THE EFFECT OF AN EXTRANEOUS AUDITORY STIMULUS ON ONGOING EXPLORATORY BEHAVIOR

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CHAPTER I

INTRODUCTION

In any given situation there are innumerable physical stimuli impinging on the receptors of an organism. Because of its physiological construction, however, the organism is only able to "focus" on a select few of these stimuli. The question arises: What properties do those few stimuli which are responded to have that favor their selection? "Novelty" has been suggested by Berlyne (1960 pp. 18-25) as one property of particular importance to stimulus selection and the concept of novelty has been found to be useful by many investigators (e.g. Darchen, 1952; Dember and Earl, 1957; Montgomery, 1953) attempting to explain the stimulus selection involved in various forms of exploratory behavior. Moreover, the results of a large number of studies (see Berlyne 1960) attest to the importance of novel stimuli to exploratory and orienting behavior.

In one subcategory of studies concerned with the exploratory effects of novelty, interest has centered on the effects of introducing new stimuli while exploratory

behavior is in progress. Berlyne (1957b), for example, found increased examination of patterns with the introduction of new colors. Most studies of this subcategory, however, have been concerned with the effects of altering the properties of the particular stimulus complex elliciting the exploratory responses. Little research interest has been directed to an examination of the effects of introducing stimuli extraneous to the exploratory situation. The present study represents an attempt to investigate the effects of a novel extraneous stimulus on ongoing exploratory behavior.

Berlyne (1960, 1963) has suggested that "arousal" plays a critical role in the mediation of exploratory behavior and, moreover, that level of arousal is "subject to the influence of a large number of variables whose effects will be additive and thus interchangeable (Berlyne, 1960, p. 209)." If an organism's level of arousal is already moderately high, exposure to additional arousal-producing stimuli might therefore be expected to drive the level even higher. If the new level should be sufficiently high to have disruptive effects on behavior, the organism, according to Berlyne, will seek to lower the level by avoiding or minimizing the impact of the new stimuli.

Assuming, as does Berlyne (1960, p. 209), that "anxiety" contributes to arousal, it might be predicted that anxious people will in general be less inclined to expose themselves to new sources of arousal than non-anxious people. Berlyne (1960 pp. 209-211) cites several studies (e.g. Brim and Hoff, 1957; Smock, 1955a; Smock, 1955b) which provide some indirect support for this prediction. A second purpose of the present experiment was, therefore, the further investigation of the effects of anxiety on exploration of stimulus patterns.

CHAPTER II

REVIEW OF THE LITERATURE AND STATEMENT OF THE PROBLEM

Relevant Stimulus Variables

Berlyne (1960) refers to the stimulus variables of particular importance to exploratory behavior as:

> . . . . collative variables since, in order to evaluate them, it is necessary to examine the similarities and differences, compatibilities and incompatibilities between elements -- between a present stimulus and stimuli that have been experienced previously (novelty and change), between one element of a pattern and other elements that accompany it (complexity), between simultaneously aroused responses (conflict), between stimuli and expectations (surprisingness), or between simultaneously aroused expectations (uncertainty). (p. 44)

The collative variable of novelty, which is most directly related to the design of this study, is usually accompanied by at least three supplementary variables: stimulus change, surprise, and incongruity (c. f. Berlyne, 1960). Incongruity may be viewed as a special case of surprise, since in both cases expectations are not met.

Surprise, however, involves comparison between a prior expectation and the actual stimulus, whereas incongruity involves comparison between expectations aroused by two or more simultaneously presented parts of a stimulus pattern.

The concept of novelty is most difficult to define. This is primarily because novelty involves an interaction between external stimuli and the past experience of the organism, and therefore, unlike sound waves for example, cannot be defined in terms of physical parameters. It can be simply defined as something that has never been experienced, but this approach obviously requires a complete specification of the organism's life history. For the organism, few stimuli are probably novel in an absolute sense. Most novel stimuli are novel only in comparison to the other stimuli in the same situation or else they are novel because they have not been perceived in the last few minutes, hours, etc. In other words, they are novel only in a relative sense. The degree of novelty, then, can probably be best determined by:

> (1) how often patterns that are similar enough to be relevant [through stimulus generalization] have been experienced before, (2) how recently they have been experienced, and (3) how similar they have been. (Berlyne, 1960, p. 22)

The Orientation Reaction

Exploratory behavior is seen by Berlyne (1960) to have as its principal function the acquisition of environmental information not previously available. When this behavior takes the form of changes in posture, in the orientation of sense organs, Berlyne treats it as one component of the "orientation reaction". Since the dependent variable of this study, time spent viewing visual patterns, involves an orientation of sense organs, it can probably be most meaningfully classified and discussed within the framework of the orientation reaction.

Interest in the orientation reaction can be traced to Pavlov (1927), who used the terms "investigatory", "what-is-it?", "orientation" and "adjusting" reflexes to describe changes in a receptor orientation occurring in response to changes in external stimulation. Pavlov regarded these immediate responses to slight changes in the environment as being biologically important to the organism, for if the organism were not provided with such a reflex his life would be constantly endangered.

Investigations by Sokolov (1954, 1957, 1958), Davis et al. (1955), and Dykman et al. (1959) have shown that the orientation reaction has several components, among which are changes in sense organs (e.g. pupil dilation), changes

in skeletal musculature (e.g. animals' ears pricking up to auditory stimulation), changes in the central nervous system (e.g. alpha blocking), and general vegetative changes (e.g. constriction of blood vessels in limbs).

The Effect of Novelty on Exploratory Behavior

Studies aimed at investigating the effects of the collative properties on exploratory behavior have typically involved visual stimuli. Moreover, they have usually involved measurement of two aspects of exploratory behavior: (a) that occurring upon presentation of novel stimuli, and (b) that occurring over time with prolonged repeated exposure to the same stimuli.

Exploration of Objects. Exploratory activity was found in cockroaches to decline according to a concave upward function with time of accessibility to a white stick (Darchen 1952). Upon replacement of the white stick with a green one there was found a resurgence of exploration. In another study Darchen (1957) found that his cockroaches explored a colored cube more promptly if the cube was introduced to the cockroaches after they had spent 60 minutes in an empty box than if the cube was introduced after 15 minutes.

Using a cube as the stimulus object Berlyne (1955) found that rats that had had previous experience with the cube made fewer approaches to the cube than did rats that had not had this previous exposure. He also found that number of approaches to the cube decreased over time. Similarly, Berlyne (1950) found two objects to be explored less by rats on their second presentation than on their first. Welker (1956) found that the longer a novel stimulus object was available to a chimpanzee, the less it was handled.

Exploration in Mazes. A somewhat different approach to investigating the effects of novelty on exploratory behavior has involved the use of mazes. Dember and Millbrook (1956) found that their rats tended to enter whichever arm of a T maze had undergone the greater change in albedo (percent of light reflected) from the preceding trial. Also using black, gray, and white for purposes of changing albedo, Montgomery (1953) found that those mazes which represented the greatest shifts in albedo, i.e. those which were most novel, elicited the most exploratory behavior.

Novelty and surprise were both investigated by Williams and Kuchta (1957). They interchanged positions of maze

arms of different colors and put them together in different combinations. It was found that a novel combination, i.e., a combination in which an unfamiliar white arm was introduced, was more effective in producing exploratory behavior than the combination to which they had been adapted. The most effective combinations, however, were those that were designed to be "surprising", i.e., combinations in which a white arm was located where a black arm had regularly been in the past. Thiessen and McGaugh (1958) similarly found that rats would enter a new maze arm more frequently than the arms with which they were already acquainted.

Berlyne and Slater (1957), however, found no significant preference between entering an arm leading to novel objects and figures and entering an arm leading to familiar ones. Once they had entered the goal box, however, the rats spent more time sniffing the novel objects than the familiar objects.

Visual Exploration of Patterns. The exploratory effects of novelty in visual patterns has also been studied. Thompson and Solomon (1954) put rats in a box with a card bearing a black and white vertically striped pattern. On the second trial the experimental group, which was presented

with a card bearing a triangle, engaged in more exploratory behavior than a control group which received the striped pattern a second time.

Berlyne (1951), in a series of experiments investigating human attention, employed an apparatus consisting of four stimulus apertures and four corresponding telegraph keys. In one experiment stimuli were simultaneously presented in two apertures on each trial and the subject was instructed to press a telegraph key corresponding to either one. In the first phase of the experiment subjects were presented with the same stimulus pattern in both apertures, while in the second phase the subjects were presented with two different stimulus patterns, the same used in the first phase and a new one. It was found that the subjects responded significantly more often to the novel stimulus than to the familiar stimulus. Berlyne (1957a) followed up this series of experiments with a better controlled design and found the same results; however, he also found that the novelty effect does not survive beyond 24 hours. Furthermore, the effect occurred only when the subjects made the same response to the stimuli in the two phases.

Effects of Added Novelty on Ongoing Exploratory Behavior and Statement of First Purpose

Montgomery and Monkman (1955) investigated the effects of "external" stimuli on exploratory behavior in rats. They found that a strong auditory stimulus administered before entrance into a maze had no effect on exploratory behavior, but if a buzzer was sounded during exploration (i.e., added novelty) there was a temporary reduction in exploratory activity.

Weiner (1959) instructed his subjects to watch for white spots on a screen and to press a key as soon as they saw one. It was found that when red spots, to which no response was required, were interspersed the subject's key-pressing rate increased. These results may be readily interpreted on a novelty basis, since the red spots could be regarded as novel stimuli and therefore might be expected to increase observing behavior.

In another series of experiments, Berlyne (1957c) investigated the effects of incongruity, increased complexity and surprisingness on ongoing exploration of tachistoscopically presented visual stimulus patterns. He found that as the degree of each of these collative properties increased, the total time (i.e., the number of exposures)

spent viewing the patterns also increased. Again using visual stimulus patterns, Berlyne (1958) found that novel animal pictures introduced during a series of animal pictures were more likely to attract visual orienting movements than the pictures that appeared repeatedly.

It has been found, therefore, that the introduction of "nonextraneous" novelty, i.e., novel stimuli appropriate to the modality involved in the exploratory behavior, can increase ongoing inspective exploration in humans (Berlyne 1957c, 1958; Weiner 1959). Montgomery and Monkman (1955) on the other hand, have found that in rats the presentation of an "extraneous" novel stimulus, i.e., a novel stimulus appropriate to a modality other than those involved in the exploratory behavior, may inhibit ongoing locomotor exploratory behavior. These findings would seem to yield conflicting predictions as to the effects of an extraneous source of novelty on ongoing inspective exploration in human subjects. One purpose of this study, then, was to determine what effect, if any, a novel stimulus might have on the ongoing inspective exploratory behavior of humans. A loud bell was used as the extraneous stimulus and time spent viewing nonrepresentational patterns served as the dependent variable.

The Interchangeability of Sources of Arousal and Statement of Second Purpose

Berlyne (1960) views the concept of arousal in the context of a continuum of alertness. Typically, physiological indicies, e.g., electroencephlographic and galvanic skin reactions, have been employed to explore this continuum. Berlyne sees "the level of arousal as subject to the influence of a large number of variables whose effects will be additive and thus interchangeable (p. 209)." He argues that anxious people may already be experiencing a high, although perhaps tolerable, degree of arousal, and, therefore, any amount of novelty introduced to the situation, even an amount quite tolerable to "normals", would be distressing. It would seem to follow that an anxious person would be more likely to show the influence of novel stimuli by attempting in some way to reduce this "supra-threshold" arousal than would a non-anxious person.

The interaction between stress and intolerance of ambiguity was investigated by Smock (1955a) giving one group of subjects stress-producing instructions and then presenting all subjects with parts of pictures and asking them to guess at what the pictures might be. The stressed

group guessed earlier and therefore was incorrect more often than the relaxed group.

A verbal test of "desire for certainty" was devised by Brim and Hoff (1957). This test was administered to one group of subjects who had been given frustrating tasks and to a second group who had performed their tasks satisfactorily. It was found that the frustrated subjects scored significantly higher on the desire-for-certainty test.

Neuropsychiatric patients were used by McReynolds and Bryan (1956) as subjects in another investigation involving the combination of arousal sources. The subjects were shown a series of cards bearing pictures after being told that each picture would appear twice. For one group (the H group) only twenty out of sixty pictures were shown twice. The groups were then given triangular shapes, on which the subjects were told there were names of "more familiar sorts of things" stamped on bottom, and odd-shaped pieces that bore names of "more novel, unusual sorts of things". The subjects were asked to choose from these two piles of objects and place their choices in categories of animal, vegetable or mineral on the basis of the name stamped on the bottom of the objects. When stopped after being allowed to classify less than half of the

objects, it was found that the H group had selected significantly fewer odd-shaped objects with unusual names than the L group (the group which, as promised, saw each picture twice).

These studies, along with others employing animals (Thompson and Higgins, 1958; Chapman and Levy, 1957; and Fonberg, 1956) furnish evidence that subjects initially exposed to some source of arousal and then put into a second situation involving an increase in arousal of quite a different source will, if given a choice of response, choose a response that allows a decrease rather than an increase in arousal. If high-anxious subjects should already be under a state of high arousal, it might be expected that when put in an arousal-producing situation they would be more likely to respond in such a manner as to reduce the arousing effects of the situation than would low-anxious subjects. Moreover, addition of yet another source of arousal (including in this case an extraneous novel stimulus) might be expected to increase any such difference in responding.

A second purpose of this study was therefore to compare the behavior of high- and low-anxious subjects when confronted with an arousal-producing situation. The

"arousal-producing situation" involved the presentation of a series of nonrepresentational visual patterns, with and without the interjection of a loud bell. It was predicted that, insofar as the experimental situation might be arousal-producing, high-anxious subjects would seek to reduce any increment in arousal by viewing the patterns for shorter periods of time, and, hence, escaping the situation sooner, than low-anxious subjects. Moreover, it was predicted that any difference in viewing time occurring between high- and low-anxious subjects would be enhanced by the presentation of yet a further source of arousal, i.e. the bell.

Assumptions Underlying the Design of the Study

An attempt will be made here to justify two of the assumptions underlying the design of this experiment: (a) that increases in arousal may be expected to accompany the presentation of novel stimuli, and (b) that "arousal" is related to the "anxiety" that the Taylor Manifest Anxiety Scale (MAS) purports to measure.

Novelty and Arousal. The assumption that novel stimuli do elicit changes in arousal is suggested by several studies. Sharpless and Jasper (1956) demonstrated

that the more novel the stimuli, the greater the arousal, with arousal being measured by EEG changes Popov (1953) presented brief tones to awaking human subjects and found that alpha suppression appeared initially in response to the tones. This alpha suppression ceased to appear after several repetitions of the tone. Repetitive flashes of light have been found to have a similar effect on alpha suppression (Wilson and Wilson, 1959). Desai (1939) found an increase in arousal (GSR) following the presentation of "surprising" stimuli.

MAS and Arousal. Berlyne (1960) treats arousal as closely related to what he calls "drive" since both refer to restlessness and heightened reactivity of the skeletal musculature. Arousal is also similar in nature to Spence's (1958) concept of drive as a general energizer. Taylor (1953) constructed the MAS within the framework of Spence's concept of drive, and she states that:

> . . . .variation in drive level of the individual is related to the level of internal anxiety or emotionality . . . . that the intensity of this anxiety could be ascertained by a paper and pencil test consisting of items describing what have been called overt or manifest symptoms of this state.

The MAS has been found to load .80 on the Objective - Analytic Anxiety Battery (IPAT) (Professor Richard J. Rankin, personal communication). Subtest # 246-I M.I.620-

623 loads .65 on the entire IPAT and it has been found that high-anxious scorers on 246-I M.I.620-623 have a greater increase in and a faster recovery of pulse rate in reaction to a shot and/or cold pressor stimuli. Subtest 2410-I M.I.444 has been found to have an average loading on the IPAT of .36, and those that scored high-anxious on this scale were found to have higher systolic blood pressure (Cattell and Scheier, 1960). If we can interpret these physiological indicies as being similar to the recognized physiological indicies of arousal, a relation between anxiety, as measured by the MAS, and arousal might be expected.

CHAPTER III

METHOD

Subjects

Instructors of Introductory Psychology at Oklahoma State University administered the MAS, in the form shown in Appendix A, to their students in a classroom situation. From a population of 81, 10 subjects were chosen who scored in the low anxiety range (1-12) and ten subjects were chosen who scored in the high anxiety range (28-35). Each of these two groups was further broken down into an experimental and a control group both equated for sex, age and MAS scores. All subjects (Ss) were naive as to the purpose of the study.

Apparatus

The lay-out of the experimental room is presented in Figure I. A 10 X 10 inch window cut in the shield served as the projection area for the patterns and the shield served to conceal the experimenter (E), the projector, the

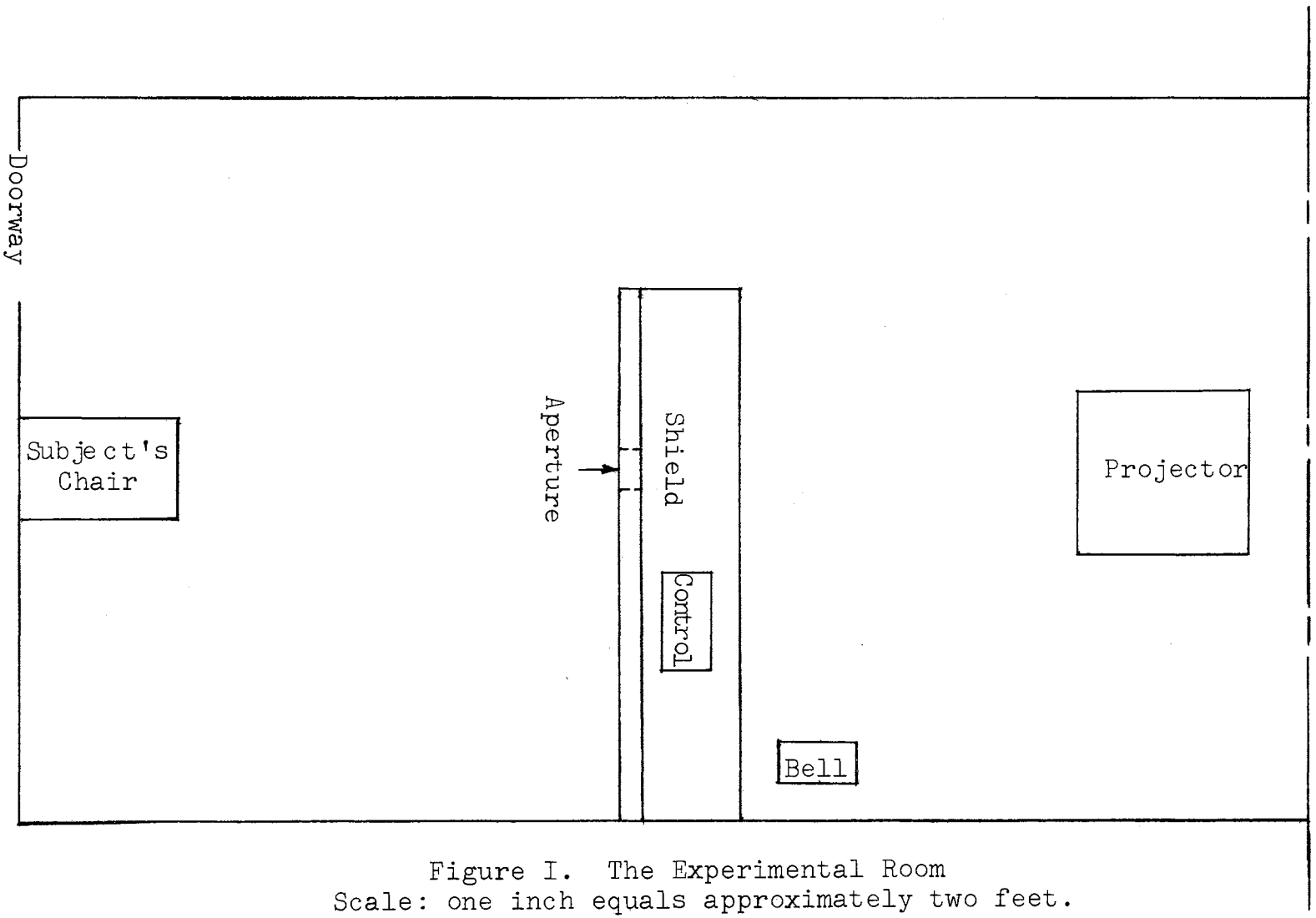

Figure I. The Experimental Room
Scale: one inch equals approximately two feet.

recording instruments, and the bell from the S. The window was covered with a tightly stretched sheet of translucent vellum paper to form a screen, and the patterns were projected on this screen by an Airquipt Superba 77a slide projector located behind the shield. The subject could terminate the projection of each slide by pressing a telegraph key, which was fastened to his chair.

An Esterline Angus Event Recorder recorded the length of time each slide was projected. Constant intertrial intervals (3.2 seconds) were maintained by a control center, custom-built by Marietta Apparatus Company, which also prevented false responding, i.e., S could not activate the projector or the recorder while a slide was being changed. A 4-inch, 6-V. Edwards Exposed Gong served for the presentation of the extraneous stimulus.

The stimulus material consisted of 36 random patterns of nonrepresentational shapes generated according to Method I of Attneave and Arnoult (1956). The patterns were photographed and made into 2 X 2 inch slides, the shapes appearing in black against a transparent background.

Procedure

Upon entering the experimental room the S was

instructed to sit in the chair and was cautioned not to touch the telegraph key. He was then given a copy of the following instructions and asked to "follow along" while E read them:

> 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. 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 you may begin and when the end of the series has been reached. Are there any questions?

The S's copy of the instructions was then taken from him and E went behind the shield and turned on the projector lamp to present the first practice slide. Next, E returned to the door and turned out the overhead lights so that the only light in the room was that from the projector. If during this time S triggered the apparatus, he was told "No, I will tell you when to begin," and E moved the slide magazine back so that the first practice slide was once again showing. Finally, the recorder was turned on and the subject was asked to begin.

Four of the slides were practice slides and were always presented in the same order at the beginning of the

series. Five presentation orders for the 32 test slides were obtained by means of a table of random numbers, and these five orders were used for the five S's of each of the four groups.

For the two experimental groups, the bell was rung on five separate occasions between presentations of two successive stimulus patterns. When a S in an experimental group pressed the telegraph key on these occasions, the following series of events occurred: (a) the shutter closed and the slide-changer of the projector was activated. (b) E sounded the bell for approximately two seconds, and (c) the shutter opened and the next slide was projected. The bell was sounded before the 6th, 17th, 20th, 24th, and 31st test slides.

After the last slide had been viewed the lights were turned on the S was thanked and instructed not to speak to anyone about the experiment. After S had left the experimental room his response times were coded for identification purposes.

CHAPTER IV

RESULTS

The viewing times were recorded on Esterline Angus chart number 1710-E graph paper that was sectioned into one-second intervals. By means of an engineering scale, the times were measured to the nearest two-tenths of a second. For a summary of the difference scores attained, see Appendix B.

For each S of the two experimental groups the time spent viewing each pattern which followed the presentation of the bell was subtracted from the time spent viewing the pattern which immediately preceded the bell. For example, the time spent viewing the sixth pattern was subtracted from that spent viewing the fifth pattern. This yielded five difference scores for each of the S's in the experimental groups. Exactly the same procedure was used for the S's in the two control groups, i.e., their viewing times were treated as if they too had received presentations of the bell before the 6th, 17th, 20th, 24th and 31st test slides. These difference scores

were analyzed by means of an analysis of variance with the data arranged in a 2 X 2 X 5 factorial design with repeated observations on the last, i.e., the order, factor. A summary of the analysis appears in Table I.

An F of 8.23 (significant at the .011 level) indicated that the ringing of the bell significantly increased the time spent viewing the following pattern. No significant difference, however, was found between the difference scores of the low- and high-anxious groups, nor was there a significant interaction found between anxiety level and condition of extraneous stimulation. Also, no significant order effect was found.

A second analysis of variance (see Table III for summary) performed on the total viewing times for the entire series of 32 patterns (Table II shows the means of the total series), arranged in a 2 X 2 factorial design revealed only a trend ($\underline{P}$ = .13) for low-anxious $\underline{S}$'s to view the patterns longer than high-anxious $\underline{S}$'s. None of the remaining $\underline{F}$ values approached statistical significance.

TABLE I

SUMMARY OF ANALYSIS OF VARIANCE

Source	df	MS	F
Between subjects	19		
A (condition of extraneous stimulation)	1	49.56	8.23*
B (anxiety level)	1	.58	
AB	1	9.24	1.53
Subjects within groups	16	6.02	
Within Subjects	80		
T (trials)	4	89.44	1.45
AT	4	41.53	
BT	4	26.50	
ABT	4	37.19	
C (subjects within groups)	64	61.64	
Total	99		

*Significant at the .011 level.

TABLE II

MEAN VIEWING TIME SCORES IN SECONDS FOR ENTIRE SERIES

Anxiety Condition	Condition of Extraneous Stimulation									
	Bell					No-Bell				
High	6.74	5.29	7.02	5.81	5.60	3.29	8.81	1.99	1.71	8.61
Low	9.16	7.69	5.82	5.65	25.54	5.96	8.89	7.78	6.34	5.75

TABLE III

SUMMARY OF ANALYSIS OF VARIANCE

Source	df	MS	F
A (anxiety level)	1	56.81	2.67*
B (condition of extraneous stimulation	1	31.72	1.49
AB	1	8.58	0.40
Within subjects	16	21.30	
Total	19		

* $P = .13$

CHAPTER V

DISCUSSION AND CONCLUSIONS

One purpose of the present study was to investigate the effects of "added novelty" on ongoing exploratory behavior. It was found that an extraneous stimulus significantly increased the length of time spent viewing nonrepresentational stimulus patterns. Although the experiment was designed using viewing time as the dependent variable, rate of key-pressing might also be regarded as the dependent variable, since it is essentially "the other side of the same coin". Therefore, when an increase in viewing time occurs, a decrease in the rate of key-pressing also occurs. The subject might be engaging in greater exploratory activity by looking at the patterns longer, or he might be reducing the amoung of his exploratory activity by prolonging the response, i.e., key-pressing, which would introduce a new pattern. Since there was no information as to what the subject was experiencing or attending to while a pattern was being projected, it is impossible to decide as to which of the

two responses might be regarded as more "meaningful".

If the results are interpreted in terms of changes in viewing times, they are in accord with those reported by Berlyne (1951, 1957a, 1957b, 1958), Thompson and Solomon (1954), and Weiner (1959) (which, however, involved a non-extraneous stimulus) in that additional novelty increased exploratory behavior. Since the effect of the bell did not dissipate over time, it might also be concluded that this effect is relatively strong.

Assuming viewing time to be the more meaningful dependent variable, the results of the present study might be interpreted as evidence for the hypothesis of "arousal additivity". In other words, assuming the stimulus patterns to be arousal-producing in their own right, the arousal produced by the bell might summate with that produced by the patterns and, therefore, serve to bring about an increment in the amount of arousal underlying exploratory behavior. However, if rate of key-pressing should be regarded as the more meaningful dependent variable, then the results of the present study might be interpreted as evidence for the hypothesis that there are limits to the amoung of arousal that an organism can tolerate, i.e., that arousal can be built up to such a

level that additional arousal-producing stimuli will serve to inhibit exploratory behavior. If so, then these results would support those of Desai (1939) who found an arrest of movement in a tapping task when a light was suddenly turned on. Similarly, the results would be consistent with those of Montgomery and Monkman (1955) who found that a very loud extraneous stimulus inhibited ongoing exploratory behavior of rats in a maze.

The assumption has been made in the present study that the increase in arousal, if indeed there was an increase, created by the bell would directly affect the viewing time of the pattern immediately following. Some alternatives to this assumption might be the following:

The arousal might have occurred only during the period that the bell was ringing and the longer viewing time may only have been a result of a recovery from fear or startle, i.e., it may have taken some time for the subject to adjust again to viewing the patterns without interruption.

Another possibility is that the subjects interpreted the bell as a cue that there was something "special" about to occur, particularly in relation to the following pattern, and, hence, proceeded to devote additional time examining

the subsequent pattern.

A second purpose of this study was to further investigate the effects of anxiety on the exploration of stimulus patterns. It was suggested, assuming that high-anxious subjects possess a higher initial level of arousal, that when presented with new arousal-producing stimuli they would react in a manner different from subjects classified as low-anxious. More specifically, Berlyne's hypothesis of additivity of arousal sources led to the prediction that high-anxious subjects presented with an arousal-producing situation would attempt to reduce the arousal effects by minimizing exposure to the situation. However, analysis of the data revealed no significant differences in viewing time between the high- and low-anxious groups. One possible explanation for this lack of difference was that, although an attempt was made to arouse anxiety (the instructions not to bump the key coupled with the wires running from the subject's chair to and under the shield), the situation probably was only mildly stressful. Nevertheless, according to the chronic view of anxiety (Rosenbaum, 1950, unpublished dissertation), a difference in behavior between the two anxiety groups should have been found even in a non-stressful situation.

Another factor might have been that some of the MAS scores were not so extreme as might have been desired (Taylor, 1953). Yet another factor may have been the small number of subjects. However, it is doubtful that this played an important role, since the F-value obtained was close to zero.

Of possible interest was the suggestion that low-anxious subjects viewed the whole series of patterns longer than the high-anxious ($P = .13$). An interpretation of this might assume an equal amount of arousal produced by both the experimental situation and the bell in both anxiety groups. If this were the case, the difference suggested between anxiety groups might have been a result of a difference in the initial level of arousal brought into the situation, i.e., the MAS scores may have been indicators of levels of arousal that were not differentially affected by the added arousal-producing stimuli associated with either the bell or the presentation of the slides. Stated another way, the viewing times may have reflected differences in arousal associated with differences in anxiety.

One limitation to the present study was that no physiological measure was employed to assess the assumed underlying arousal patterns. This, of course, means that

any serious interpretation of viewing time differences in terms of differences in arousal is highly circular, since the behavior being "explained" by arousal is also serving as the measure of arousal. Even if arousal should have been measured independently, however, there would still be problems of interpretation. For example, a decrease in viewing time associated with an increase in arousal could have been interpreted either as demonstrating an inhibitory effect of arousal on exploration, or, as supporting the view that arousal is facilitative to a degree but that when it reaches an uncomfortable level the organism attempts to escape. Another limitation, one already noted, lies in the rather arbitrary assumption that viewing time is a more meaningful measure of exploration or "attention" than is rate of key-pressing.

The findings of the present study certainly point to the importance of controlling extraneous auditory stimuli when investigating exploratory behavior. Future studies should be designed to investigate the effects of different kinds, combinations, intensities and temporal sequences of stimuli on exploratory and related forms of behavior.

CHAPTER VI

SUMMARY

One purpose of this study was to investigate the effects of added novelty more specifically, an "extraneous" auditory stimulus -- on ongoing visual exploratory behavior. An extraneous stimulus was defined as a stimulus appropriate to a modality other than those involved in the exploratory behavior. A second purpose was to investigate further the effects of anxiety on exploration behavior.

Twenty subjects, ten low-anxious and ten high-anxious, were selected on the basis of scores on the Taylor Manifest Anxiety Scale. All subjects viewed four practice and thirty-two test slides of nonrepresentational patterns. For two groups, one containing five low-anxious subjects and the other five high-anxious subjects, a bell was rung on five different occassions during the slide-presentation series. No bell was sounded for the remaining two groups.

It was found that the viewing time associated with a pattern was significantly increased if its presentation was preceded by the ringing of the bell. This finding was

interpreted within the framework of Berlyne's concept of arousal and arousal additivity, although some alternative explanations were also offered. No difference was found in viewing time between the two anxiety groups, nor did anxiety level interact significantly with condition of extraneous stimulation or trial order.

The findings offer evidence that extraneous stimuli may significantly affect ongoing exploratory behavior, and, therefore, it was suggested such stimuli be controlled in subsequent investigations: Moreover, it was also suggested that future studies be designed to investigate the effects of different kinds, combinations, intensities and temporal sequences of extraneous stimuli on exploratory and related forms of behavior.

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APPENDIX A

BIOGRAPHICAL INVENTORY IV

Do not write or mark on this booklet in any way. Your answers to the statements in this inventory are to be recorded only on the separate Answer Sheet.

The Statements in this booklet represent experiences, ways of doing things, or beliefs or preferences that are true of some people but are not true of others. Read each statement and decide whether or not it is true with respect to yourself. If it is true or mostly true, blacken the answer space in column T on the Answer Sheet in the row numbered the same as the statement you are answering. If the statement is not usually true or is not true at all, blacken the space in column F in the numbered row. Answer the statements as carefully and honestly as you can. There are no correct or wrong answers. We are interested in the way you work and in the things you believe. Sometimes it may be difficult to make a decision, but please answer every item either true or false without skipping any.

REMEMBER: Mark the answer space in column T if the statement is true or mostly true; mark the answer space in column F if the statement is false or mostly false. Be sure the space you blacken is in the row numbered the same as the item you are answering. Mark each item as you come to it; be sure to mark one and only one answer space for each item. Here is an example:

	T	F
I would like to be an artist.	II	II

If you would like to be an artist, that is, if the statement is true as far as you are concerned, you would mark the answer space under T. If the statement is false, you would mark the space under F.

If you have any questions, please ask them now.

DO NOT MARK ON THIS BOOKLET

1. Once in a while I think of things too bad to talk about.
2. I find it hard to keep my mind on a task or job.
3. I blush as often as others.
4. I do not always tell the truth.
5. People often disappoint me.
6. I get angry sometimes.
7. I am easily embarrassed.
8. It makes me nervous to have to wait.
9. I sweat very easily even on cool days.
10. I frequently notice my hand shakes when I try to do something.
11. I have often felt that I faced so many difficulties I could not overcome them.
12. Sometimes when I am not feeling well I am cross.
13. I cannot keep my mind on one thing.
14. When in a group of people I have trouble thinking of the right things to talk about.
15. If I could get into a movie without paying and be sure I was not seen I would probably do it.
16. Often my bowels don't move for several days at a time.
17. I often find myself worrying about something.
18. I do not have as many fears as my friends.
19. At times I think I am no good at all.
20. I like to know some important people because it makes me feel important.
21. I do not tire quickly.
22. At times I have been worried beyond reason about something that really did not matter.
23. I do not like everyone I know.
24. I am more self-conscious than most people.

25. I am a very nervous person.

26. I am not afraid to handle money.

27. My family does not like the work I have chosen (or the work I intend to choose for my life work.)

28. I gossip a little at times.

29. Sometimes at elections I vote for men about whom I know very little.

30. I am the kind of person who takes things hard.

31. My feelings are hurt easier than most people.

32. I worry over money and business.

33. My parents and family find more fault with me than they should.

34. I often dream about things I don't like to tell other people.

35. I am liked by most people who know me.

36. I have reason for feeling jealous of one or more members of my family.

37. Once in a while I laugh at a dirty joke.

38. At times I lost sleep over worry.

39. At times I feel like swearing.

40. Sometimes I become so excited that I find it hard to get to sleep.

41. No one cares much what happens to you.

42. I do not read every editorial in the newspaper every day.

43. I feel anxious about something or someone almost all of the time.

44. Once in a while I put off until tomorrow what I ought to do today.

45. Most anytime I would rather sit and daydream than to do anything else.

46. Life is often a strain for me.

47. I have diarrhea ("the runs") once a month or more.

48. At times I am so restless that I cannot sit in a chair for very long.

49. My table manners are not quite as good at home as when I am out in company.

50. Criticism or scolding hurts me terribly.

51. I am often sick to my stomach.

52. I usually expect to succeed in things I do.

53. I am very confident of myself.

54. I cry easily.

55. I am often afraid that I am going to blush.

56. I have nightmares every few nights.

57. I don't like to face a difficulty or make an important decision.

58. I certainly feel useless at times.

59. It does not bother me particularly to see animals suffer.

60. I have a great deal of stomach trouble.

61. When embarrassed I often break out in a sweat which is very annoying.

62. It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of thing.

63. I have very few headaches.

64. I am happy most of the time.

65. My hands and feet are usually warm enough.

66. I would rather win than lose a game.

67. I am not at all confident of myself.

68. I feel hungry almost all the time.

69. I have very few quarrels with members of my family.

70. I do not often notice my heart pounding and I am seldom short of breath.

71. At times my thoughts have raced ahead faster than I could speak them.

72. I am usually calm and not easily upset.

73. I am about as nervous as other people.

74. I work under a great deal of strain.

75. Often I can't understand why I have been so cross and grouchy.

76. At times I feel that I am going to crack up.

77. At times I am all full of energy.

78. I wish I could be as happy as others.

79. I often think, "I wish I were a child again."

80. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.

81. I have been afraid of things or people that I knew could not hurt me.

82. I worry quite a bit over possible troubles.

83. I have had periods in which I carried on activities without knowing later what I had been doing.

84. I find it hard to set aside a task that I have undertaken, even for a short time.

85. My sleep is restless and disturbed.

86. I can easily make other people afraid of me, and sometimes do for the fun of it.

87. I practically never blush.

88. I am never happier than when alone.

APPENDIX B

SUMMARY OF DIFFERENCE SCORES

		Order	Difference Scores					Total
			C_1	C_2	C_3	C_4	C_5	
A_1(Condition of extraneous stimulation	B_1 (High Anxious)	1	7.8	5.4	-4.4	-4.2	-7.2	-2.6
		2	-1.8	1.4	-3.8	1.0	1.8	-1.4
		3	-5.4	0.6	1.8	1.8	-0.4	-1.6
		4	-0.8	2.8	0.2	-2.8	-0.8	-1.4
		5	46.2	-37.6	-1.6	-0.6	-6.0	0.4
	B_2 (Low Anxious)	1	7.4	-0.8	-0.8	3.2	-3.8	5.2
		2	0.4	-0.8	-0.2	-0.2	-0.4	-1.2
		3	-5.2	3.0	4.8	-0.4	-0.8	1.4
		4	-2.8	0.4	1.0	-1.8	0.2	-3.0
		5	7.0	-3.4	1.4	1.0	-3.6	2.4
A_2(Control)	B_1 (High Anxious)	1	11.8	9.8	1.4	1.4	-3.2	21.0
		2	3.6	3.6	-4.0	11.8	-10.6	4.4
		3	-0.2	5.2	2.4	2.8	6.0	16.2
		4	0.0	0.0	-2.2	-1.8	1.8	-2.2
		5	0.0	-1.6	1.6	2.6	1.8	4.4
	B_2 (Low Anxious)	1	2.6	-0.4	-1.4	1.0	-0.6	1.2
		2	7.6	1.6	-2.0	0.2	0.0	7.4
		3	-0.2	7.2	2.4	0.0	1.4	10.8
		4	0.8	0.0	0.2	-0.4	0.0	0.6
		5	3.4	-0.8	0.4	6.2	-4.4	4.8

VITA

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Master of Science

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