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Ocular Photography as a Scientific Approach to the Study of Art

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OCULAR PHOTOGRAPHY AS A SCIENTIFIC APPROACH TO THE STUDY OF ART

HERMAN F. BRANDT

Regardless of how we look at art we project into the art object the response as expressed by individuals. Whether we judge design or color we evaluate it in the light of our own response to it. Since this is the general procedure in arriving at a decision in judging paintings or statuary we need to make inquiry as to just what behavior is involved in making such a choice.

From the findings of experimental laboratories of artists and psychologists it is apparent that artists as individuals or as a class are attempting to arrive at a criterion for judging the adequacy of artistic creations. Without reviewing the various techniques employed by experts in arriving at a standard for judging art, the author of this paper proposes to evaluate the response to art objects by analyzing the ocular patterns of subjects observing specified designs.

PURPOSE OF THE STUDY

The purpose of this study is an attempt to evaluate by means of Ocular Photography the stimulating effects of designs when presented in pairs to observers. It is further an endeavor to find an answer to such questions as:-

1. *What relative time do subjects spend on cards when selecting one of two designs regardless of their preference?*
2. *What is the relative excursion frequency of subjects when selecting one of two designs?*
3. *What is the ratio of attention time to excursion frequency when subjects observe designs mounted in the vertical or horizontal plane?*
4. *What relative attention time is devoted to preferred and non-preferred designs according to the judgment of the observers?*
5. *What relative attention time do subjects spend when observing cards in the order of sequence?*
6. *What relative attention time is devoted by subjects on designs when their selection agrees or disagrees with the choice of experts?*

Finally this research study is an attempt to ascertain whether correlations can be established between the so called laws of color and composition and eye movements.

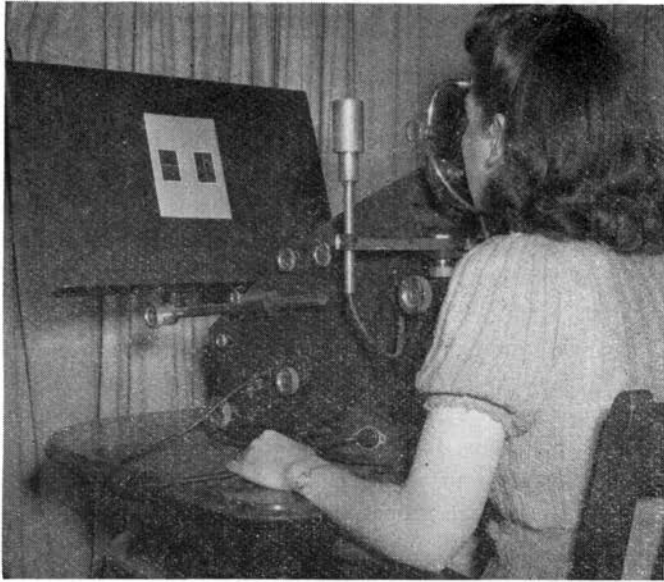


Fig. 1. Portable eye camera and exposure card¹

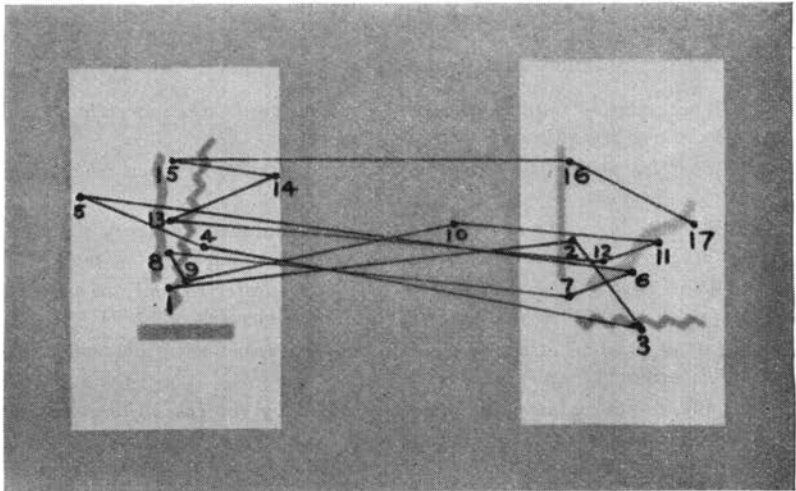


Fig. 2 Ocular pattern of subject 13 observing card #5

1. The eye camera was invented and developed by the author of this study.

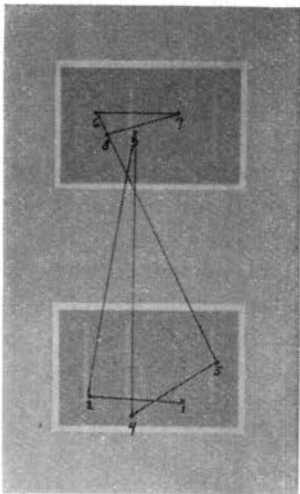


Fig. 3 Ocular pattern of subject 13 observing card #14

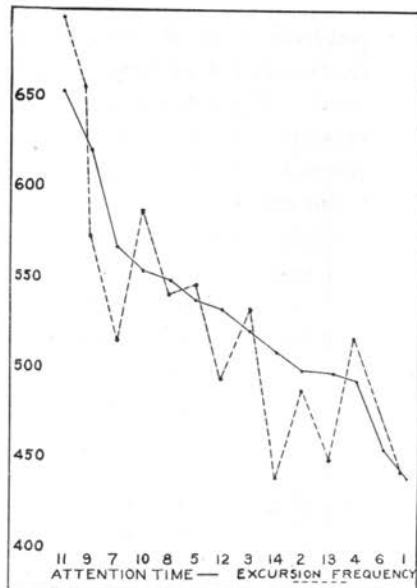


Fig. 4 Relative attention time to excursion frequency

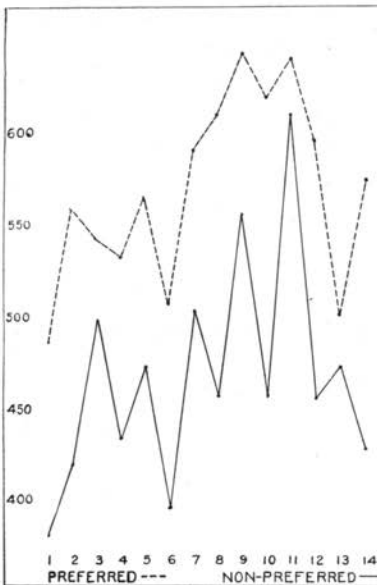


Fig. 5 Attention time of preferred and non-preferred designs

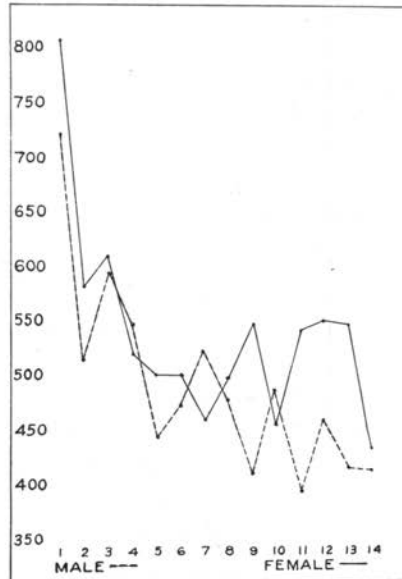


Fig. 6 Attention time of respective cards in order of sequence

PROCEDURE

Subjects: Fifty-six subjects, 28 male and 28 female, (college students selected at random) were asked to observe 14 pairs of designs. (The designs are the creation of Maitland Graves which appeared in the August, 1941 issue of the *American* magazine, pages 96-97 and are described in detail in his book "The Art of Color and Design.")¹

Exposure cards: Each pair of designs was mounted on a card $5\frac{1}{4}$ x 6 inches with a neutral gray background and presented to each of the 56 subjects with the following instructions:—"Here is a test that will enable you to determine for yourself to what degree you are gifted with good taste. On these cards are 14 pairs of designs. Study each pair carefully and decide which one appeals to you most. Don't be too analytical about it, just pick the one in each pair that strikes you as more unified, better balanced or more appealing than its mate. As soon as you have decided which of the two designs is better record your answer."

The sequence of the cards was rotated so that every card appeared in every position of the series. This procedure was followed in order to eliminate the interest or fatigue factor. The identification numbers used on each pair of designs is identical to the numbers used in the *American* magazine.

Apparatus: Subjects were photographed with an eye camera illustrated in Fig. 1. This portable bidimensional eye camera photographs accurately every eye fixation as well as every movement. The location, duration and sequence of every fixation is obtained by this technique together with the number, direction and distance of the excursion² accompanying the fixations.

RESULTS

In order to accommodate the reader in obtaining information relative to the general problem of the Laws of Composition and Eye Movements as revealed by Ocular Photography the author provides the answers based on this study in the order listed under the caption of the purpose of this study.

1. *What relative time do subjects spend on cards when selecting one of two designs regardless of their preference?*

1. Graves, Maitland, "The Art of Color and Design," McGraw Hill Book Co. 1941, New York and London

2. An excursion is an eye movement from one fixation to the next.

Table I

Relative time subjects spend on cards regardless of preference*

Card No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Ave.
Male	4.82	4.96	5.27	4.27	4.80	4.00	5.71	4.93	5.41	5.27	5.71	5.27	4.43	4.73	4.97
Female	3.87	4.86	5.18	5.46	5.71	5.07	5.32	5.78	6.61	5.55	6.86	5.18	5.36	5.32	5.44

* All time is recorded in terms of seconds or a fraction thereof.

Based upon the above table the male subjects spend an average of 4.97 seconds on each of the 14 pairs of designs while the female subjects spend an average of 5.44 seconds while observing the same cards. This is an average of 5.21 seconds per card for both male and female subjects. It is apparent that female subjects spend more time in making their selection than do male observers.

2. *What is the relative excursion frequency of subjects when selecting one of two designs?*

It seems natural that subjects in selecting one or two designs make excursions from one to the other in an attempt to arrive at a decision. Whether this difference for preference is obvious or concealed to the observer may determine for him the relative number of excursions necessary in making his selection.

Table II

Relative excursion frequency of subjects observing designs mounted vertically and horizontally.

Card No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Ave.
Male	4.50	4.89	5.21	4.57	5.00	4.14	5.32	4.96	5.21	5.89	6.39	4.86	3.93	4.71	4.93
Female	4.29	4.71	5.14	5.57	5.64	5.21	4.71	5.57	5.93	5.54	7.18	4.86	5.00	4.64	5.29

Male subjects according to the above table make an average of 4.93 excursions per card when selecting one of two designs, while female subjects make an average of 5.29 excursions for each card. As in attention time female subjects exceed their male competitors in excursion frequency while making their selection. In computing the relation of attention time to excursion frequency of 4.97 to 4.93 for the males and 5.44 to 5.29 for the female subjects, we arrive at a ratio of 1.00:.99 to 1.00:.97 for the two groups respectively. Female subjects make fewer excursions per unit of time than their male competitors. Both groups make an average of almost one excursion for every second of observation time.

Table III

Correlation of attention time and excursion frequency for cards 1-14

Card No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Ave.
Av. Att. Time	4.36	4.91	5.22	4.87	5.26	4.54	5.12	5.36	6.02	5.41	6.28	5.22	4.89	5.03	5.21
Av. Exc. Freq.	4.39	4.80	5.18	5.07	5.32	4.68	5.02	5.27	5.57	5.71	6.79	4.86	4.46	4.36	5.11

Subjects spend an average of 5.21 seconds per card and make 5.11 excursions during the same observation time. The correlation between attention time and excursion frequency is .763 for all subjects participating.

Based on the correlation of attention time and excursion frequency it is apparent that whenever more time is spent on a certain card the excursion frequency is increased proportionally. The highest deviation of attention time to excursion frequency is for cards 3, 9 and 12 while a perfect relation exists for cards 1, 5 and 10. Card no. 11 has the highest attention time and excursion frequency while card no. 1 the lowest in both measures of ocular performance.

Figures 2 and 3 represent typical ocular patterns resulting when a subject observes designs with the intention of selecting the one which according to his own judgment of good art is preferred.

3. *What is the ratio of attention time to excursion frequency when subjects observe designs mounted in the vertical or horizontal plane?*

Designs mounted horizontally appear on cards 1, 2, 3, 4, 5, 6, 10 and 11 and designs mounted vertically appear on cards 7, 8, 9, 12, 13 and 14.

Table IV

Relative excursion frequency of subjects observing designs mounted vertically and horizontally.			
Design Mounted	Attention Time	Excursion Frequency	Ratio
Horizontally	5.11	5.24	1.00:1.03
Vertically	5.34	4.92	1.00: .92

The results as tabulated in Table IV corroborate the findings of earlier studies which revealed that vertical eye movements are inhibited while horizontal ones (other things being equal) are facilitated.⁴ More time is spent on cards when observing designs mounted vertically than when such combinations are displayed horizontally. Although observation time is prolonged fewer excursions are executed in the same unit of time.

Figure 4 indicates that considerably fewer excursions were made for designs mounted vertically than those appearing horizontally.

4. *What relative attention time is devoted to preferred and non-preferred designs according to the judgment of the observers?*

4. H. F. Brandt, Ocular patterns and their psychological implications *Am. J. of Psych.* Vol. 53, No. 2, April, 1940, pp. 260-268.

When subjects are requested to select one of two designs it is apparent that a certain attention time is required in order to make such a decision. But in addition it is necessary to obtain information relative to the attention time devoted to preferred and non-preferred designs.

Table V

Relative time spent by subjects on Preferred and Non-preferred designs.

Card No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Ave.
Designs Preferred	4.88	5.61	5.44	5.35	5.67	5.09	5.92	6.11	6.45	6.21	6.43	5.97	5.03	5.76	5.71
Designs Non Pref.	3.83	4.21	5.01	4.35	4.75	3.99	5.11	4.60	5.58	4.21	6.13	4.58	4.75	4.29	4.71

Based upon the results as tabulated in Table V subjects spend an average of 5.71 seconds on designs preferred while only 4.71 seconds is devoted to designs not preferred by the observer. This difference of attention time for the preferred and non-preferred designs of male and female observers is 5.51 to 4.43 and 5.90 to 4.98 respectively.

Table VI

Relative time spent on preferred and non-preferred designs						
Design	M	σ	SEM	Md	SEdiff	C.R.
Preferred	159.76	13.55	3.76			
				28.00	5.74	4.88
Non-Pref.	131.76	16.68	4.63			

Not only is more time spent on designs selected than upon those rejected by the observer but in addition in a much larger number of choices is more time devoted to designs preferred. In only 11% of the total number of choices is more time devoted to the non-preferred than to the ones preferred.

5. *What relative attention time do subjects spend when observing cards in the order of sequence?*

As stated under the caption of procedure, cards were rotated in sequence so that each card appeared in every position of the series. The question which naturally arises is whether subjects spend more time on cards appearing earlier or later in the series.

Table VII

Relative attention time devoted by subjects when observing 14 exposure cards in order of sequence.

Card Sequence	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Ave.
Male	7.29	5.20	5.98	5.52	4.48	4.73	5.27	4.85	4.15	4.91	3.98	4.66	4.21	4.18	4.97
Female	8.10	5.87	6.14	5.23	5.04	5.03	4.66	5.01	5.51	4.61	5.41	5.54	5.51	4.39	5.44

The correlation of attention time and the order of sequence is .805 when attention time of male and female is combined for each

position. Figure 6 is a graphic representation of the diminishing attention time devoted to cards appearing later in the series. Male subjects show a greater attention time loss for succeeding exposure cards than do female observers.

6. *What relative attention time is devoted by subjects on designs when their selection agrees or disagrees with the choice of experts?*

Four hundred and sixty five (465) of the seven hundred and eighty four (784) choices of the subjects agree with that of the experts while three hundred and nineteen (319) disagree. Female subjects spend more time in making their selection but a larger number of their choices agree with those of the experts. Both male and female subjects spend significantly less time on designs when their choice agrees with that of the experts. This might imply that the human mind as evaluated by this analysis finds it less difficult to make a choice between two designs when selecting the one which according to experts conforms to fundamental principles of good art.

Table VIII

Attention time of subjects when choice agrees with experts

Subjects	Agrees with Experts		Disagrees with Experts	
	Frequency	Average Time	Frequency	Average Time
Male	223	2.78	169	7.86
Female	242	3.80	150	8.09
M & F	465	3.31	319	7.96

SUMMARY AND CONCLUSIONS

This study endeavors to discover by means of Ocular Photography a correspondence between the so called Laws of Color and Designs and Ocular Patterns. It is an attempt to evaluate the art object by scientifically testing the response of individuals to it. Based upon the response of individuals to the art object the author further proposes to provide a criterion for the verification of the adequacy or inadequacy of the observed field.

A number of ocular response patterns together with their psychological implications stand out clearly. One is that the female subjects as a group spend more time when selecting one of two designs. This increased attention time seems to be justified, however, since a larger number of their choices agree with those of experts.

A second phenomenon revealed by this technique is that significantly more time is spent on designs preferred by subjects as compared to designs rejected according to their own judgment. This

conclusion seems logical due to the fact that human nature desires to retain or sustain what is satisfying and dispel or discontinue as soon as possible that which is dissatisfying. The neural hypothesis theory contends that the readiness of the nervous system determines for an individual the degree of satisfaction which accompanies such an act.

In computing the relative excursions made by subjects when observing designs mounted vertically or horizontally it is apparent that significantly more excursions are made when the eye is permitted to move laterally. This might imply that less aesthetical satisfaction accompanies an ocular performance when an excess of vertical eye movements is necessitated due to the character of the composition.

It is noteworthy that the attention of subjects observing respective exposure cards is consistently longer for cards presented earlier in the series than those observed later. This would imply that a certain degree of fatigue or loss of interest operates. Cards seen first are accorded a longer observation time than those appearing later in the series. This is apparent especially for the first four cards of the series. The diminishing attention time for subsequent exposure cards is less pronounced for female than for male observers. Attention is diminished considerably when observing fourteen exposure cards but just how much attention time would be reduced by exposing additional cards can not be ascertained by the results of this study.

Another interesting discovery made by this study is that significantly less time is devoted to designs selected by the observer in agreement with those selected by experts.

Graves in his study designates designs preferred by artists. This study reveals that the average layman prefers a larger number of designs (465) in agreement with experts than those that are non-preferred, (319) by such authorities.

Just why observers should devote less time to designs preferred by both the artist and layman is not clear at this time. The only possible explanation the author proposes is that the difference was sufficiently obvious that little time was required to arrive at a decision.

When speaking of the psychology of art we are no longer thinking in abstract terms when employing Ocular Photography as a Scientific Approach to the Study of Color and Composition. If the principle known as the golden mean with a ratio of 1.618:1.00 is

considered more adequate than other proportions and if certain colors are positive, aggressive, relieving or tranquil and if balance, variety, dominance or unity seems to be inherent then it seems feasible that the unconscious reaction of the eyes is reflected in ocular patterns resulting. Based upon such implication it is likely that the behavior of the eye constitutes the final court of appeal in ascertaining the adequacy or inadequacy of a composition.

It is likely that original responses to color and composition are as natural as our response to salt and sugar. It is, however, expected that experience and association especially of the earlier years have a definite effect upon our response to the field of observation.

If this approach to the study of art will aid in a more adequate creation of it, we have much to expect from Ocular Photography as a technique in evaluating the why of color and design.

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