HUMAN EXPLORATORY BEHAVIOR IN A SPONTANEOUS VERSUS A LABORATORY SETTING

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CHAPTER I

REVIEW OF THE LITERATURE AND STATEMENT OF THE PROBLEM

Introduction

Recent research reflects an increasing interest in the quantitative specification of the stimulus determinants associated with exploratory and observing behavior (e.g., Berlyne, 1960, p. 38). One methodological problem attending the investigation of exploratory behavior is the artificiality imposed by the restrictions associated with laboratory settings (cf. Welker, 1960). To provide an indication of the generality of data collected in a laboratory setting, exploratory behavior (more specifically, viewing time) was measured in a natural setting and compared with that observed in a laboratory one. A secondary purpose was to determine if subjects (*S*s) who spontaneously examine patterns are representative of the same population from which *S*s have characteristically been drawn for studies of human exploratory behavior.

Review of the Literature

The literature pertinent to the experiment reported in this thesis includes (a) studies comparing exploratory behavior under "natural" and under "laboratory" conditions, (b) studies relating molar measures of "complexity" to exploratory behavior, (c) studies relating more analytic measures of complexity to exploratory behavior, and (d) methodological attempts to specify the physical parameters of visual form.

Studies Comparing Exploratory Behavior under Natural and under Laboratory Conditions. This author is familiar with only one human study employing a natural setting simiiliar to the one used in this thesis. Marston (1927), in measuring the introversion-extraversion dimension of personality, traced the paths followed by a group of children as they wandered through a museum. The children were unaware that their movements were being recorded. Slowness in moving from one exhibit to the other and poor attention to exhibits were taken as indicators of introversion, whereas spontaneous interest in the exhibits, i.e., rapid movement from one to the other, was taken as an indicator of extraversion.

The natural versus the laboratory distinction made here is clearly analogous to the "free" versus "forced" situations which Welker (1957) has used in his investigation of exploratory behavior. Under the forced condition the animal is placed directly into an open, illuminated chamber and under the free condition it is allowed freedom of choice to enter the same situation from a small darkened box adjacent to the exploratory chamber. Welker has found that exploratory behavior differs in these two situations. In general, rats show less activity in the exploratory chamber when they are free to enter it. He has suggested some reasons as to why this difference occurs. For example, he interprets responses by rats to highly novel stimuli in free situations in terms of an exploratory or curiosity drive and responses to novel stimuli in forced situations in terms of escape motivation (1957). Ehrlich and Burns (1958) and Segall (1959) have shown that highly novel or complex situations evoke mild avoidance reactions which they also interpret in terms of anxiety or escape motivation. Hayes (1960), however, believes that Welker's suggestion that fear initiates exploratory behavior is unwarranted. His data, like Welker's, showed that rats tended to avoid a strange place, if possible, but that those rats most inclined to do so were least active when confined in it, a result Hayes considers incompatible with the escape-directed hypothesis.

Studies Relating Molar Measures of Complexity to Exploratory Behavior. Berlyne (1958), using the method of triads to present patterns with varying degrees of complexity to 3-to-9-month-old infants, noted that the most complex stimulus in each series of the three patterns was significantly more likely to attract first fixations. Berlyne reported that the two stimulus patterns in the series containing more contour elicited "attentive" behavior to a greater extent than the others. Studying the relations of stimulus complexity to observing responses in pre-school children, again with the method of triads, Cantor, Cantor, and Ditrichs (1963) found a significant "complexity level effect". The Ss spent more time observing highly complex patterns as compared with patterns of medium or low complexity. Berlyne (1958) using adult human Ss, found a significant positive relationship between the number of elements defining his patterns and orienting responses. In contrast to the above findings, one conclusion of a program of research conducted by Spitz and Hoats (1961) dealing with the relation of stimulus complexity to certain behaviors of institutionalized high-grade adolescent retardates was that groups of retardates and normals showed a decided preference for less complex stimuli when given a choice between stimuli representing two levels of complexity.

Investigating the persistence of visual exploratory behavior in rhesus monkeys, Butler (1954) observed that the degree of responsiveness to visual incentives depended upon the class of visual stimuli employed: the _S_s performed manipulative tasks to view other monkeys or moving toy trains more often than to view an empty chamber. In very molar terms, the results suggest the importance of such variables as movement, number of elements, and other variables related to complexity in an essentially free situation.

Studies Relating More Analytic Measures of Complexity to Exploratory Behavior. Quantification of form dimensions began with the impetus received from information theory (Shannon, 1948). Brown (1966) has observed that since then such seemingly diverse areas as discrimination learning (e.g., Fisher, 1959), exploratory and related forms of behavior (e.g., Berlyne, 1960), complexity ratings of forms (e.g., Attneave, 1957), and the retention and recognition of visual patterns (e.g., French, 1954), as well as information theory, have all contributed to the current press for "...a specification and measurement of physical form parameters" (Attneave and Arnoult, 1956; Michels and Zusne, 1965; Zusne, 1965). For example, Hochberg and McAlister (1953), in their study of "figural goodness", have measured information load in terms of number of elements; French (1954) using highly specified dot patterns, has found that increased complexity (amount of information) facilitates recognition, though a curvilinear relationship occurred when the task was identification. In research concerned with discrimination learning, Fisher (1959) has reported that racoons more easily discriminated between 6-sided shapes than between 4-or-5 sided shapes. Attneave (1957) has shown that number of elements, number of independent turns, symmetry, and angular variability are important factors in judgements of complexity.

A reflection of this trend, i.e., an increasing interest in the physical determinants of behavior, is also seen in attempts to determine the properties of patterns associated with exploratory behavior. Brown (1966) has shown that the number of components making up patterns is important to exploratory behavior in rats, and Nance and Wheeler (1965), using patterns containing 3, 6, and 12 shapes, have reported that the viewing time of squirrel monkeys significantly increased as the number of components constituting the patterns increased.

Although number of turns, symmetry, and angular variability accounted for nearly all of the variance in subjects' complexity ratings (Attneave, 1957), in a series of studies conducted by Brown and his students using both human and animal Ss, the number-of-turns variable has been related to viewing time only inconsistently. From data obtained under three instructional sets, Brown and Farha (1966) found that patterns containing nine-sided shapes were viewed longer under "neutral" and "interestingness" sets, whereas three-sided shapes were viewed longer under a "pleasingness" set. Again, time spent viewing nonsense shapes was found to be significantly related to number of turns in a study conducted by Beaver and Brown (1963). In contrast, Brown and O'Donnell (1966) obtained non-significant results with respect to the same variable. With human Ss they did find further support for the importance of number of components and angular variance to "attentional" responding; with monkeys only the number-of-components variable reached significance. Brown and Lucas (1966) have completed a study with human Ss in which number of components, angular variance, and dissimilarity of border width had a significant effect on viewing time measures, while number of turns and border width did not. In general, non-informational variables, such as color (Brown and Farha, 1966) and border width (Brown and Lucas,

1966) fail to significantly affect viewing time.

Methodological Attempts to Specify the Physical Parameters of Visual Form. A number of approaches have developed in an effort to identify the physical properties of visual form, and a resultant communication problem has developed from the diversity of operations of physical measurement employed in the construction of stimulus patterns for experimental use.

An early quantitative treatment of stimulus patterns was provided by Hochberg and McAlister (1953). Using as their stimulus dimensions (a) number of angles, (b) line segments, and (c) points of intersections of complex line figures, an inverse relationship was found between response probability and the amount of information required to define the dimensions of the pattern responded to.

Several forms of physical invariance (e.g., symmetry) have been described by Attneave (1954); in his 1957 study he employed six physical parameters of shapes, namely, (1) angular variability, (2) number of turns, (3) matrix grain, (4) curvedness, (5) symmetry, and (6) a size-invariant measure of dispersion, called "non-compactness" (see Attneave and Arnoult, 1956). Berlyne (1960, p. 38) has suggested "number of distinguishable elements" and "dissimilarity among elements" as parameters underlying complexity.

Drawing largely from the work of Attneave and Arnoult, Brown (1964) has more recently compiled the most extensive list of stimulus properties available by which visual patterns may be described quantitatively. Included are such variables as border width; orientation; elevation; component proximity, and dissimilarity of curvature. In a thorough review of the metrics of visual form, Michels and Zusne (1965) classified physical form parameters into three major types:

> This classification is based on whether changes in the magnitude of the parameter affect the information content (as defined in information theory) or the structure of the shape, or both. Changes in the parameters of one type affect the information content as well as the structure of the shape so radically that they place it in another population of shapes. This type will be called transitive parameters. The number of inflections in the contour of a shape (i.e., sides of vertices) and the dicotomy of straight versus curved lines in the contour belong here. Changes in another type of parameter do not change either the information content or the structure of the shape, and only the response to the changed shape may be affected since the retinal image of the shape suffers transposition of either location or size, as when a shape is rotated or its area changed. This type of parameter will be called transpositional. Changes in the third type of parameter affect the structure of the shape but not the informational content. Thus, a triangle is still a triangle regardless of whether it is made thinner or more symmetrical than it was before. This type will be called intransitive.

Statement of the Problem

One methodological problem attending the investigation of exploratory behavior is the artificiality imposed by the restrictions associated with the experimental setting (Welker, 1961). Clearly, in situations employing measures of exploratory behavior the human subject (1) has committed himself to perform an experimental task for reasons unrelated to the task itself (e.g., he volunteers to serve as a subject to gain extra class credit), and (2) may become aware that the time he spends looking at each pattern is the behavior under observation. If exploratory behavior could be elicited in a more "natural" setting, i.e., one in which the subject is unaware that he is being observed, the results would provide an indication of the generality of data collected in a laboratory setting. The purpose of this research, then, was to compare data on exploratory behavior collected in an experimental setting with that obtained in a more natural situation. More specifically, the question was asked: Do stimulus properties found to be important to exploratory behavior in a laboratory setting also affect exploratory behavior in a natural one? Since a pilot study indicated that some subjects will not look at visual patterns spontaneously, a secondary purpose was to determine if subjects who do spontaneously examine patterns are representative of the same population from which subjects have been characteristically drawn for studies of human exploratory behavior.

CHAPTER II

METHOD

Subjects

The subjects (<u>S</u>s) were 60 under graduate volunteers, 30 men and 30 women, enrolled in introductory psychology classes at Oklahoma State University.

Apparatus and Stimulus Patterns

Eight stimulus patterns, all containing non-representational shapes varying in (1) Angular Variance (AV), (2) Number of Components, (NC), and (3) Number of Turns (NT), were painted with India Ink on 8 25 x 25-cm. squares of white cardboard. Four of the patterns are presented in Figure 1. The patterns were photographed and made into 2 x 2-inch slides with the shapes appearing black against a white background when projected onto a screen. Four practice patterns, each containing four or five shapes positioned in areas corresponding to those in the test patterns, were constructed in a random manner. Unfortunately, resemblance to the test patterns was not completely

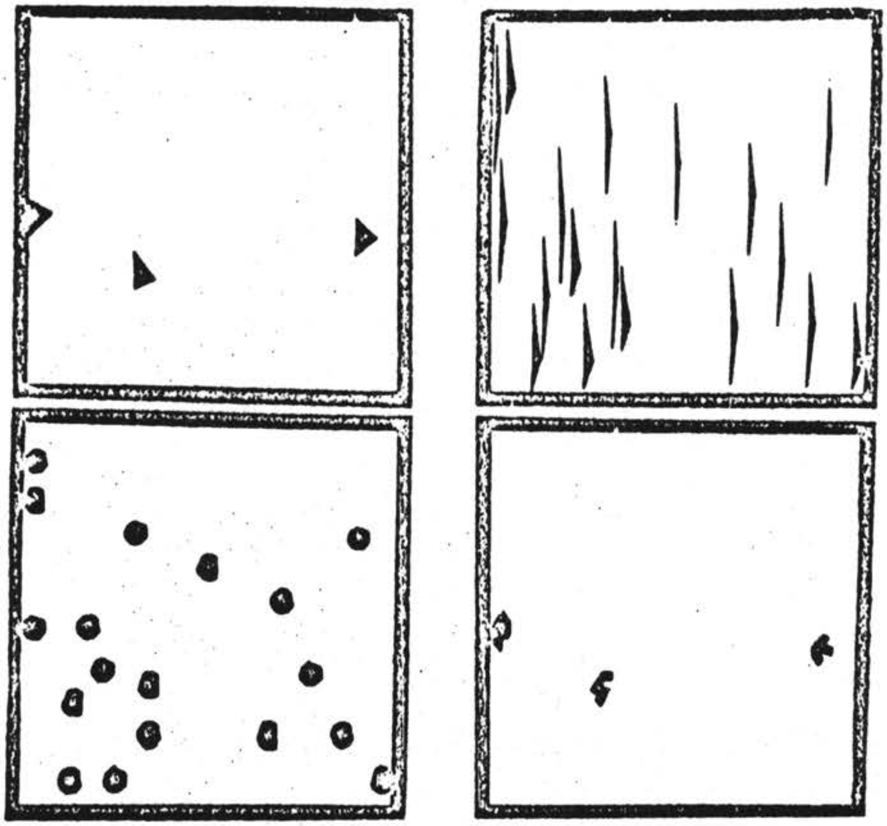

Figure 1. Reproductions of four of the test patterns. Pattern 1 (upper left) contains 3 triangles of low AV, Pattern 7 (upper right) contains 18 triangles of high AV, Pattern 6 (lower left) contains 18 12-angled polygons of low AV, and Pattern 4 (lower right) 3 12-angled polygons of high AV. The black frames have been added only for purposes of delineation.

eliminated, for two of the practice patterns contained the same triangles as the experimental patterns while the other two contained polygons unlike the nine-sided shapes in the test patterns. Construction of the patterns has been succinctly described by Brown and O'Donnell (1966):

> Number of Turns (NT) refers to the number of angles (or changes in curvature) which characterizes the contour of a shape. To provide shapes representing two levels of NT a pool of 50 triangles and 50 12-angled polygons was measuring the size of each of the turns in a shape's contour and computing the variance of the distribution of these measurements. All measurements are made with the interior of the shape as the point of reference so that convex turns are measured as less than 180° and concave turns as more than 180°. The AV of each of the 100 shapes was determined and the three triangles and three twelve-angled shapes with relatively low AV (mean AV = 246 and 249.7, respectively) were selected for experimental use. The shapes were chosen so each triangle with low (high) AV was matched as closely as possible in AV with one of the 12-angles shapes with low (high) AV. Each of the 12 experimental shapes was photographically reduced to an area of 200 mm^2.
>
> Number of components (NC) refers to the number of shapes which make up a pattern. The two levels of NC were 3 and 18. To prepare a prototype for the 18-component patterns a 25-cm. X 25-cm. grid was drawn and 18 cells were chosen by means of a table of random numbers. Measurements were taken on four properties of this prototype pattern (see Brown, 1964): the average distance separating the 18 cells (11.16 cm.), the standard deviation of the distance between the cells (6.07 cm.), the average "height" of the cells (10.39 cm.), and the average "dextrality" of the cells (10.72 cm.). A second 25-cm. X 25-cm. grid was then drawn and three cells were chosen so as to provide a 3-component prototype pattern with similar

pattern properties. The values of the 3-component prototype on the four pattern dimensions were 13.93 cm., 5.84 cm., 10.33 cm., and 10.67 cm., respectively.

Using the two prototype patterns eight experimental patterns were drawn on 25-cm. X 25-cm. squares of heavy white paper. Four of the patterns are presented in Figure 1.

The 3-component pattern containing triangles of low AV (Pattern 1) was prepared first. To do this the three triangles of low AV were randomly assigned to the three cells of the 3-component prototype pattern. Next, the 3-component pattern containing 12-angled shapes of low AV (Pattern 2) was prepared by assigning each 12-angled shape of low AV to the cell assigned (in Pattern 1) the triangle matched with it in AV. Patterns 3 and 4 (the high AV, 3-component patterns containing triangles and 12-angled shapes, respectively) were prepared in the same manner as Patterns 1 and 2.

To construct Pattern 5, the 18-component pattern with triangles of low AV, the three triangles of low AV were randomly assigned to the 18 cells in the 18-component prototype pattern, with the restriction that each shape occupy six cells. As above, the 18-component pattern containing 12-angled shapes of low AV (Pattern 6) was prepared by assigning each 12-angled shape of low AV to the six cells assigned (in Pattern 5) the triangle matched with it in AV. Also, as above, Patterns 7 and 8 (the high AV, 18-component patterns containing triangles and 12-angled shapes, respectively) were prepared in the same manner as Patterns 5 and 6.

All shapes were placed in a vertical orientation (see Brown, 1964). Since the shapes were 200 $mm.^2$ in area and the cells to which they were assigned were only 100 $mm.^2$, each shape was drawn by centering it by eye on its respective cell.

A right-handed desk-chair with a telegraph key attached to one arm was placed to the right of the entrance to the experimental room. The chair was located 4 feet 8 inches in front of a black plywood screen measuring 7 feet 3 inches in length and 5 feet in height. A 10 $inch^2$ window, covered with a tightly stretched sheet of tracing paper, was located 9 inches from the top of the screen and positioned 6 inches to the right of the chair. A second chair of molded plastic, a small table, an ashtray, and a variety of reading material were situated so that the subject's activities could be observed through a peephole with a diameter of .25 inches drilled in the plywood screen. To camouflage the peephole, a second hole was drilled 5 inches directly above it continuing a line naturally formed by the bolts holding the screen together. Preliminary inspection showed that subjects could not see through the peephole when seated properly in the chairs designated for them.

A blackbound scrapbook containing the four practice patterns followed by the eight test patterns, each encased in a transparent covering, was predominently placed among the other reading material. The first page was exposed, bearing the typed statement: "For the best effect, view these patterns in the order of their appearance." The scrapbook itself was labeled "Experimental Drawings".

Behind the screen was an elevated Airquipt Superba 77a slide projector, equipped with a solenoid-operated shutter so directed at the screen that the projected patterns bore the same special dimensions as those originally prepared. An Esterline Angus Event Recorder operated and recorded the opening and closing of the shutter mechanism. The slides were carefully placed in the projector magazine to assure the appearance of proper orientation of the patterns with respect to the subjects. The telegraph key, shutter, and the projector were so connected with a Marietta interval-timer that pressure on the key served to (a) close the shutter, (b) advance the slide magazine of the projector, and (c) reopen the shutter. The interval between exposure times was approximately 2 seconds.

Procedure

The 60 subjects who met the criterion of viewing patterns in the scrapbook spontaneously were alternately assigned to one of two experimental groups of 30 subjects each. Subjects in the "laboratory" group were interrupted after viewing the practice patterns and shown slides, whereas those assigned to the "natural" group were allowed to finish viewing the entire scrapbook.

When the S arrived he was shown to the experimental room, seated in the plastic chair facing the screen, and requested to "relax for a few minutes" while the apparatus was being set up. The scrapbook and reading material were within easy reach to the right of the chair. For the natural setting, the experimentor retired behind the screen to observe whether or not the subject viewed the patterns in the scrapbook spontaneously; if he did so within seven minutes, the experimentor manually operated a pen connected to the event recorder each time the subject turned a page. While the experimentor was readily able to see the top of a page as it was turned, the slant at which subjects held the scrapbook in their laps usually precluded any indication of the pattern being viewed, thus reducing the opportunity for experimentor bias to affect the viewing-time measures.

To control for order effects, the test patterns were presented in ten random orders, each order being used for three subjects. The practice patterns preceding the test patterns were used in an attempt to reduce the attentional effects of novelty.

The question arose as to whether or not the subjects who provide "spontaneous" data are representative of the same population from which samples are characteristically drawn in this type of research. It is clear that no direct comparison can be made between data obtained in a laboratory setting with those obtained in a natural one unless the samples taken in each situation are representative of the same population. To control for the possibility that subjects who looked at the scrapbook spontaneously represented a biased sample, the 30 _Ss_ of the laboratory group were selected only after they had begun to examine the patterns spontaneously. The subjects in this setting were interrupted after they had inspected only two of the practice patterns. The experimentor then announced that the apparatus was ready and seated the subject in the desk-chair. Slides bearing patterns identical to the test patterns in the scrapbook, preceded by the two scrapbook practice patterns the subsubject had not yet seen, were immediately presented to the subject in the same random orders as were used for the scrapbook presentations. Moreover, the projected patterns on the slides bore the same spacial dimensions and orientation as did the scrapbook patterns. However, due to difficulties in centering and focusing the patterns containing high values of number of components within the window screen, only 17 of the 18 components of the projected patterns were actually shown.

Instructions employed earlier by Brown and O'Donnell (1966) were presented to the subject in written form and he was asked to read them along with the experimentor. The instructions were as follows:

> A series of patterns will be presented in this window. The length of each presentation will be up to you. Look at each pattern for as long as you like, and, when you don't wish to see it any longer, press this button and the next pattern will be presented. When you press the button, push it briefly but firmly and then withdraw your hand completely and place it in your lap. If you don't keep your hand at some distance from the button, you may accidently trigger the apparatus before you wish to. You will not be tested on what you see or on any other aspect of the situation and there will be no shock or pain involved.
>
> Remember, look at each pattern only as long as you wish and then press the button and a new pattern will appear. I will tell you when to begin, and I will also tell you when the end of the series has been reached. Are there any questions?

The 60 subjects who met the criterion of viewing the practice patterns spontaneously were alternately placed in the two treatment conditions. More specifically, if one subject was allowed to view the entire scrapbook of patterns, the next subject was interrupted and shown the slides.

In the process of obtaining 60 spontaneous viewers, 176 volunteers who did not view the patterns spontaneously were rejected. Of these 65 were women, and 51 were men.

Of the 60 subjects who did qualify, the sexes were equally distributed. The laboratory group consisted of 17 men and 13 women while the natural group contained 17 women and 13 men.

CHAPTER III

RESULTS

Eight exposure times, each recorded to the nearest one-fourth of a second, were obtained from each of 60 subjects, giving a total of 480 observations. To control for extreme variability, the data was rejected if the subject viewed any pattern in the series for more than 20 seconds or less than 1.5 seconds in duration. Consequently, approximately 8 subjects were rejected. The exposure times were analyzed by means of an analysis of variance, with the data arranged in a 2 X 2 X 2 X 2 factorial design with repeated observations on the last three, i.e., the stimulus, factors. The summary of the analysis is presented in Table I.

It can be seen that no significant difference between the two observation conditions appeared. Thus, the natural group did not differ from the laboratory group in overall time spent viewing the patterns. Moreover, the conditions of observation failed to interact significantly with any of the three stimulus variables, showing that the

TABLE I

SUMMARY OF ANALYSIS OF VARIANCE

Source	df	MS	F
A	58	43.80208	.82673
B	406	23.85208	4.6156*
C	406	802.12551	15.5222***
D	406	36.85208	7.1313**
total	479		
error a	58	52.9840	
error b	406	5.1676	

* $P < .05$
** $P < .01$
*** $P < .001$

viewing time of the two groups were not differentially affected by the stimulus properties.

Patterns containing high values of angular variance were viewed significantly longer than patterns of low angular variance (M's = 6.86 sec. and 6.41 sec., respectively; $\underline{F} = 4.6156$, df = 1/479, $P < .05$). In addition, viewing time was significantly affected by the number-of-components variable (M's = 7.93 seconds and 5.34 seconds, for patterns containing 3 and 18 components, respectively; $\underline{F} = 15.5222$, df = 1/479, $\underline{P} < .001$). Finally, patterns containing nine-sided polygons were viewed longer than those containing triangular components (M's = 6.91 seconds and 6.36 seconds, respectively, $\underline{F} = 7.1313$, df = 1/479, $\underline{P} < .01$). None of the stimulus interactions approached significance.

CHAPTER IV

DISCUSSION

In contrast to Welker's finding (1957) that the behavior of rats in free and forced situations differ, there was no significant difference between the total times each group spent viewing patterns, i.e., in exploratory activity. Moreover, the two groups failed to differ in the "direction" of their exploratory behavior, e.g., both groups viewed nine-sided shapes longer than three-sided shapes. In addition to obvious differences (e.g., the subject species, and the response measure), the two studies are not strictly analogous methodologically. Although the subjects in the natural setting were "free" to view the scrapbook patterns, paralleling Welker's free situation, in a sense, they were "forced" to view the patterns in a prescribed sequence. In the laboratory setting the subjects were asked to view slides but were not forced to do so. In addition they entered the experimental situation quite voluntarily. While remaining possible, an escape-motivation interpretation seems inappropriate to describe the behavior of human subjects in such a laboratory setting.

The significant effect of the number of components and the angular variance on viewing time parallels the results of the Brown and O'Donnell (1966) study, and was hardly unexpected, since, aside from the differential treatment conditions, the present study was essentially replicatory. The number-of-components effect is consistent with a number of earlier studies of exploratory behavior employing number of elements or angular variance as an index of visual complexity. It has been found to correlate positively with exploratory behavior in rats (Brown, 1961); Dember, Earl, and Paradise (1957); visual fixation in human infants (Berlyne, 1958, observing behavior in pre-school children (Cantor, Cantor and Ditrichs, 1963), and observing behavior in human adults (Berlyne, 1963). Since scanning movements are largely confined to the contours of shapes (Zusne and Michels, 1965), and since the correlation of number of components and the amount of contour present in a pattern is a positive one, a positive relationship between viewing time and the number-of-components variable might well have been predicted.

The angular variance of shapes has also previously been found to be an important determinant of human attention (Brown and O'Donnell, 1966; Brown and Lucas, 1966). Brown and O'Donnell (1966) state that "Shapes of high AV tend to have longer contours than shapes of low AV, and, therefore, more time should be required to scan them." However, that differences in viewing time associated with differences in number of components or angular variance can be explained entirely on the basis of differences in time required to scan contours has recently been ruled out (Brown and Lucas, 1966). An alternative interpretation, in terms of information theory, would explain longer viewing times to shapes of high angular variance as resulting from increased "information".

The statistical significance reached by the number-of-turns variable was surprizing in light of the data of Brown and O'Donnell (1966) and Brown and Lucas (1966), and thus presents a more difficult problem for interpretation (cf. Brown, 1966). Two possible explanations are that (1) the subject population sampled in this study was different from that in the Brown and O'Donnell experiment (1966), but since this argument is counteracted by the similarity of the outcomes of the other manipulated variables (angular variance and number of components), a more likely interpretation is that (2) the lack of control for novelty led to the significant effect of the number-of-turns variable. More specifically, the triangles in the practice patterns were similar to those in the test patterns, whereas the polygons in the practice patterns were unlike the polygons in the test patterns. This would tend to make the test polygons more novel than the two triangles, and, hence, would favor greater exploration of the polygons.

The problem of interpretation of the number-of-turns variable relates to the larger question concerning the representativeness of the spontaneous viewers employed in this study as compared with those generally used in studies of exploratory behavior. Had the results of this study been identical to those of the Brown and O'Donnell study (1966), it might be concluded that the subjects were drawn from the same population. However, since number of turns was a significant variable in this study, no conclusions can be reached regarding the representativeness of the population sampled. It may well be that spontaneous viewers represent a biased sample, or, that the subject populations were the same, but that novelty factors entered into this study to produce the number-of-turns effect. If a control group had been instructed to look at the patterns and then compared with the spontaneous viewers, it might have been possible to determine if the laboratory group was representative. Such a control group would not have been completely satisfactory, however, since any difference between such a control group and the other two groups would still have had at least two explanations: (1) the spontaneous viewers might indeed not have been representative of the usual populations used in studies of exploratory behavior, or (2) the difference might be attributed to the effect of the instructions given to the control, but not the laboratory or natural, group.

Since no significant difference between the observation conditions was observed, and since none of the interactions was significant, both qualitatively and quantitatively the behavior of the laboratory and the natural group did not differ, a finding which argues positively for the generality of data on exploratory behavior obtained in a laboratory setting. The question concerning the representativeness of the subjects used, however, cannot be answered here, and remains a problem for further research.

Some of the more obvious criticisms of this study have already been mentioned: (1) the lack of control for the exploratory effects of novelty arising from a poor selection of practice patterns, (2) the lack of an adequate control in attempting to access the representativeness of the population employed in the study, and (3) the lack of a design clearly paralleling those of studies employing rats in free versus forced situations. Further, the patterns or figures within patterns may have had differential assosiation values for the subjects, since several subjects voluntarily reported specific associations informally at the conclusion of the experimental session.

Brown (1966) has pointed out another more general limitation connected with the physical specification of patterns. The specification of form, being spacial, is limited to the use of tactual and visual modalities. Consequently, findings relating to the physical determinants of viewing time and other measures of exploratory behavior in this and prior studies may be limited to these two modalities; for further generalization there is an obvious need for temporal and spatio-temporal specification as well.

The dependent measure, viewing time, is vulnerable to two major criticisms: (1) a restriction on the number of variables which can be manipulated simultaneously using a repeated-measures factorial design (Ss become "bored" when presented with more than 20 to 30 patterns), and (2) the variability in responses. Some arbitrary criterion was found necessary to eliminate responses of extremely long or short duration. It is to be remembered that in this study any series of responses which contained a response of less than 1.5 seconds or more than 20 seconds was rejected.

CHAPTER V

SUMMARY

The purpose of this study was to investigate a methodological problem attending the study of exploratory behavior, i.e., the artificiality imposed by the restrictions associated with laboratory settings.

An indication of the generality of exploratory behavior in a laboratory setting was obtained by (a) recording the time each of 30 Ss spent viewing a series of stimulus patterns on slides in a laboratory setting, (b) recording the time each of the 30 Ss spent "spontaneously" viewing a series of the same stimulus patterns in a scrapbook in a natural setting (i.e., one in which the Ss were not aware that they were being observed), and (c) comparing both groups with data previously obtained in an experimental setting which did not employ the criterion of preliminary spontaneous viewing imposed on both groups of this study.

No significant difference between the treatment conditions appeared. Moreover, the condition of observation failed to interact significantly with any of the three stimulus variables. Viewing time was significantly affected by each of the three stimulus factors: angular variance, number of components, and number of turns. It was concluded that viewing time under natural and laboratory conditions is not differentially affected by the properties of the stimuli.

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