largest in ROTHKO 2 and was the lowest in MALEWITSCH 1 (Table 4).

The coefficients of correlation were calculated among the mean gazing speed, mean duration of gaze and frequency of gazing, which showed high correlation (Table 5).

**Table 4:** Mean gazing speed, Mean duration of gaze, Frequency of gazing

	mean gazing speed (deg/sec)	mean duration of gaze(msec)	frequency of gazing (points/sec)
MONDRIAN 1	20.57	9.97	6.98
MONDRIAN 2	18.46	10.08	7.24
MONDRIAN 3	19.83	9.96	7.05
MALEWITSCH 1	18.72	10.22	6.94
MALEWITSCH 2	16.97	10.73	7.41
MALEWITSCH 3	16.77	11.24	7.41
ROTHKO 1	17.72	10.04	7.17
ROTHKO 2	15.89	11.10	7.84
ROTHKO 3	16.96	10.29	7.28

**Table 5:** Coefficients of correlation table

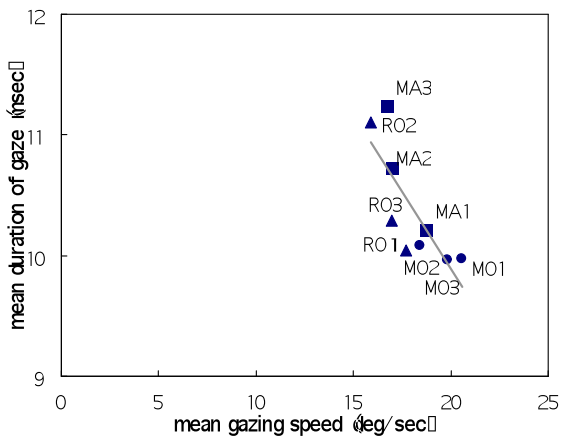
mean gazing speed (deg/sec)	1		
mean duration of gaze (msec)	-0.79	1	
frequency of gazing (points/sec)	-0.85	0.81	1
	mean gazing speed	mean duration of gaze	frequency of gazing

The mean gazing speed, mean duration of gaze, and frequency of gazing were analyzed by multiple regression analysis. The multiple correlation coefficient was 0.85, and the coefficient of determination  $R^2$  of the regression line was 0.73. The square of the multiple correlation coefficient after adjusting the degree of freedom was 0.69. The regression model was confirmed to be significant ( $F(1, 7) = 18.82$ ,  $p < .01$ ) by analysis of variance. At a faster mean gazing speed, the mean duration of gaze was shorter, and the frequency of gazing was lower. The frequency of gazing increased as the mean duration of gaze increased (Figs. 14 to 16).

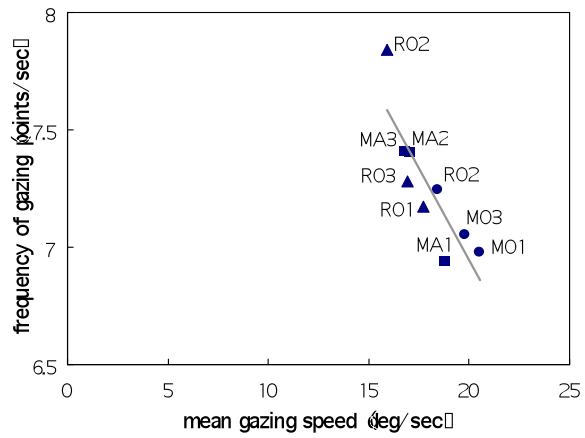
The stimulation of the 9 painting images was compared by determining the order of gazing frequency separately for gazes longer than 100 msec but shorter than 200 msec and those longer than 200 msec (Table 6). Other than ROTHKO 2, which showed the largest frequency of gaze of 100 to 200 msec, the frequency of gaze of 100 to 200 msec was largest in Malewitsch's paintings, followed by Mondrian's and Rothko's, which were classified by straight line expression. The frequency of gaze of 200 msec or longer was the largest in MALEWITSCH 3 and ROTHKO 3. In ROTHKO 3, the frequency of gaze of 200 msec or longer was large compared to the mean duration of gaze and the overall frequency of gazing. ROTHKO 1 showed the smallest frequency of gaze of both 100 to 200 msec and over 200 msec.

The fastest of the mean gazing speed was Mondrian's paintings, followed by Malewitsch's and Rothko's. The mean duration of gaze was the longest in Malewitsch's paintings, followed by Rothko's and Mondrian's (Tables 7 and 8).



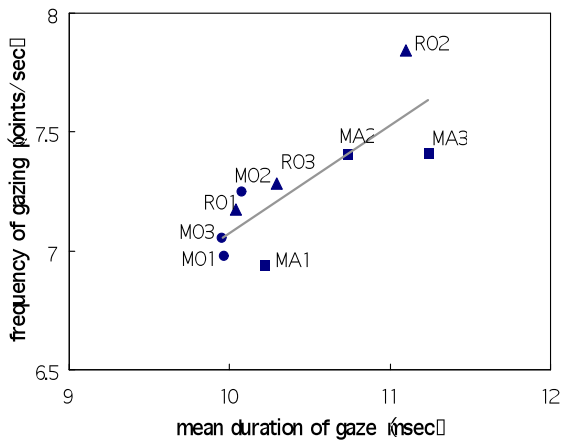


**Figure 14:** Scatter diagram of Mean gazing speed and Mean duration of gaze



**Figure 15:** Scatter diagram of Mean gazing speed and Frequency of gazing

**Table 6:** Ranking of Frequency of gazing



**Figure 16:** Scatter diagram of Mean duration of gaze and Frequency of gazing

frequency of gaze of 100msec to 200msec (points/sec)	frequency of gaze of over 200msec (points/sec)
ROTHKO 2	MALEWITSCH 3 0.10
MALEWITSCH 3	ROTHKO 3 0.10
MALEWITSCH 2	MALEWITSCH 2 0.09
MALEWITSCH 1	MONDRIAN 2 0.08
MONDRIAN 1	MONDRIAN 3 0.08
MONDRIAN 3	MALEWITSCH 1 0.07
MONDRIAN 2	MONDRIAN 1 0.06
ROTHKO 3	ROTHKO 2 0.06
ROTHKO 1	ROTHKO 1 0.05

**Table 7:** Mean gazing speed of classified by straight line expression

	mean gazing speed (deg/sec)
Mondrian's paintings	19.52
Malewitsch's paintings	17.32
Rothko's paintings	16.75

**Table 8:** Mean duration of gaze of classified by straight line expression

	mean duration of gaze (msec)
Malewitsch's paintings	10.94
Rothko's paintings	10.52
Mondrian's paintings	10.07

Gaze moved along colored quadrilateral and vertical and horizontal lines in MONDRIAN 1 and 2 and along vertical and horizontal lines in the entire painting in MONDRIAN 3. Moreover, MONDRIAN 2 was found in interviews after the experiment to have caused Hermann Grid illusion in some subjects. MALEWITSCH 1 and 2 showed a trend of gaze moving on oblique lines and inclined rectangles, which were emphasized with hue and saturation differences. On MALEWITSCH 3, gaze moved on randomly oblique lines and inclined rectangles and stratified rectangles, which were emphasized with differences in brightness and saturation. ROTHKO 1 showed a trend of gaze moving around colored shapes. On

ROTHKO 2, gaze moved throughout the picture dispersedly and around blurs at the boundaries of colored shapes. ROTHKO 3 showed a trend of gaze moving from the center of the image to the figurative blur on the bottom right. In the interview surveys after the experiment, many subjects mentioned that they were attracted to the figurative blur on the bottom right of ROTHKO 3.

### 4.3. DISCUSSION

Eye movement while viewing paintings was monitored. The resultant mean gazing speed, mean duration of gaze, and frequency of gazing were found in multiple regression analysis to be mutually correlated. At faster mean gazing speed, the mean duration of gaze was shorter and the frequency of gazing was smaller.

An analysis of gazing frequency for each duration class showed that the frequency of gaze of 100 to 200 msec was the largest on ROTHKO 2, showing a large frequency of short gazes. This was related to resulting in the largest frequency of gaze on ROTHKO 2. The result was likely attributable to a single hue constituting 2/3 of ROTHKO 2 and the picture having almost no prominent elements, which led to the gaze of the viewers dispersing over a large area of the painting. This estimation was supported by the paths of gaze. MALEWITSCH 3 showed a largest frequency of gaze of over 200 msec, and showed a large frequency of long gaze. This was related to resulting in the longest mean duration of gaze on MALEWITSCH 3. This was likely attributable to MALEWITSCH 3 having many distinctive components with a number of randomly oblique lines and inclined rectangles, which were emphasized with differences in brightness and saturation, stratified rectangles and boundaries curve shapes on the background. Viewers had a trend of staring at the large number of prominent elements long, which was supported by the gaze path analysis. Similarly, ROTHKO 3 showed a largest frequency of gaze of over 200 msec, and showed a large frequency of long gaze. Moreover, the frequency of gaze of over 200 msec was found to be large compared to the mean duration of gaze and the overall frequency of gazing. A possible cause was that ROTHKO 3 contains more figurative elements than other Rothko's paintings and viewers gazed on figurative blur expressions on a part of the painting, as supported by gaze analysis and interviews after the experiment.

In the investigation of paintings classified by straight line expression, Mondrian's paintings, which emphasize vertical and horizontal lines, showed the fastest mean gazing speed. As gaze was detected to have moved along vertical and horizontal lines on the paintings and as perception experiment has shown vertical and horizontal lines are easiest to see, the results of this investigation support the visual guidance effects of vertical and horizontal lines.

## 5. CONCLUSION

Impression evaluations of Malewitsch's paintings, which emphasize oblique lines and inclined rectangles, Mondrian's paintings, which emphasize vertical and horizontal lines, and Rothko's paintings, which do not emphasize boundaries, were similar among those that had similar straight line expression elements.

Eye movement analysis showed that the mean duration of gaze and the frequency of gazing decreased as mean gazing speed increased. Abstract paintings are composed of oblique line and inclined rectangle expressions, which are emphasized with differences in hue, brightness and saturation, induced high frequency of long gaze, suggesting long gaze on prominent elements. Abstract paintings are composed of emphasize vertical and horizontal line expressions elicited fast mean gazing speed and short duration of

gazing, suggesting eyes moved fast along vertical and horizontal lines. Abstract paintings are composed of few elements and do not have emphasize boundaries, clear lines or shapes, the mean gazing speed was slow, suggesting that viewers moved their eyes slowly and scanned over the large area of the painting.

Analysis of eye movement and impression evaluation of abstract paintings classified by straight line expression showed that Malewitsch's paintings, which emphasize oblique lines and inclined rectangles, elicited high frequency of gaze of over 100 msec and impression evaluation of being most hard, irritable, dynamic and exciting. Mondrian's paintings, which emphasize vertical and horizontal lines, elicited the fast mean gazing speed and the short duration of gazing and were evaluated to be most cheerful and light. Rothko's paintings, which do not emphasize boundaries elicited slow in mean gazing speed and were evaluated to be most mild, comfortable, static, relaxing and tedious. The results showed that straight line expressions in abstract paintings affect the impression evaluation and eye movement of viewers.

Elements other than straight line expression, such as colors in ROTHKO 2, affected impression evaluation. Matiere, such as blurs in ROTHKO 3, also affected eye movement. This suggests that mutual interactions of components that constitute paintings cannot be disregarded. However, paintings that are works of art are composed of many components that fuse with each other. Thus, basic studies on characteristic expressions of components, like this study, should contribute to understanding of appreciation of works of art. Effects of components other than straight lines need to be investigated in relation to impression evaluation and physiological reactions.

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20. Figure 2: ditto, P274, 151, Composition with Yellow, Blue, and Red, 1937-1942, Oil on canvas, 82.5x71
21. Figure 3: ditto, P290, 164, New York City; New York City 1, 1941 [first stage] 1941-1942[second stage], Oil on canvas, 119x114
22. Figure 4: Fauchereau S., Malewitsch, Malewitsch's art Publishing Co., Ltd, 43, Suprematism, 1916, Oil on canvas, 88x70, Collection Stedelijk Museum Amsterdam
23. Figure 5: Mondrian and Abstract Paintings, 1995, World Masterpieces 24, Chuokoron, 13, Malewitsch, Suprematism No. 50, 1915, Oil on canvas, 97x66, Collection Stedelijk Museum Amsterdam
24. Figure 6: Fauchereau S., Malewitsch, Malewitsch's art Publishing Co., Ltd, 43, Suprematism (Suprematism No. 58), 1916, Oil on canvas, 79.5x70.5" Collection State Russian Museum
25. Figure 7: Waldman D., Mark Rothko, 1903-1970, A Retrospective New York: H, N, Abrams, 1978, c1964, 112, Untitled, 1953, Oil on canvas, 74x61" Collection Mr. and Mrs. Robert Kardon
26. Figure 8: ditto, 96, Untitled, 1951, Oil on canvas, 93x57" Collection Mr. and Mrs. Gifford Phillips, New York
27. Figure 9: ditto, 77, Number18, 1948-1949, Oil on canvas, 67 1/4x55 7/8" Collection Vassar College Art Gallery, Poughkeepsie, New York, Gift of Mrs. John D. Rockefeller, III