

HOW PEOPLE LOOK AT PICTURES

A STUDY OF THE
PSYCHOLOGY OF PERCEPTION IN ART

By

GUY THOMAS BUSWELL

Professor of Educational Psychology, The University of Chicago



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CHAPTER I

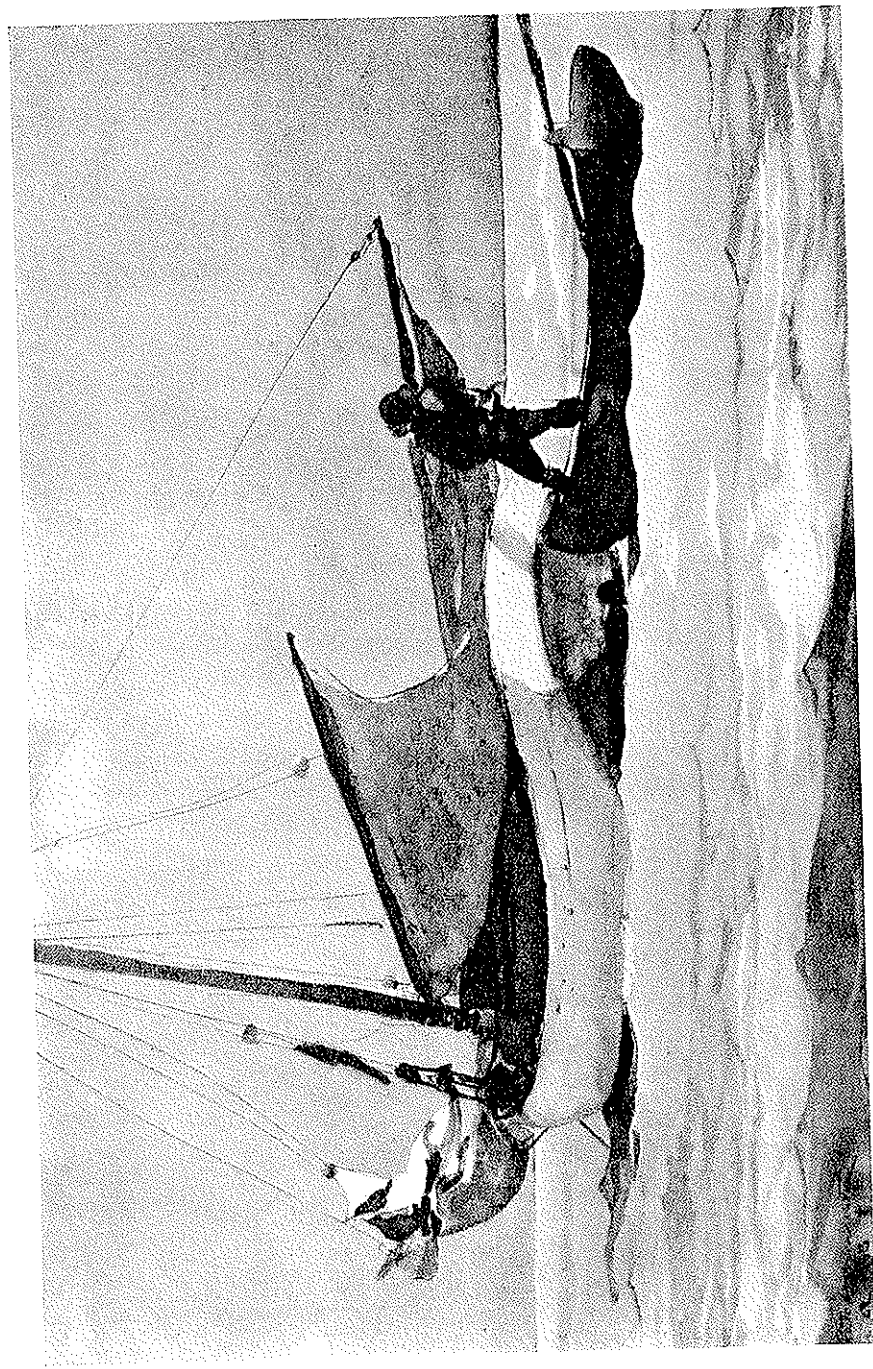
INTRODUCTION

MISS W. was asked to look at a set of large colored pictures as she would if she were selecting one of the pictures for her own. As she looked at the pictures a photographic record was obtained of her eye movements from which an exact reproduction of her pattern of visual perception was made. In looking at the picture "Stowing the Sail—Bahamas," reproduced here in black and white instead of color as Plate I on page 2, Miss W. made the sequence of visual fixations which is shown by the dots and lines superimposed on the dim print of the picture which appears as Plate II on page 3 of this report. The small black dots on the picture indicate the centers of successive fixations of the eyes, while the numbers beside the dots show the serial order of the fixations. The lines are drawn to connect the dots in series.

In looking at the picture Miss W. first looked at the position of the dot marked "1," located just below the mast of the boat. Her second, third, and fourth fixations led to the boatman's head on the right. Fixations 5 to 8, inclusive, made a swing to the lower part of the small boat and back again to the boatman's head. From this position there follows a series of fixations which makes a survey of the center and forward parts of the boat. The small red flag hanging from the rigging does not receive direct attention until the fourteenth fixation. Fixations 20 to 33, inclusive, permit a reobservation of the boatman and the small rowboat. The latter portion of the time spent on the picture is given mostly to the green water in the lower left corner. At the end of the forty-fifth fixation Miss W. signaled for the next picture to be shown.

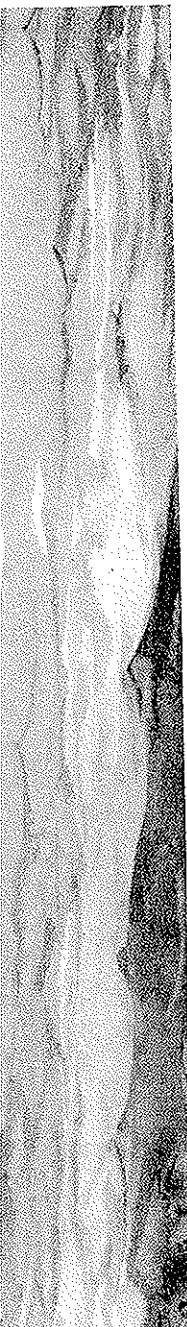
Certain general facts are apparent from the pattern of perception as shown in Plate II. This particular subject gave no direct attention to the upper third of the picture. Likewise, the lower right corner of the picture received no direct observation. Whatever impressions Miss W. had from these parts of the picture came through peripheral vision. Also, it is apparent that the boatman and the rowboat in which he is standing received a very large part of the subject's attention. Another general center

PLATE I



Courtesy, Art Institute of Chicago

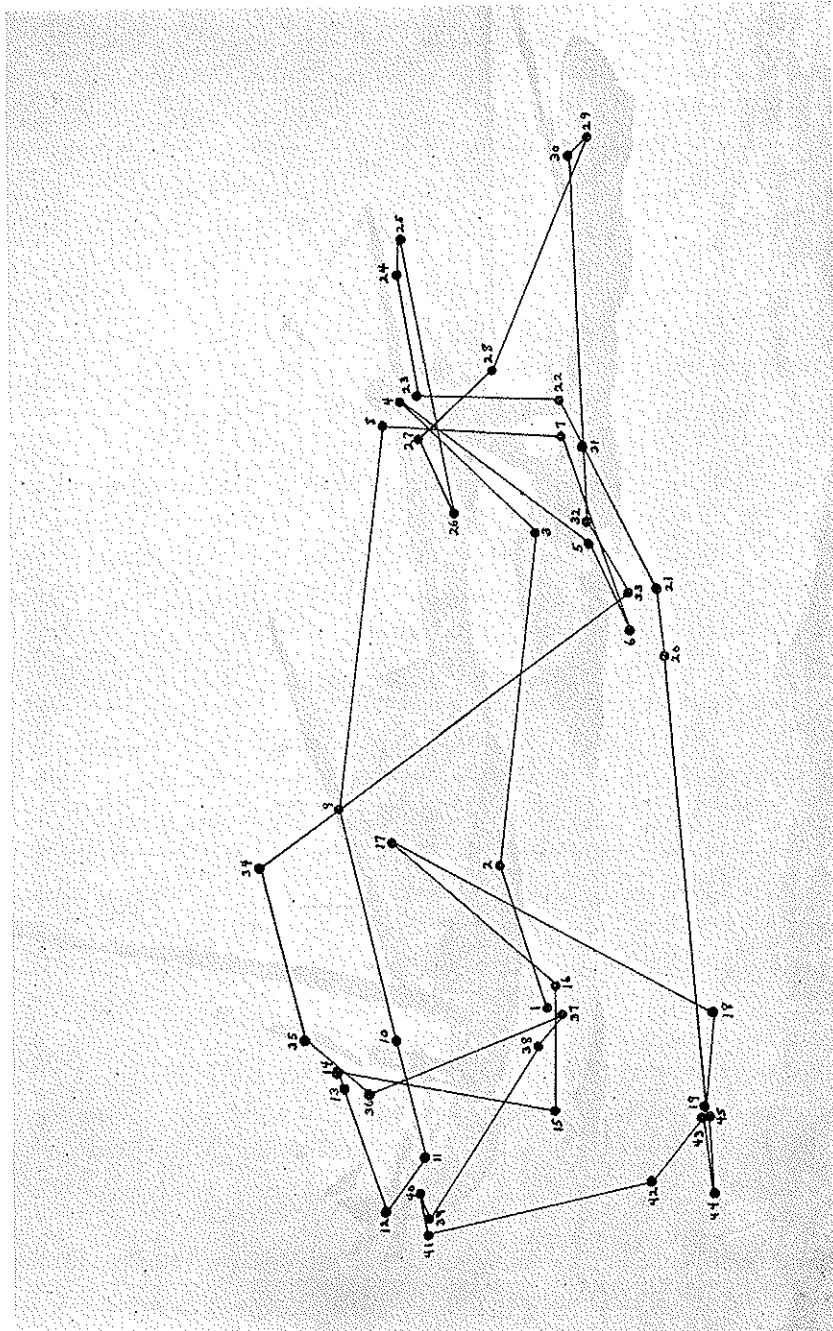
PICTURE 9, "STOWING THE SAIL—BAHAMAS," WINSLOW HOMER
In color, size 27.3 cm. X 17.9 cm.



Courtesy Art Institute of Chicago

PICTURE 9, "STOWING THE SAIL—BAHAMAS," WINSLOW HOMER
In color, size 27.3 cm. X 17.2 cm.

PLATE II



RECORD OF MISS W. (SUBJECT 52), PICTURE 9

1-2	7-9	10-6	18-7	25-10	28-5	31-11	34-6	37-8	40-9	43-11
2-10	8-9	11-6	19-8	22-12	29-5	32-7	35-7	38-25	41-24	44-16
3-11	9-9	12-8	17-9	23-7	29-12	33-10	36-8	39-13	42-10	45-8
			18-5	24-14	27-11					

Durations of fixation pauses for this and similar plates to follow are given above. The first number in each pair indicates the serial order of the fixation; the second number the duration of the fixation in thirtieths of a second. For example, the duration of the first fixation in this plate is 2 thirtieths of a second; of the second fixation 10 thirtieths, etc.

of interest seems to be the fore part of the large boat where the dots cluster in three subcenters of attention. The tall mast and the rope leading upward to its top receive no direct observation whatever. Regardless of whatever may have been the artist's intentions when he painted the picture, the facts remain that at this particular time the visual response of Miss W. to the picture was as indicated in the pattern of perception shown.

The nature of Miss W.'s response can be made still more interesting by adding to the diagram showing the position of her successive fixations some information concerning the duration of each of the fixations of her eyes. By a method to be described later it is possible to determine with precision the duration of each successive fixation pause as Miss W. looked at the picture. The unit used in measuring the duration of the fixations is one-thirtieth of a second. In thirtieths of a second the durations of the first five fixations were, respectively, 2, 10, 11, 14, and 9. Certain of the fixations were considerably longer than others. For example, Fixation 38 was 25 thirtieths of a second in duration, while Fixations 41 and 44 were respectively 24 and 16 thirtieths of a second. The cause of such variations in duration will be considered in a later chapter.

A second example of a pattern of perception is shown as the record of Miss D. in looking at a colored painting of a plate. The picture used is reproduced without color in Plate III, while the dots and lines showing the pattern of perception are shown in Plate IV. In looking at this picture Miss D. made her first three fixations near the center of the plate. Fixation 4 is in the upper left direction and is followed by a series of seven fixations, Numbers 5 to 11, inclusive, which cover approximately a third of the border of the plate. At Fixation 12 the eye swings back to the center of the picture and in the following fixations, 13 to 27, inclusive, the eye makes a general survey of the center portion of the plate in two somewhat circular movements. Fixations 29 to 32 fall in the border at the base of the plate, whereas the last two fixations return to the center of the picture. The durations of Miss D.'s fixations vary from 3 to 15 thirtieths of a second.

PROBLEM

The two cases which have been described in the foregoing pages give a very limited answer to the question, "What does a person do when he looks at a picture?" This question is obviously a very general one which may be restated as a series of specific questions relating to the nature of

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PLATE III



Originative Vorbilder, XXVIII, 1

Verlag Julius Hoffmann Stuttgart

Majoliken, Italien. XV. bis XVI. Jahrhundert. Berlin, Schloßmuseum

PICTURE 17, MAJOLIKEN, ITALIEN

From *Farbige Meisterwerke aus dem Kunsthandwerk des Abend- und Morgenlandes*, Julius Hoffman, Verlag/Stuttgart. In color, size 17.1×14.5 cm.

PLATE IV

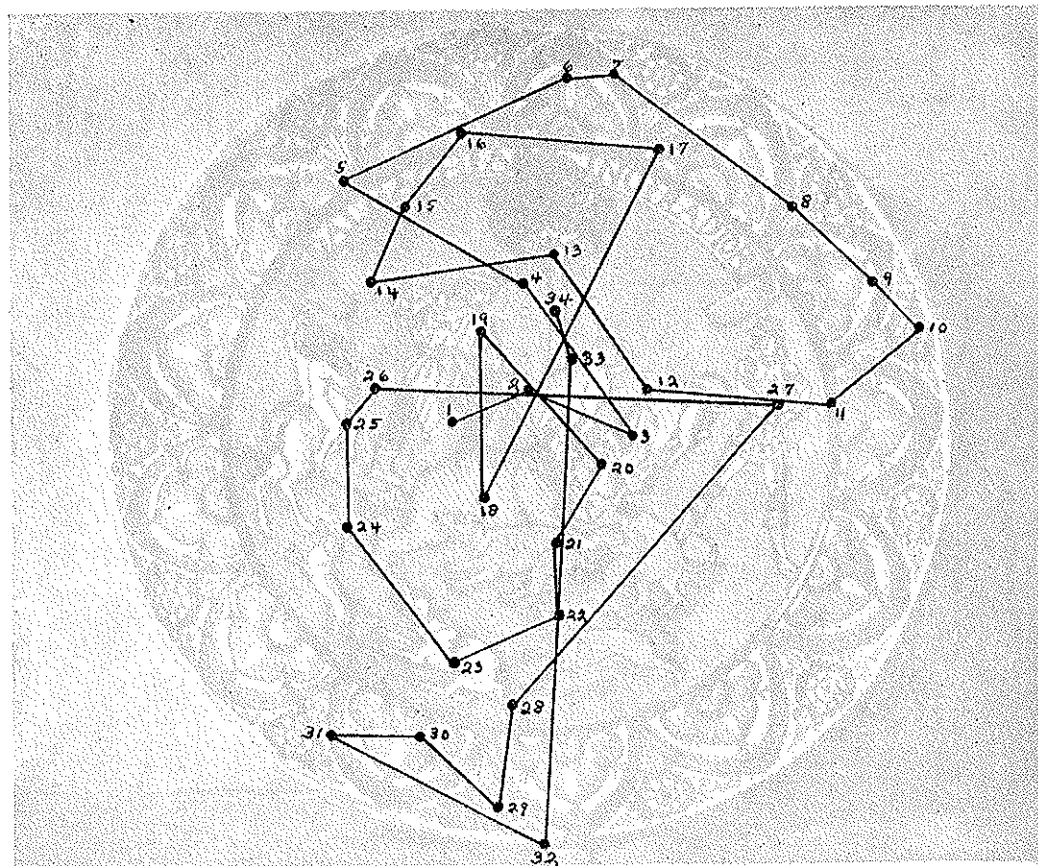


Abbildung Tafel No. XXVIII. 1
 Atlas der Psychologie, XV. (u. XVI.) Jahrgang, Berlin, Schönbachverlag

RECORD OF Miss D. (SUBJECT 9), PICTURE 17

1- 5	6- 7	11- 3	16- 9	21- 7	26- 6	31- 4
2- 7	7-16	12-10	17-11	22- 7	27- 5	32- 5
3- 6	8- 7	13-11	18- 3	23-12	28- 7	33- 4
4-13	9- 7	14- 7	19- 7	24-10	29- 6	34-11
5-15	10-14	15- 6	20-14	25- 8	30- 5	

the processes of perception and attention while studying any work of art. Certain of these questions relate to the characteristics of the picture being observed. For example, what is the effect of color or lack of color? What are the main centers of interest in looking at a picture? Does the pattern of perception reflect the way the various parts of the picture are balanced? Other questions might be asked relating to the characteristics of the persons looking at a picture. For example, does previous training or ability in art make a difference in a pattern of perception? Do children and adults look at a picture in the same way? Do Oriental subjects look at a Japanese print in the same manner as Western people? Still other questions might have to do with the conditions under which a picture is observed. For example, do the directions given to the observer influence the pattern of perception? Do the characteristics of perception vary with the length of time during which a person looks at a picture?

Questions such as the foregoing have been discussed in the literature relating to the psychology of art, but, so far as the writer is able to discover, the attempts to analyze the perceptual process in looking at a picture have been based upon introspective and subjective evidence. In the present study the data are entirely objective. It will be interesting to find the extent to which the objective evidence obtained from photographs of eye movements corroborates the hypotheses which have been built up subjectively relating to the general patterns of perception in looking at pictures.

Many books on the subject of art make reference to eye movements. The statements which are made rest on introspective evidence, but they indicate an acute interest on the part of the artist and the art critic in the nature of the process of visual perception. As samples of the type of references found, the following quotations, selected at random, are given.

"A more or less differentiated pattern, gradually lengthened in its design and intensified in its color, will draw the eye from the lightly developed part toward the more expressive. . . . Since a picture is something different from a section cut out from nature, it must provide a means of allowing the eye to travel through all parts associated within the frame."¹

"Then as the beholder stands back from the canvas to take in the ensemble, his eye is pleased by the color-harmony, it rests lovingly upon the balance of the composition, and follows with satisfaction the rhythmic flow of line."²

¹ Eugen Neuhaus, *The Appreciation of Art* (Boston: Ginn & Co., 1924), p. 155.

² Carlton Noyes, *The Gate of Appreciation* (Boston: Houghton, Mifflin & Co., 1907), p. 46.

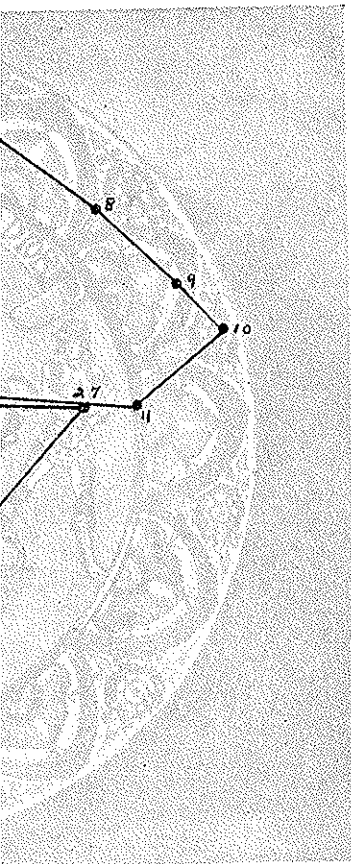


Figure 17
Schiffman

FIGURE 17	
26-0	31-4
27-5	32-5
28-7	33-4
29-6	34-11
30-5	

"Your eye does not follow the muscle and bone making of the arm. It follows the spirit of life in the arm."³

"And doubtless we have all been conscious at times of our eye being swept across a textile or a wall-paper pattern in spite of us. Stop and analyze the situation and it will frequently be found it is due to rhythm by *alternation*—the alternation of a light with a dark unit, of a large with a small unit, of one hue with another, or one shape with another, and so on. Some rhythms by alternation are so compelling as to be irritating. They snatch our eye and away they go! A motor that runs away with us is much worse than one that sticks on dead center. But that is not the fault of the principle but rather of the designer. Also the simple repetition of a unique shape is often quite as compelling, carrying our eye across a design like the beat of a drum in a march."⁴

"In the study of unity through the movement or swing of a picture one soon becomes sensitive to whatever, without right, catches and detains the eye. . . . An appreciation of the movement of a picture—that natural course given to it in the progress of lines or attractive points which carry the eye through it—becomes the initiative in the artist's effort to effect unity."⁵

"But you will notice, how large a stretch of empty space is left at the top of the lunette, so that the eye is drawn upward and the dignity of the whole decoration thereby elevated."⁶

"The use of this easy transitional line rather than the contradictory line leads the eye surely, but less harshly to the central figure."⁷

"The eye follows line. Line directs eye movement. The effects of this movement vary with the type of movement."⁸

"Lines which carry the eye downward give the feeling of reticence that may amount to dejection. . . . Lines which carry the eye upward give an uplift of spirit as well as of eye movement."⁹

"Form as well as line directs eye movement. The eye tends to move along the path of least resistance. The vertical rectangle carries the eye upward. The horizontal rectangle carries the eye horizontally. The eye is carried most easily when the form is simple. Details of surface pattern or complicated contour interrupt eye movement."¹⁰

³ Robert Henri, *The Art Spirit* (Philadelphia: J. B. Lippincott Co., 1923), p. 109.

⁴ George H. Opdyke, *Art and Nature Appreciation* (New York: Macmillan Co., 1932), p. 512.

⁵ Henry R. Poore, *Art Principles in Practice* (New York: G. P. Putnam's Sons, The Knickerbocker Press, 1930), p. 56.

⁶ Charles H. Caffin, *A Guide to Pictures* (New York: Doubleday, Page & Co., 1914), p. 80.

⁷ Harriet Goldstein and Vetta Goldstein, *Art in Every Day Life* (New York: Macmillan Co., 1926), pp. 22-23.

⁸ Margaret E. Mathias, *The Teaching of Art* (New York: Charles Scribner's Sons, 1932), p. 20.

⁹ *Ibid.*, p. 21.

¹⁰ *Ibid.*, pp. 24-25.

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The quotations in the foregoing paragraphs are particularly interesting in view of the fact that the writers had no precise objective evidence with which to verify their statements. They are quoted here as samples of the kinds of inferences which appear repeatedly in books on art. The data furnished in the following pages will make it possible to observe the extent to which the various hypotheses regarding eye movements are in harmony with the objective patterns of perception which will be shown.

METHOD AND APPARATUS USED IN PRESENT INVESTIGATION

The method used in this study consists in photographing on a moving film the eye movements of a group of subjects while they look at a series of pictures. The technique is new only in its application to the field of art. There already exists a very considerable literature relating to the movements of the eyes in the process of reading. The resulting analyses of the reading process have been exceedingly valuable in developing improved methods for teaching reading. The nature of the eye movements in reading has been traced from the first grade through the college period and has been studied for a great many different types of reading both in the vernacular and in several foreign languages. Technically the problem of photographing eye movements in reading is much more simple than in the case of looking at pictures, since in reading it is only the horizontal movements of the eyes which are of any great significance. However, in looking at pictures it is necessary to secure simultaneously a record of both the vertical and horizontal eye movements. This involves technical difficulties which were surmounted by the construction of the elaborate apparatus used for the present study. Students in the field of psychology and education are already familiar with the technique of photographing eye movements. However, for readers whose major interest is in the field of art a description of the method and apparatus will be given.

It should be clearly understood at the beginning that the movements of the eyes are significant only in so far as they are symptoms of the perceptual processes which appear while looking at a picture. Ordinarily a person is entirely unconscious of the characteristics of these tiny movements of his eyes and it is entirely impossible for him to describe them accurately even when he gives his close attention to them. Eye movements are unconscious adjustments to the demands of attention during a visual experience. The underlying assumption in this study is that in a visual experi-

ence the center of fixation of the eyes is the center of attention at a given time. If this is true then the record of eye movements in looking at a picture supplies objective evidence of the pattern of perception during that experience. In view of the fact that one's response to a picture is, at least in the first instance, a matter of visual perception, any objective analysis of this process of perception should supply data of considerable significance to the artist.

The present report does not treat in any manner the nature of the process of appreciation while looking at pictures. The evidence in regard to perceptual patterns is entirely objective, but it furnishes no indication, except by inference, as to what the nature of the subject's inner response to the picture may be. The writer prefers that the reader draw his own inferences from the data presented. For example, in looking at a landscape painting such as "The Silence of the Night" the fact that one subject gives a large part of his visual attention to the small section of the picture at the end of the road indicates without any question that the observer was interested in this particular part of the picture, at least to the extent of giving a considerable amount of his time to looking at it. However, the fact that he has a great cluster of eye fixations around this position indicates nothing at all as to whether he approved or disapproved of the artist's treatment of that section, as to whether or not he liked it, or as to what might have been the character of his mental reflections during the time that he was looking at that part of the picture.

The method of securing a record of eye movements consists in photographing a beam of light from a six-volt ribbon-filament lamp reflected first to the cornea of the eye from silvered glass mirrors and then from the cornea to a second set of mirrors, through a camera lens and a set of wedge prisms to a moving kinoscope film. By means of the prisms back of each lens the beam of light from the eye is split into two beams, one of which is directed to a horizontally moving film and the other to a vertically moving film. In this way the movements of the same eye are recorded on both films. The direction of the pencil of light reflected from the cornea is changed with each movement of the eye. As the subject looks at a picture a photograph is made which records the movements of the eye in a sharply focussed line upon the two films. By means of a fan blade driven by a synchronous motor, the beam of light is interrupted thirty times per second between the lens and the film in such a manner that on the film the

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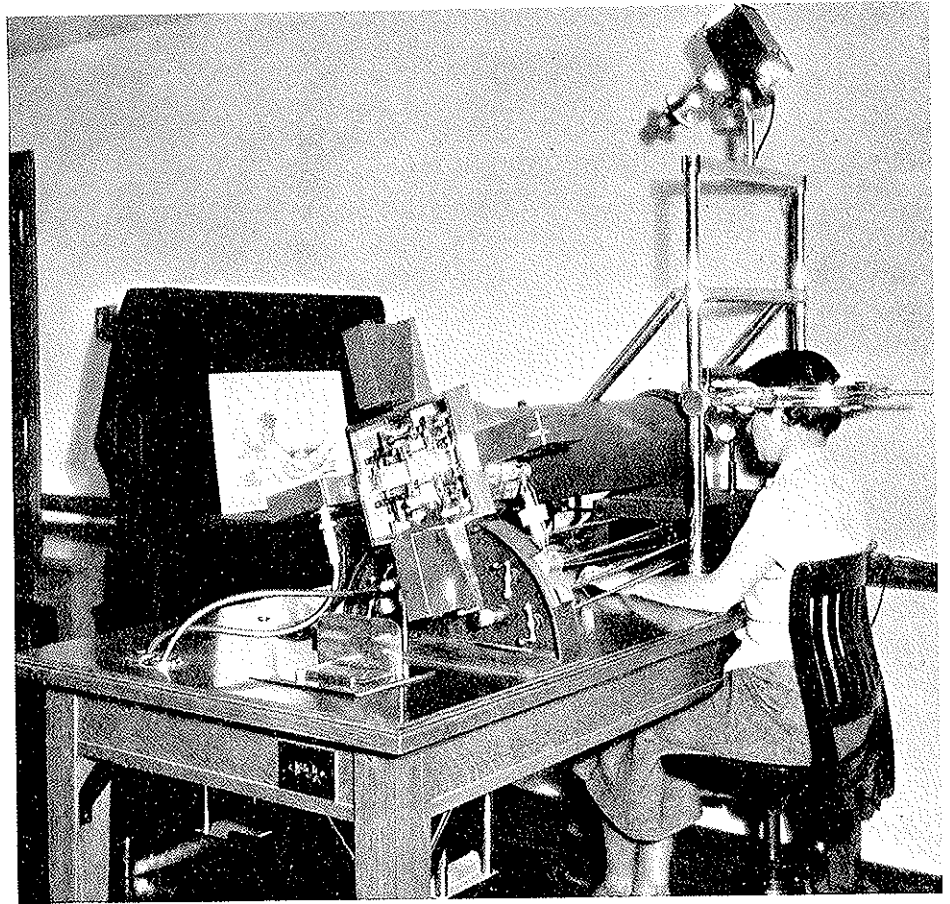
line of light appears as a series of dots, each dot representing one-thirtieth of a second of time. By counting the number of dots in each fixation pause it is possible to determine with precision exactly how long a person looked at each position in the picture. Only subjects were used whose vision was sufficiently normal to look at the picture without the use of spectacles. The apparatus used is shown photographed from two positions in Plates V and VI.

The apparatus was built for the particular purpose of this experiment in the workshop of the laboratories in educational psychology of the University of Chicago. Basically the apparatus is a large camera built in such a way that the two films can be moved continuously during the process of photographing. The various lenses and mirrors are simply for the purpose of bringing to a focus on the film the reflection of the tiny spot of light from the cornea of the eye. The light which reflects on the eye originates under the table. It is passed forward through a series of lenses and then upward through two holes in the table, after which it strikes two circular mirrors and is reflected to the subject's eyes. Instead of facing the camera lens, as has been necessary with previous pieces of apparatus of this sort, the subject is placed at right angles to the camera which gives him an open field of vision of whatever size is needed. Small pictures can be placed as close as the normal reading distance of twelve inches, whereas larger pictures can be set back whatever number of feet seems desirable. The provision of this larger field of vision adds a great deal of flexibility to the uses of the apparatus.

The subject sits in a specially constructed chair which can be raised or lowered to the proper height. When he is in position the head rest shown is lowered around the back of the subject's head in order to eliminate head movements. On the whole, the position is comfortable and, after a few seconds of adjustment, the apparatus causes the subject no inconvenience. A record of head movements is obtained for every picture by securing through a second lens on the apparatus a photograph of a beam of light reflected from a chromium bead on a pair of spectacle frames which the subject wears. The use of a head line, particularly for the vertical record, is absolutely necessary to insure precision in plotting the record.

The nature of the film record is shown in Plate VII which reproduces a short section from the beginning of one pair of films. The dots in the lines represent time intervals of one-thirtieth of a second. The straight line on

PLATE V

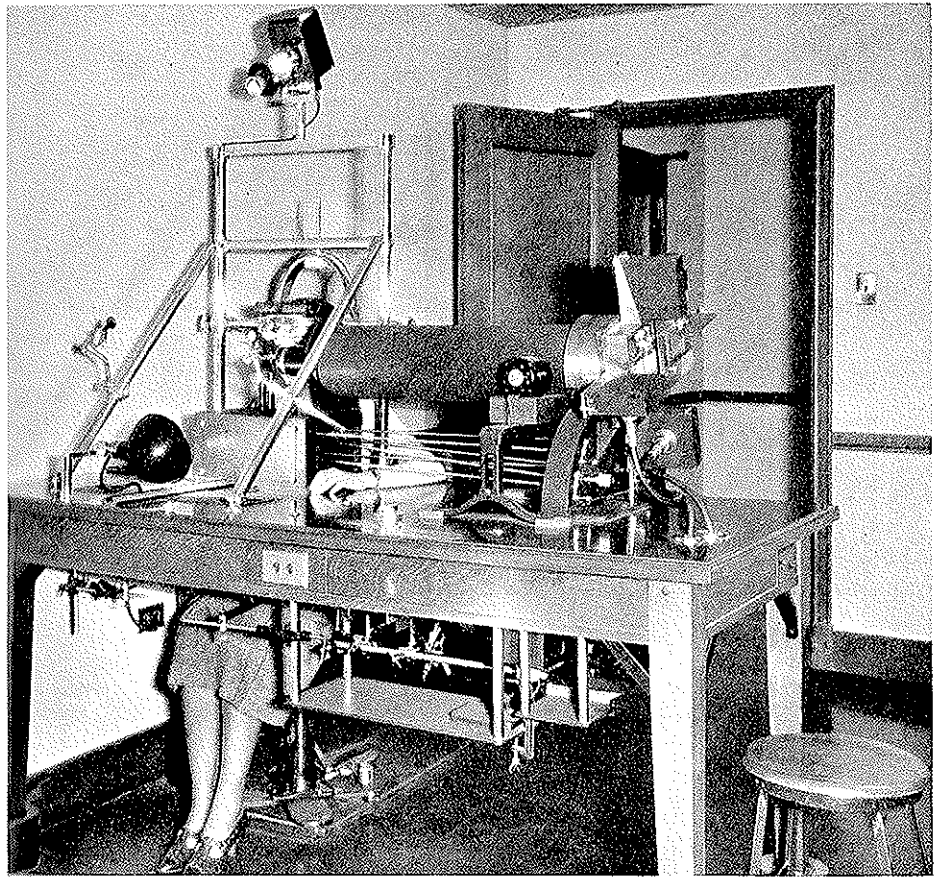


APPARATUS USED FOR PHOTOGRAPHING EYE MOVEMENTS, FRONT VIEW

PLATE VI

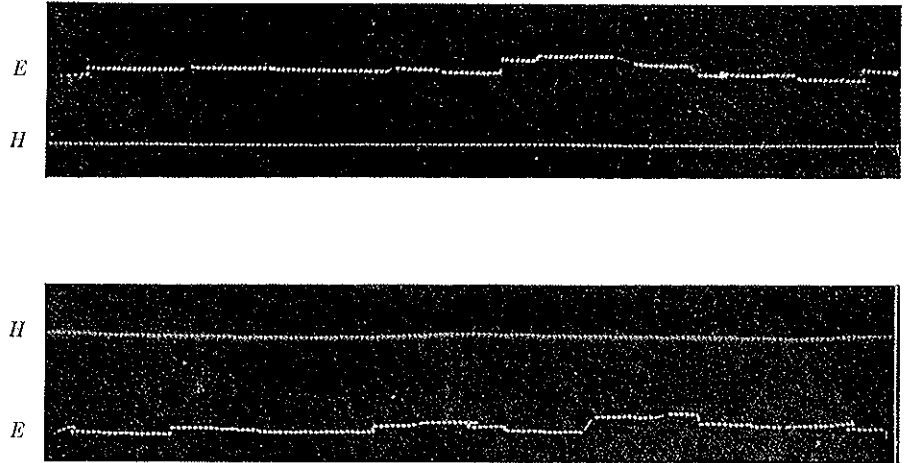


FRONT VIEW



APPARATUS USED FOR PHOTOGRAPHING EYE MOVEMENTS, REAR VIEW

PLATE VII



SAMPLE OF FILM RECORD SECURED BY EYE-MOVEMENT APPARATUS

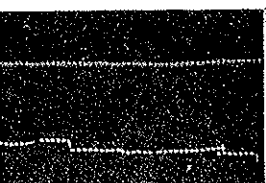
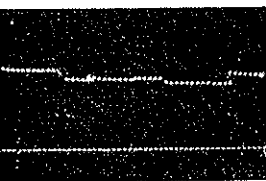
The upper record shows the horizontal movements of the eye; the lower record shows the vertical movements. The lines marked *E* show eye movements. The lines marked *H* show record of head movement. Each dot represents one-thirtieth of a second.

each film is the headline, made by the chromium bead on the spectacle frames. The irregular lines show the successive fixations of the eyes. The upper film shows the horizontal record and the lower film the vertical record. The first fixation is 4 thirtieths of a second in duration; the second, third, and fourth are 19, 16, and 21 thirtieths, respectively. The films are plotted by projecting them through a stereopticon lantern. The vertical and horizontal position of each fixation is recorded on a numerical scale and these positions are then co-ordinated and marked on the picture. Points of reference for fitting the film record to the exact size of the picture were secured from initial fixations on four dots placed adjacent to each margin of the picture. For the complete investigation some 18,000 feet of film were used.

The amount of error involved in plotting the films was studied experimentally with a group of 47 subjects by photographing a series of five dots placed at intervals of one inch in both the horizontal and vertical planes. The deviation of the plotted positions of the fixations from the actual position of the dots was then tabulated. Using the outer two of the five dots as points of reference, the horizontal plottings of the three inner dots fell within two millimeters of the exact position in 72 per cent of the cases and within five millimeters in 91 per cent of the cases; for the vertical movements the corresponding numbers were 75 per cent and 86 per cent. Since an error of even five millimeters in position for pictures of the size used would not affect any of the interpretations made of the data, the technique may be considered well within the necessary range of accuracy. However, in looking at an individual fixation on a picture the reader should bear in mind that the true center of fixation may vary from the indicated one by not more than five millimeters in from 86 to 91 per cent of the cases.

A fixation of the eyes, of course, covers an area rather than simply a point. There is no means of knowing exactly how large the area of clear fixation is. The dots showing the position of fixations should be interpreted as the central points of areas of clear recognition which shade off gradually into areas of peripheral vision.

In looking at a picture, just as in the process of reading, the eye moves in a series of quick jerks and pauses. The eye does not slide over the picture, as many people seem to think it does. The duration of the fixation pauses varies a good deal, a pause of 3 thirtieths of a second being very brief, one of 8 to 10 thirtieths being quite common, and pauses of more than 20 thirtieths of a second occurring only in approximate-



ENT APPARATUS

lower record shows the vertical
marked *H* show record of head

ly 5 per cent of the cases. These movements and pauses of the eyes may be noted by direct observation, but the movements are too rapid to be counted accurately and the pauses too brief to be timed without the use of special apparatus.

SUBJECT AND MATERIALS FOR THE PRESENT INVESTIGATION

Photographic records of eye movements were obtained from two hundred individuals for the present investigation. Of this number 12 were elementary grade children, 44 were high-school pupils, and 144 were adult subjects. Of the adult subjects 47 were secured from the Art School of the Art Institute of Chicago and were persons who had from two to five years of special training in the field of art. Fourteen other subjects had made sufficient study of art to be classified as art students. The great majority of the remaining adult subjects were college or graduate students.

In addition to taking photographic records of eye movements the McAdory Art Test was administered to all of the subjects above the elementary grades. In a later chapter the data from the investigation are analyzed in terms of the amount of training in art school and of artistic ability as measured by the McAdory Art Test.

In the entire investigation 55 different pictures were used. For one group of 9 subjects photographic records were made from 39 different pictures for each subject. Thirty-four subjects looked at 21 or more pictures each. For the remaining subjects fewer pictures were taken. However, the total number of completed records used in this report is 1,877. The only records discarded were those where the amount of head movement was so great as to render doubtful the plotting of the picture or where some ocular defect made the film record unreliable.

A complete list of the pictures used in the investigation is given in Appendix A of this report. The 55 pictures used may be classified roughly into eight different groups as follows: Pictures 1 to 16, paintings, some in color and some in black and white; Pictures 17 to 22, vases and dishes; Pictures 23 to 30, furniture and design; Pictures 31 to 35, photographs of statuary and museum pieces; Pictures 36 to 39, tapestries and designs on cloth; Pictures 40 to 47, architecture and interior design; Pictures 48 to 50, posters; Pictures 51 to 55, outlines, silhouettes, and geometric figures.

The prints and photographs used were of excellent quality. The sizes of the pictures as used and also reduced reproductions are included in Appendix A.

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INVESTIGATION

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OUTLINE OF REPORT

The data and the results of the investigation will be presented in the following chapters. In chapter ii the principal centers of interest in pictures and the general nature of the perceptual patterns will be treated. Chapter iii will consist in an analysis of the variations in duration of fixation pauses and the relation of these variations to certain aspects of the perceptual process. Chapter iv will deal with certain variations in perception as related to characteristics of the pictures. The principal topics here will be the effects of color, the perception of design, silhouette, and outline, and a comparison of eye movements in looking at finished and unfinished paintings. Chapter v will deal with variations in perception which are related to the characteristics of individuals. Comparisons will be made of persons with and without training in art, of children and adults, and of Western and Oriental subjects. Chapter vi will treat the effect of directions given to the subject prior to looking at the picture. These directions determine the mental attitude or "set" of the individual. The final chapter, vii, summarizes the findings of the investigation and presents some general interpretations of the data.

As far as the writer can ascertain, this is the first experimental study of eye movements in looking at pictures. As is generally the case when a technique is first applied in a new field this study possesses many of the characteristics of a survey experiment rather than one which tests carefully formulated hypotheses. The writer is in a much better position to set up such hypotheses now than at the beginning of the study. Subsequent studies may deal more specifically with some of the problems raised by this one.

This study is an application of certain scientific techniques to problems in art. The writer is not a specialist in art; his contribution is simply the application of techniques, which have been found useful in psychology, to the study of the perceptual process in looking at pictures, a process which is of common interest to both artists and psychologists. In the main, the writer will limit his efforts to the presentation of a body of objective data which relates to many problems of the artist. Rather than risk making interpretations in a field in which he is an amateur, he leaves to the artist the drawing of generalizations which go beyond the common field of the psychology of perception.

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CHAPTER V

VARIATIONS IN PERCEPTION RELATED TO CHARACTERISTICS OF INDIVIDUALS

ONE of the questions which was studied in this investigation is what relationship certain characteristics of individuals may have to the nature of perception in looking at pictures. In this chapter three aspects of this question will be considered. First, do persons with training or special ability in art show characteristic differences in looking at pictures as compared with persons without training or special ability? In the second place, do children and adults display the same general characteristics of perception? It has been shown that, in learning to read, the characteristics of eye movements undergo a series of well-marked changes during that period of years in which the reading process is maturing. Is there a similar process of maturing or learning to look at pictures during which children display patterns of perception which vary from stage to stage as they grow older? The third question is whether differences of nationality or race may affect the character of one's perceptual habits. For example, in looking at a Japanese print would Oriental subjects display the same characteristics of eye movements as subjects living in America? In the present chapter some evidence relating to these three questions will be presented.

THE RELATION OF TRAINING AND SPECIAL ABILITY IN ART TO THE PERCEPTUAL PROCESS IN LOOKING AT PICTURES

As has already been stated in the introductory chapter, forty-seven of the subjects used in this investigation were students in the Art School of the Art Institute of Chicago. The great majority of these students had more than two years' training, in many cases the period of special study of art amounting to four or five years. In addition to these students from the Art Institute certain other subjects were used who had had special training in art in other institutions. All told there were sixty-one subjects which are classified in this investigation as belonging to the art group. All other subjects, with the exception of elementary-school children, were classified

in the non-art group. The elementary-school children were not considered in either of these two groups.

It is quite conceivable that study in a school of art is no guaranty that a student possesses artistic talent or that he profits greatly by such training, since in many art schools anyone can be admitted if he pays the tuition. It is quite to be expected that some persons, by this method of classification, might be counted as art students who would not possess the characteristics of this group in general.

As a supplementary method of classification all of the subjects in the experiment, with the exception of the elementary-school children, were given the McAdory Art Test.¹ The McAdory Art Test consists of a series of seventy-two plates on each of which are four pictures consisting of a great variety of materials, designs of one sort or another, pottery, pictures in color as well as black and white, etc. In view of the length of time required for taking the entire test the plates were divided into two groups on the basis of an experimental try-out in such a way that the two halves of the test gave substantially the same score. For purposes of this investigation, a form consisting of half of the items of the test was used. Furthermore, the method for scoring the test which was available in 1932, the time when this investigation was begun, was modified in favor of an improved method of scoring. This method of scoring is described in detail in Appendix B. On the basis of this method of scoring the median for the entire group, the upper and lower quartiles, and the range of scores were determined. These are shown in Table VIII. This table gives the data for the entire group of subjects and also for four subgroups, namely, the high-school pupils, the entire group of subjects studying art, the non-art adults, and a select group of the thirty art students having the most training. It is interesting to note that the medians for the entire art group, namely, 177.3, and for the non-art group of adults, 176.5, are practically identical. It is interesting to note, also, that the high-school pupils' median was only slightly lower, namely, 173.0. The median for the selected group of thirty mature art students was 177.0.

In order to make a special study of those ranking high and low on the art test special tabulations were made for those subjects from the entire group who ranked in the upper and the lower quartiles. By eliminating

¹ Margaret McAdory, *McAdory Art Test* (New York: Bureau of Publications, Teachers College, Columbia University, 1929). Pp. 72.

the middle 50 per cent, whatever characteristics are found for the remaining two groups will be less affected by overlapping abilities and will give a clearer picture of whatever differences exist between the two groups.

TABLE VIII
SCORES ON MCADORY ART TEST FOR ADULT AND HIGH-SCHOOL SUBJECTS*
(Based on Revised Method of Scoring)

Group	Number of Cases	Median	Upper Quartile	Lower Quartile	Range
All adults	185	176.3	183.2	168.6	124-99
High school	44	173.0	180.5	167.0	121-94
All art students	59	177.3	183.3	169.4	124-99
Non-art adults	82	176.5	183.9	168.3	125-96
Selected art group	30	177.0	185.5	167.5	124-99

* The scores of three adults are omitted from these computations since these subjects were added after this part of the study was completed. The three scores were 170, 190, and 194.

TABLE IX
COMPARISON OF AVERAGE DURATION OF FIXATIONS IN RELATION
TO TRAINING AND ABILITY IN ART
(Based on Average for First Twenty-five Fixations)

Picture Number	Total Number of Cases	By Work in Art School			By Quartile on Art Test	
		Art	Special Art Group	Non-Art	High Quartile	Low Quartile
2	80	8.7	8.2	9.2	9.2	8.6
8	59	9.3	8.9	10.4	9.6	10.1
9	82	8.0	7.8	9.6	9.4	9.1
12	93	8.7	7.8	10.3	10.0	9.4
13	61	9.0	8.6	9.5	8.9	8.5
32	59	9.9	10.4	10.3	9.6	9.8
47	98	8.8	8.7	9.5	9.2	9.3
Average		8.9	8.6	9.8	9.4	9.3

If there are any consistent differences due to special ability, as shown by the scores on the art test, or due to training, as evidenced by several years study in an art school, one would expect them to be displayed in duration of fixation pauses. This possibility was tested by such comparisons as are shown in Table IX, which is based on seven of the pictures used in this investigation.

As shown in Table IX, the group of art students made on the average

8.9 thirtieths of a second per fixation pause, while the duration for the non-art group was 9.8 thirtieths. Furthermore, this difference was consistently true for each of the seven pictures as well as the average, the duration of fixations for the non-art group being longer in every case. Likewise, when the group of 30 specially selected art students was studied in the same manner, the tendency for students of art to make shorter fixations than the non-art group is quite consistent. It was found that the average duration of their fixations was 8.6.

When the higher quartile and the lower quartile groups on the art test are compared, no consistent differences are found. For four of the pictures those in the high quartile made longer fixations than those in the low quartile. For the other three pictures the reverse was true. As far as this investigation is able to determine, duration of fixation pauses during the first twenty-five fixations shows no significant difference between the two groups classified by score on the art test.

In view of the fact which has been shown earlier that the duration of fixations increases during the latter part of a long observation of a picture, a special comparison was made of Fixations 76-100 for a group of 26 subjects who ranked in the lower quartile on the test and 33 subjects who ranked in the upper quartile. Using all the pictures for these subjects where there were as many as 100 fixations, the average duration time for Fixations 76-100 was 9.3 thirtieths of a second for the upper quartile and 9.7 for the lower. For this same group of subjects looking at the same pictures the corresponding averages for the first 25 fixations were 8.5 and 8.4 thirtieths of a second. In both groups the average duration of a fixation increased during the latter part of the film, but the differences in average duration between the two groups for the same series of fixations was very small. The specially selected group of 30 art students made an average duration of 8.8 thirtieths of a second for Fixations 76-100, which is shorter than the averages for both upper and lower quartile groups.

In respect to duration of fixations, the group which had studied art made consistently shorter durations, both during the first 25 fixations in looking at seven different pictures and during Fixations 76-100. On the other hand, ability as measured by the art test apparently has little relation to duration of fixation pauses. Attention will now be given to the possible effects upon position of fixations and centers of interest.

Comparisons were made both by general distribution of fixations in

group density plots and by tabulations of the percentage of fixations in each of the sixteen rectangles of various pictures. The results here, as in the case of duration of fixation, were not conclusive. Minor differences were apparent from picture to picture, but no consistent major differentiation in the patterns of perception could be identified. The average differences between the groups were so much less than the individual differences within each group that the results cannot be considered significant.

The following comparisons may be cited as random samples of the differences which were found. In looking at Picture 47, a cathedral interior, those subjects in the upper quartile on the art test gave much more attention to the lower half of the picture, whereas subjects in the lower quartile gave more attention to the upper half of the picture. However, the paired groups of subjects available for this particular comparison was small, there being but sixteen cases in each quartile. For these two groups of sixteen cases the upper group had 55.3 per cent of its fixations in the lower half of the picture, whereas the lower quartile had 55.8 per cent of its fixations in the upper half.

For Picture 9, "Stowing the Sail," the subjects in the upper quartile on the art test placed 49.6 per cent of their fixations in the center four rectangles, whereas those in the lower quartile placed 57.2 per cent of their fixations in the same area.

For Picture 2, "Mount Equinox, Winter," in color, the subjects were divided into thirds. Of those in the upper third according to the art test, 2.2 per cent of the fixations were on the top row of rectangles, that is, the row including the blue sky, whereas for the lower third on the test 8.8 per cent of the fixations fell on this area of the picture. For the same picture the rectangles that received the most attention from all subjects, namely, Rectangles 6 and 10, received from the upper quartile group 30.6 per cent of all their fixations, while from the lower group these two rectangles received 38.3 per cent of all their fixations.

Random differences such as those just described could be cited in considerable number, but the writer has been able to discover no consistent pattern of difference when all of the results are considered together. The conclusion to which he is forced, therefore, is that rank on an art test or experience in an art school does not affect the perceptual pattern in looking at a picture enough to make apparent any characteristic differences between the two groups.

It is possible that the methods of classifying the groups are not sufficiently valid to make apparent real differences that may exist. However, no better methods of classification were available for this investigation nor does the writer know of any other objective method to suggest by means of which subjects for such an experiment might be classified more precisely in terms of artistic ability or lack of ability. The differences, whatever they may be, which exist between persons with and without artistic ability evidently exist in the central processes of the mind rather than in the perceptual pattern of the eyes. In view of the differences which are so easily apparent between mature and immature readers, both of the vernacular and foreign languages, this conclusion to which one is forced from the data at hand is in no sense satisfactory and must be considered as tentative.

COMPARISON OF CHILDREN AND ADULTS

The comparison of children and adults was based mainly upon two pictures: Picture 34, two French mannikins, and Picture 12, "The Solemn Pledge." The eleven subjects used were from the sixth grade of the elementary school, with the exception of one child from Grade IV.

Table X shows the data in regard to duration of fixation pauses for Pictures 34 and 12. For Picture 34 average duration for the entire group of adult subjects was 9.2 thirtieths of a second, whereas for the children it was 10.2 thirtieths. However, for Picture 12 the corresponding averages were 10.6 thirtieths for fixations by the adults and 9.5 thirtieths for fixations by the children. In one case the average duration for the children was shorter; in the other case the average for the adults was shorter.

In the previous discussion of duration of fixations it was pointed out that for the entire group of subjects there was a tendency for the fixations to get longer as the subject continued to look at the picture. This tendency is also apparent with children. For Picture 34 the children showed an average of 7.9 thirtieths of a second for the first fixation, an average of 7.6 for the first five fixations, 8.6 for the second five, and 10.6 for the last five. For Picture 12 the corresponding averages for the group of children were 5.5, 8.6, 8.1, and 10.2.

If one may judge from duration of fixations, children at the sixth-grade level show substantially the same characteristics as adults. In the case of reading, children make longer fixations than adults and the process of learning to read is characterized by a negatively accelerated shortening of

groups are not sufficient to exist. However, this investigation nor suggest by means of differences, whatever without artistic ability than in the perceptions which are so easily of the vernacular proceed from the data as tentative.

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the duration of fixations. However, in the process of reading most of this learning takes place prior to the sixth grade. There is apparently no evidence of a similar process of "learning" to look at pictures, at least as far as sixth-grade children are concerned. It is difficult to photograph the eye movements of younger children, due to the fact that they do not sit still for a sufficiently long period of time. The type of head movements which young children make are particularly disturbing for vertical fixations. The head rest could be tightened sufficiently to hold them still, but if this were done their reactions would scarcely be normal. One eight-year-old child was photographed in looking at Picture 5, "The Grief of the Pasha."

TABLE X

COMPARISON OF DURATION OF FIXATIONS FOR CHILDREN AND ADULTS

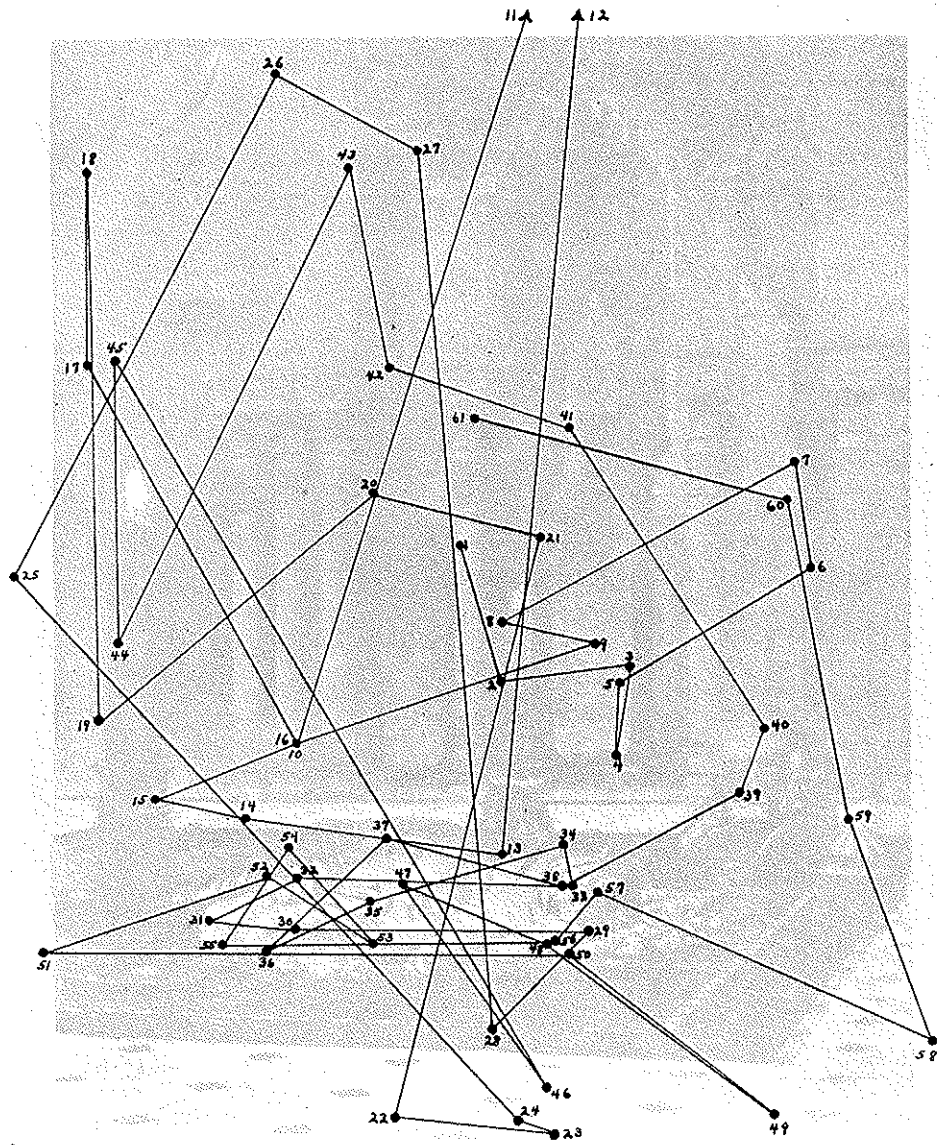
NUMBER OF PICTURE	TYPE OF SUBJECTS	NUMBER OF CASES	AVERAGE DURATION OF FIXATIONS						
			Entire Picture	First Fixation	First Five Fixations	Second Five Fixations	Last Five Fixations	Longest	Shortest
34.....	Adult	28	9.2	5.7	8.0	9.3	9.2	30.9	3.6
	Child	10	10.2	7.9	7.6	8.6	10.6	40.7	3.2
12.....	Adult	73	10.6	6.0	8.3	10.7	10.7	43.5	3.6
	Child	12	9.5	5.5	8.6	8.1	10.2	32.8	3.4

His record is shown as Plate LXIV. He showed a tendency to look off the edge of the picture several times, his eleventh and twelfth fixations falling so far above the picture that they are not recorded on the plate. It is interesting to note that not until the twenty-ninth fixation was there any detailed examination of the tiger. This particular boy was evidently more interested in the architectural characteristics and decorations in the building than in the animal. The durations of fixations, as indicated on the plate, were brief, the longest fixation being 16 thirtieths of a second. The average duration for the entire picture is 7.1 thirtieths of a second. The adult average for the same picture is 8.9.

PERCEPTUAL PATTERNS OF ORIENTAL SUBJECTS

In view of the differences between Oriental and Western art an attempt was made to compare the perceptual processes of a group of Oriental subjects with those of American subjects. Certain difficulties were encoun-

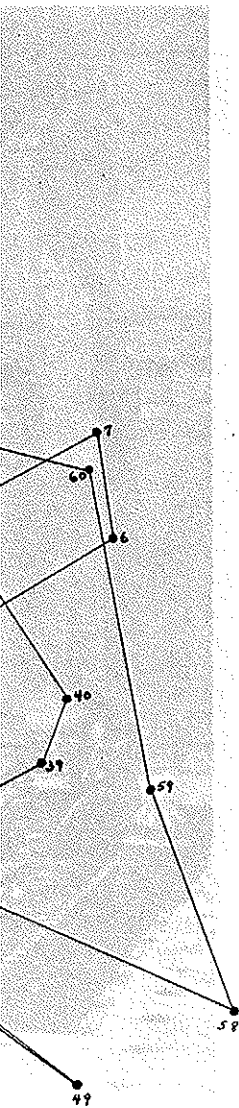
PLATE LXIV



RECORD OF SUBJECT 197, PICTURE 5

1-5	8-4	15-9	22-5	29-7	36-7	43-5	50-8	57-10
2-4	9-5	16-7	23-8	30-6	37-4	44-6	51-6	58-7
3-8	10-8	17-5	24-16	31-7	38-4	45-14	52-6	59-6
4-13	11-6	18-7	25-13	32-6	39-6	46-7	53-4	60-5
5-5	12-6	19-10	26-5	33-6	40-13	47-13	54-7	61-7
6-6	13-11	20-5	27-6	34-7	41-8	48-5	55-8	
7-6	14-8	21-8	28-5	35-7	42-7	49-4	56-5	

tered which makes the comparison less significant than it was hoped it might be. In the first place, the number of Chinese and Japanese subjects available was limited. In the second place, a good many who could be secured wore glasses and were not able to look at pictures normally without them. In the third place, some of the subjects who were used did not hold their eyes open sufficiently wide to get a good photograph. Consequently, valid records which could be plotted accurately were secured from only six of the Oriental subjects. The pictures used were the two Japanese prints, Pictures 13 and 14. The number of cases is too small to attempt to treat them statistically. A comparison of the plotted records shows no consistent difference between the Oriental subjects and the American subjects. In the case of Picture 13, "The Wave," each of the Oriental subjects who looked at this picture concentrated somewhat more than was typical of the American subjects upon some one point in the picture. However, the point of concentration was different for different subjects, one of them concentrating on the snow-capped mountain, a second one making a large cluster of fixations at the crest of the wave, and a third finding the principal center of interest in the left central part of the picture. For Picture 14 this characteristic of concentration was not particularly obvious, and if the plottings for the Oriental subjects were mixed with those of the American subjects, it would be impossible to identify, simply by looking at the plottings, which belonged to either group. If there is a difference in pattern of perception between Oriental and American subjects, it was not revealed in the data available in this investigation. Likewise, in duration of fixations the Oriental subjects showed no marked deviation from the American subjects.



50- 8	57-10
51- 6	58- 7
52- 6	59- 6
53- 4	60- 5
54- 7	61- 7
55- 8	
56- 5	

CHAPTER VI

VARIATIONS IN PERCEPTION DUE TO DIRECTIONS FOR LOOKING AT PICTURES

THE mental "set" obtained by the directions given for looking at a picture obviously influences the characteristics of the perceptual process. Several types of directions were used in this investigation. In general, the subjects were told simply to look at the pictures in their normal manner, whatever that was. However, in certain special cases the directions were varied to see the particular effects obtained.

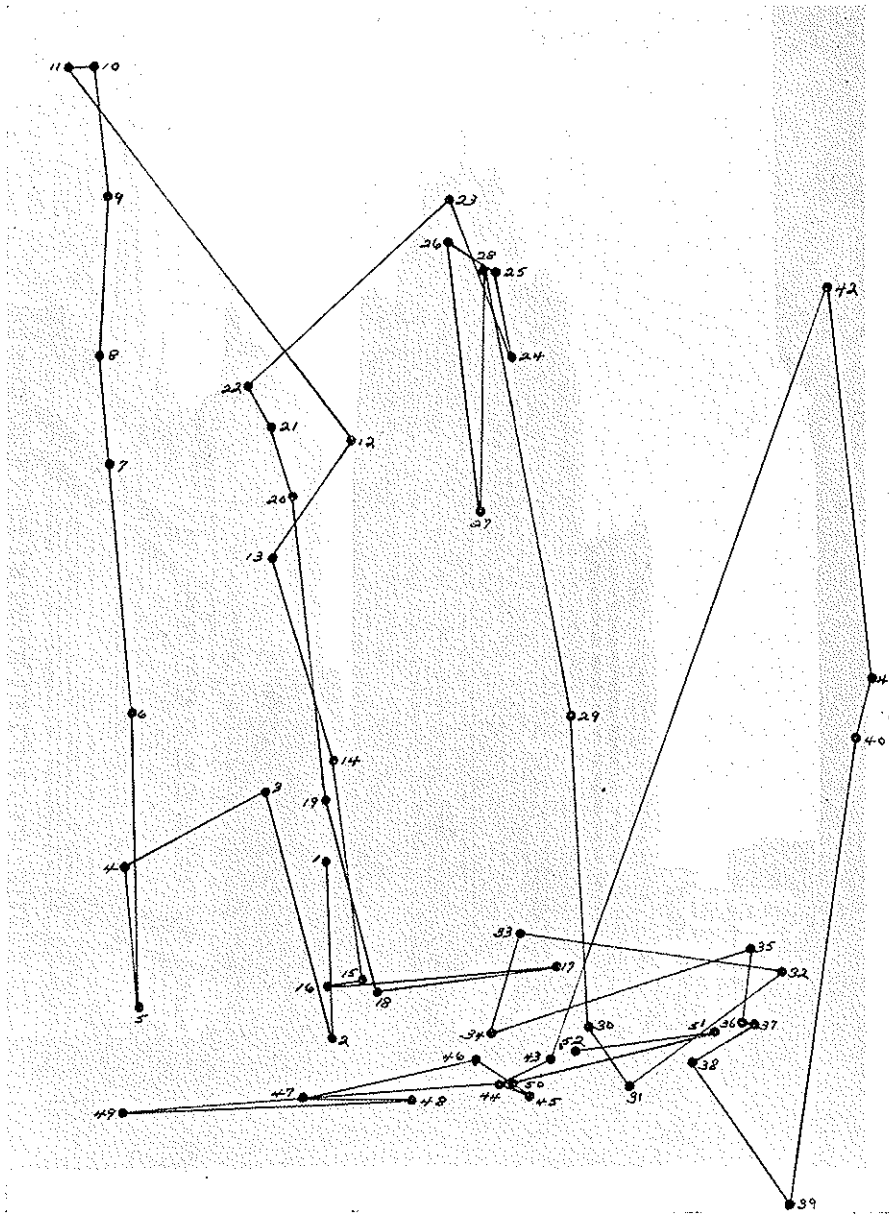
Plates LXV and LXVI show two records of the same subject in looking at Picture 43, the Tribune Tower. Plate LXV was obtained in the normal manner without any special directions being given. After that record was secured, the subject was told to look at the picture again to see if he could find a person looking out of one of the windows of the tower. Plate LXVI shows the results of this detailed search. By tracing the lines of successive fixations the trend of this searching movement can be observed. It is apparent that the subject made a very detailed examination of the tower, digressing once to look at the clock tower at the left of the picture and digressing three times to look at the people in the lower part of the picture. In the first picture, Plate LXV, there are only 2 of the 52 fixations which are 20 or more thirtieths of a second in duration. In the second picture, Plate LXVI, there are 13 out of 107 fixations which are 20 or more thirtieths of a second in duration. In Plate LXV there are 25 of the entire 52 fixations which are 7 or less thirtieths of a second in duration, whereas in Plate LXVI there are in the first 52 fixations only 16 which are equally short. The change in directions to look carefully for a given characteristic of the picture produced a much more detailed examination and also longer fixations.

A second variation in directions for looking at pictures was obtained by having one group of subjects look at a series of pictures without any special directions after which they were given a page of comment on the pictures which they had just observed. Following their reading of this body of descriptive material a second photograph was taken of their eye

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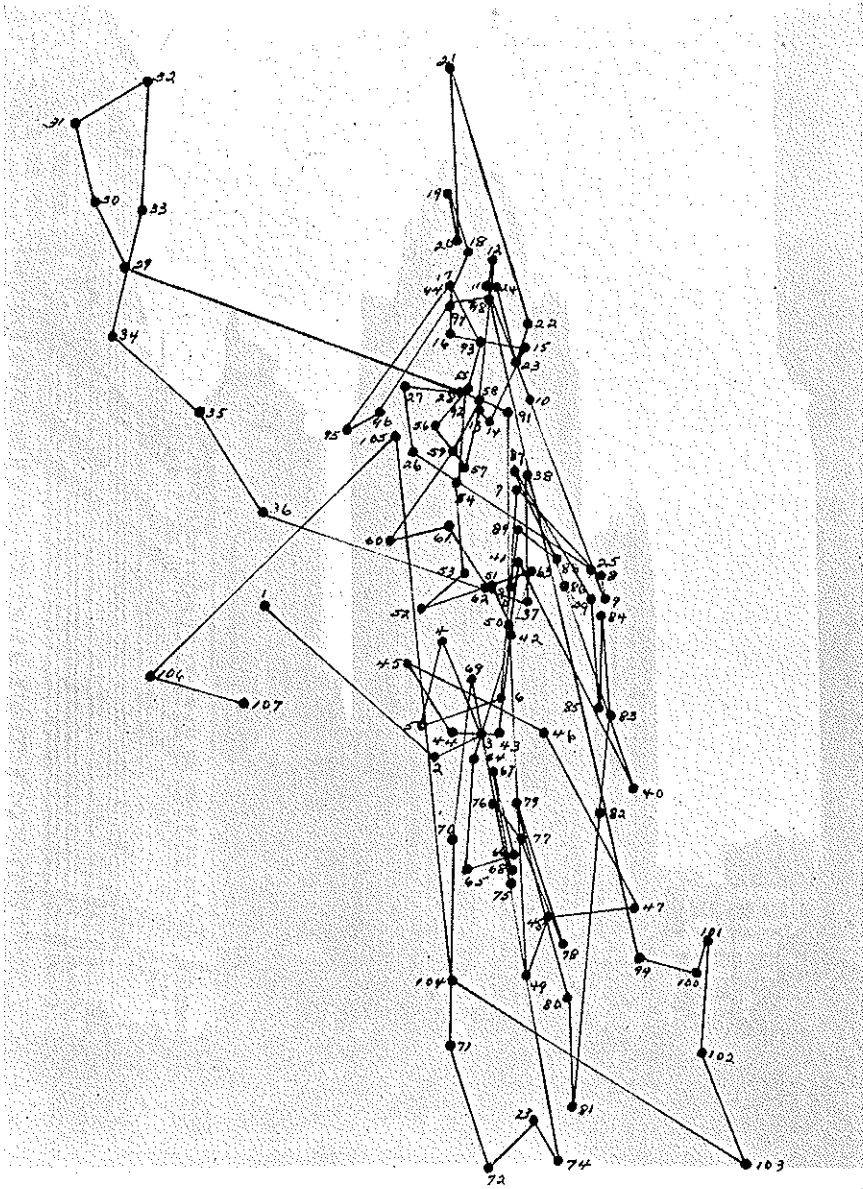
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RECORD OF SUBJECT 9, PICTURE 43

1-16	7- 6	13- 7	19- 4	25- 6	31-10	37- 6	43- 8	49-17
2-11	8- 5	14-14	20- 6	26- 7	32-12	38- 3	44- 7	50- 7
3- 4	9- 5	15- 9	21- 5	27-17	33- 8	39-12	45-12	51- 6
4- 8	10-49	16- 6	22- 5	28- 9	34- 4	40- 7	46- 5	52-11
5-10	11-21	17-10	23-11	29- 6	35-13	41- 6	47-11	
6- 5	12- 6	18- 5	24- 7	30- 9	36- 9	42-10	48- 8	

PLATE LXVI



RECORD OF SUBJECT 9, PICTURE 43

1- 4	12-13	23-10	34-10	45-24	56-11	67- 7	78- 5	89- 5	100- 5
2- 8	13-17	24- 9	35- 7	46- 6	57-13	68- 5	79-28	90-14	101- 8
3- 4	14- 5	25- 9	36- 9	47- 7	58-30	69-28	80- 9	91- 8	102- 4
4-12	15-21	26- 8	37- 7	48-10	59-22	70-11	81- 9	92-10	103- 3
5- 6	16-12	27-11	38- 7	49- 9	60-20	71-14	82- 8	93- 8	104- 4
6-24	17- 7	28-28	39- 4	50-11	61-11	72- 6	83- 5	94-15	105- 5
7-14	18-12	29- 6	40- 7	51-21	62-13	73- 7	84- 7	95- 5	106- 8
8- 8	19-10	30-10	41- 8	52-15	63-30	74- 8	85- 5	96- 8	107- 4
9- 8	20- 8	31- 6	42- 6	53- 7	64- 7	75- 8	86- 5	97- 5	
10-10	21- 8	32- 4	43- 9	54- 8	65- 6	76-17	87-10	98-14	
11-14	22- 8	33- 8	44-21	55- 7	66-10	77- 5	88-20	99- 6	

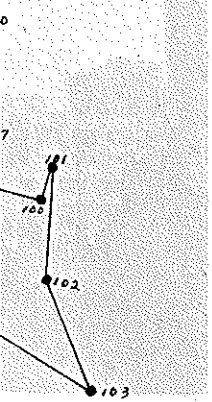
movements. The page of material was designed to arouse interest in particular parts of the picture and to stimulate a somewhat different type of observation. The situation was alternated so that for some pictures the subject first looked at the picture, then read the descriptive material, and then looked at the picture again; whereas for other pictures the descriptive material was read before the picture was observed at all. The results of these comparisons can be obtained in numbers of fixations made on the picture, which is an indirect measure of the degree of interest in it, since the subject was permitted to look at it as long as he wished. Also, comparisons are made in terms of the average duration of fixation pauses in the two cases, and in the centers of interest before and after reading.

Records for Picture 11, "The Judgment of Paris," and Picture 12, "The Solemn Pledge," showing eye movements before and after reading were obtained from a small group of six subjects. For Picture 11 the average duration of fixations before reading was 9.6, while after reading the average was 10.7. The corresponding averages for Picture 12 are 12.5 before and 11.00 after reading. Further study will be needed before generalization is possible.

One consistent difference which appeared was the tendency to look at the picture for a longer time after the reading. For Picture 11 the average number of fixations before reading was 61.3, while after reading the average number of fixations was 108.8. The corresponding averages for Picture 12 are 77.0 and 91.8.

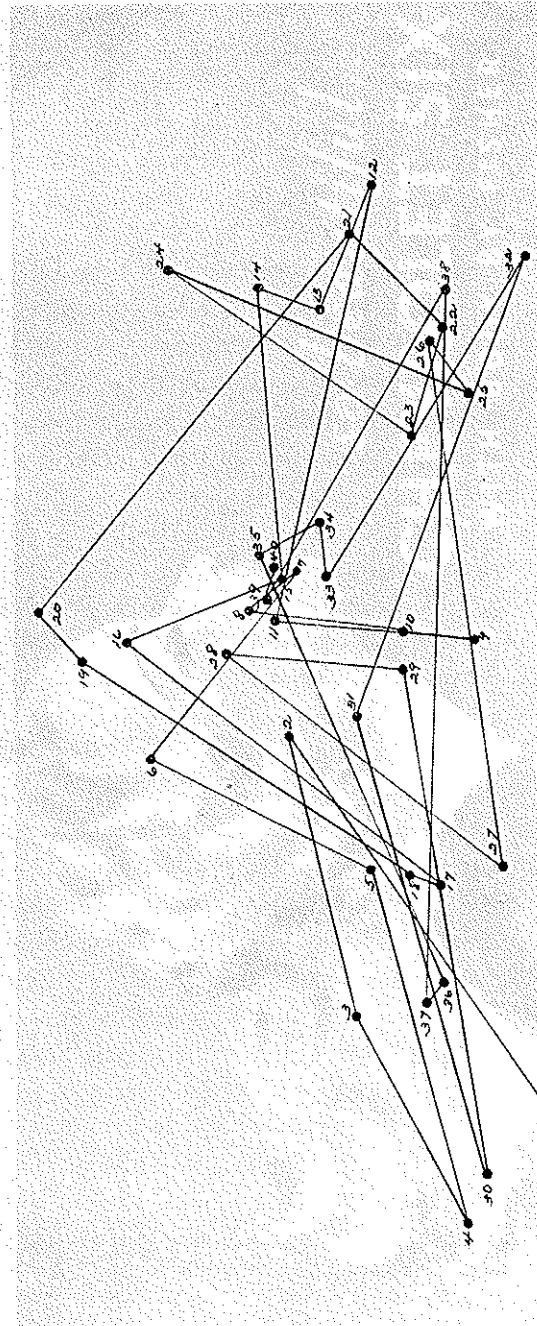
A third general direction of a different sort was used for Pictures 37 and 38, in which case the subject was asked to choose which of the various panels he liked best. The reaction of subjects to these pictures has been described in an earlier chapter. In order to clarify the effect of the directions a tabulation was made of the number of fixations upon each of the panels as compared with the one which the subject said he liked best after he had finished looking at the pictures. As would be expected, there were more fixations upon the panel which was preferred in the majority of cases, although notable exceptions were apparent, such as Subject 10 who gave over twice as many fixations to one panel which he did not like than to the one which he preferred.

One additional item of the study had to do with eye movements in looking at a series of three advertising posters. These posters are shown in the Appendix as Pictures 48, 49, and 50. The posters chosen were se-



3-5	89-5	100-5
9-28	90-14	101-8
1-9	91-8	102-4
1-9	92-10	103-3
2-8	93-8	104-4
1-5	94-15	105-5
1-7	95-5	106-8
1-5	96-8	107-4
1-5	97-5	
7-10	98-14	
3-20	99-6	

PLATE LXVII



RECORD OF SUBJECT 27, PICTURE 48

1- 9	7-11	10- 9	13- 5	16- 6	19-10	22-11	25- 4	28-24	31- 8	34- 9	37-13	40-15
2- 8	8-15	11-16	14-19	17- 5	20-20	23- 8	26- 7	29- 6	32- 9	35- 8	38- 6	
3- 8	9- 5	12- 7	15- 9	18-10	21- 9	24- 8	27-13	30- 4	33- 8	36- 6	39- 6	

RECORD OF SUBJECT 27, PICTURE 48

1-9	4-8	7-11	10-9	15-5	16-6	19-10	22-11	25-24	31-8	34-9	37-13	40-15
2-8	5-8	8-12	11-10	14-10	17-5	20-20	23-8	26-6	29-9	32-8	35-6	
3-8	6-12	9-3	12-7	15-9	18-10	21-9	24-8	27-4	30-3	33-6	36-6	

lected because they had received awards for special merit in the year in which they were designed. In each case there was a small amount of printing in large type on the poster relating to the object advertised. In view of the fact that the primary purpose of a poster is to advertise, it is interesting to note the relative amount of attention given to the picture and to the printed material. The plotting shown in Plate LXVII is typical of those obtained from the three posters. As would be expected, the picture of the girl was the principal center of interest. Not until the twelfth fixation was any attention given to the car which is advertised and then for a brief succession of three fixations. The eye returns again to the printing for Fixation 21, but swings back to the girl's face and hair on Fixation 27. On Fixation 32 the eye once more returns to the printing, but only for the one fixation.

The technique of photographing eye movements in looking at advertising pictures has obvious advantages, both for the art designer and for the advertiser. It is assumed that the purpose of the picture in an advertisement of this type is to catch and hold the attention until the eye is lead to the description of the material to be sold. Obviously, a certain amount of balance is desirable between these two elements. In terms of the extensive use to which a single poster is often put the reactions of a sample group of subjects, selected from the class of individuals to whom the advertisement is supposed to appeal, would be of great value in the selection of picture advertising. There is a great variety of problems in the field of commercial art to which this type of technique might be applied to advantage.