SEEING IS BELIEVING: THE FOCUSING OF AGGRESSION THROUGH THE USE OF EXTERNAL STIMULI

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SEEING IS BELIEVING: THE FOCUSING OF AGGRESSION THROUGH THE USE OF EXTERNAL STIMULI

An Abstract

Presented to

the Graduate Council of

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

James William Voorhees

June 1977

ABSTRACT

As shock is typically applied to the tail in the single-animal shock-elicited aggression task, it is not uncommon to observe subjects attending to locus of shock rather than aggressing toward a target located in front of them. Previous research has indicated that aggressive responding toward the target may be significantly influenced by external stimulus conditions. More specifically, it has been shown that the mere presence of another animal increased target-directed aggression significantly more than did such conditions as; the tape recorded vocalizations of an animal being shocked, or an inanimate object. The present experiment was designed to determine the crucial aspects of the external animal responsible for this increase in aggression. Three groups of test animals received olfactory, visual, and olfactory-visual cues respectively from the external animal. A fourth group served as a control and was presented only with the restraint device that held the external animal for presentation to the other groups. Each subject received a 10-min testing session during which 200, 1.5 mA shocks of 300 msec duration were administered. The number of aggressive responses shown by each subject was automatically recorded. The results indicated that the combination of olfactory and visual

stimuli was necessary to produce a focusing of aggression toward the target. These results indicate that research in the area of shock-elicited aggression must take external stimulation into account.

SEEING IS BELIEVING: THE FOCUSING OF AGGRESSION THROUGH THE USE OF EXTERNAL STIMULI

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Master of Arts

by

James William Voorhees

June 1977

To the Graduate Council:

I am submitting herewith a Thesis written by James William Voorhees entitled "Seeing is Believing: The Focusing of Aggression Through the Use of External Stimuli". I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Psychology

Stephen F. Davis

Major Professor

We have read this thesis and recommend its acceptance:

William L. Dannemann

Second Committee Member

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Accepted for the Council:

Wayne E. Stamper

Dean of the Graduate School

ACKNOWLEDGEMENTS

I would like to acknowledge my graditude to Mary Nell Travis who started this line of investigation into shock-elicited aggression, to Lynda who gave me the support and encouragement to change horses in the mid-stream of my life; and most of all to Steve Davis who not only provided the new horse, but threw in riding lessons as well.

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CHAPTER I

INTRODUCTION

In 1939 O'Kelly and Steckle published a study that marked the advent of the current interest in the phenomena of shock-elicited aggression. In this study they used a pair of rats confined to a small chamber who were given foot shock via a grid floor. Aggressive fighting between the animals occurred upon initiation of shock. In fact, the fighting continued for up to four hours after the shocks had ceased. The continuation of fighting in the absence of shock was a difficult phenomena to explain, let alone replicate. Daniel (1943) attempted several replications of the O'Kelly and Steckle (1939) study, and did observe aggression during shock sessions. However, he reported that the observed aggression ceased immediately with the termination of the shock.

Some twenty years later Ulrich and Azrin (1962) attempted to obtain quantified measurements of this phenomena and also to establish some of the parameters influencing it. One study reported by Ulrich and Azrin (1962), using paired rats exposed to foot shock, reported that upon initiation of the shock the rats assumed a stereotyped fighting position, rearing on their hind legs and striking out with their forepaws. Aggression was measured by two independent observers who recorded the number of aggressive responses made and the time spent in aggression. They found that as the frequency of shock increased so did the amount of aggression. However, no aggressive responses occurred between shocks or after the shock session was completed. No difference in aggressiveness was shown when pairs of animals reared in isolation or reared communally were compared. In interspecies experiments it was shown that a rat would aggress against a hampster or a guinea pig, but only the hampster would aggress back. They also found that if only one of the subjects in the pair was receiving shock, it would aggress against the non-shocked subject. To determine what type of object would be attacked, an inanimate object, and a recently decased rat were presented to the test subject. Neither of these objects elicited aggression from the shocked subject. It was only when the dead rat was moved around the cage on a stick did it elicit aggression from the subject receiving the shock.

Azrin, Hutchinson, and Hake (1963) demonstrated that squirrel monkeys began fighting at the onset of shock and continued aggressing after the shock was terminated. In fact, aggression continued until the monkeys were physically separated from each other. In a follow-up study Azrin, Ulrich, Hutchinson, and Norman (1964) found that tail pinches caused a squirrel monkey to aggress a cloth covered ball placed in the cage. Further, Azrin, Hutchinson, and Sallery (1964) found that a squirrel monkey would attack a rat, a mouse, a ball, or a doll when shocked. They felt that this attack of inanimate objects not seen in rat studies might be the result of the increased aggressiveness of monkeys over rats. It was also postulated that the observed aggression was the result of a prior learned association between pain and the presence of another animal. This hypothesis was questioned by Hutchinson, Ulrich, and Azrin (1965) in a study using rats that were reared as social isolates. As these subjects displayed aggression, it was argued that aggression must be an unlearned reaction. A possible problem with this study concerned the fact that the rats were not isolated until 22 days of age. Hence, it is possible that enough social learning had taken place prior to this time to enable the animal to achieve the postulated association. On the other hand, it was noted that the social isolate animals did show less aggression than the communally raised animals.

Several attempts have been made to explain the causes of aggression seen in the paired-rat type of situation. If a single animal is placed in a shock chamber and administered foot shock he will attempt to escape the shock, and will not show the stereotyped fighting postures seen in the paired subject studies.

Ulrich and Azrin (1962) reported observing this escape-avoidance type of behavior in single subjects subjected to foot shock. Azrin, Hutchinson, and Hake (1967) have stated that the escape reaction is present in some of the attack behavior seen in the shock-induced aggression situation. They make the point that:

> Attack and escape-avoidance constitute two of the basic reactions to adversive shocks. In analyzing their (sic) interactions the present studies showed that the escape-avoidance reaction was prepotent over the attack reaction, since attack resulted only if, and when, the escape or avoidance responses did not eliminate the shock... The presence of a target appears to interfere with shock avoidance or escape behavior only when (1) the avoidance behavior is not eliminating the shocks, and (2) the avoidance and attack reactions are physically incompatable. (p. 345)

In these two statements lie the basic problems encountered in the paired-rat studies. If the purpose of the experiment is to measure the amount of aggression manifested by a subject when exposed to adversive stimuli, then the use of the paired-subject design has two apparent problems. First, the measurement of aggression is subjective. Two or more observers watch the subjects and score actions and reactions as "aggressive". Subjective measurement, no matter how skilled the observer, is still just that, subjective, difficult to quantify and even more difficult to replicate. A second problem is that some of the actions made by the animals must, of necessity, be counteraggressive, caused by the attack of the other animal and not the direct result of the aversive stimuli. This reaction is presumably what was observed in the O'Kelly and Steckle (1939) study where the animals continued to aggress long after the shock was terminated.

One solution to the problems inherent in the paired-animal studies was to use a single subject. The immediate difficulty was, as seen in the Ulrich and Azrin (1962), and Azrin et al. (1967) studies was that a single animal enclosed in a shock chamber would not aggress against an inanimate object. Escape-avoidance behavior remained prepotent. In 1968 Azrin, Rubin, and Hutchinson, recognizing the problems inherent in the paired-rat studies, devised a single-animal-restraint apparatus designed to eliminate the escape-avoidance behavior of the subject. This apparatus was coupled with a target level located immediately in front of the subject and connected to automatic monitoring equipment so that aggressive responses could be recorded objectively. The apparatus consisted of a plexiglas tube to contain the subject and a restraining rod which was connected to the animal's tail where it extended from the rear of the tube. Electrodes were connected to the rat's tail via the rod, and delivered unavoidable tail shock at 3-sec. intervals. The shock was of 5.0 mA intensity and each shock was of a 200-msec. duration. This study incorporated many of the desirable features found in previous paired-rat studies. For example - an inanimate object was used as the target to eliminate the uncontrolled effects of counter aggression by a live rat (e.g., Azrin, et al., 1964), the rat was forced to face the target (e.g., Hutchinson, et al., 1966), the animal was placed close to the target (e.g., Ulrich and Azrin, 1962), and the shock was delivered through surface electrodes and was unavoidable (e.g., Azrin, et al., 1967). Several types of targets were tested and it was found that the biting attack was not unique to a particular type of target or target configuration. With the development of the single restrained animal apparatus, several investigators have reported the effects of various manipulations. Creer and Powell (1971) investigated the effects of age and housing of subjects and found no significant difference in amount of aggression. Cahoon, Crosby, Dunn, Herrin, Hill and McGinnis (1971) attempted to ascertain the effect of food deprivation on shock-elicited aggression. Although a significant relationship was obtained, this study can be questioned because of the very small number of subjects (n=3) in each group, as well as being a within-subjects design and therefore suspect in regards to possible learned responses.

Although the use of a single, restrained rat has many advantages over the use of subject pairs receiving foot shock, there is one factor that has continued to plague this area of rat research (no pun intended). That is the factor of within-group variability. As an example, in the Cahoon et al. (1971) study, (one of the few reporting raw score data) the three subjects in the food deprived group had, over four test sessions, responses of: S_1=107, 0, 40, 71; S_2=74, 75, 157, 84; S_3=67, 130, 71, 40. Within-group variability of this magnitude is high enough to obscure even the strongest between-groups effects. What is causing this variability, and how can it be controlled? In an experiment by Mollenhour, Voorhees, and Davis (1977) involving rapid eye movement (REM) sleep deprivation and shock-elicited aggression, an apparatus similar to the one described by Azrin et al. (1968) was used. In that study it was noted, albeit subjectively, that a number of the subjects spent much of the time trying to turn around in the restraint tube in an apparent attempt to locate the source of the pain or to try to escape. This suggests, rather strongly, that for some of the subjects, during at least part of the shock session, the escape-avoidance reaction was still prepotent.

Moyer (1968) divides aggression into several classes or types on the basis of the stimulus situation that will elicit it. He identifies seven types of aggression or aggressive behavior: Predatory, inter-male, fear-induced, irritable, territoral, maternal, and instrumental. Of the types of aggression Moyer mentions two of them seem particularly cogent here, fear-induced and irritable. A closer consideration of these categories may be helpful in resolving some of the conceptual problems that may have arisen.

Fear-induced aggression is always preceded by an attempt to escape, if the escape is frustrated and the subject animal realizes that escape is not possible then irritable aggression may result. Ulrich (1966) showed that irritable aggression can be induced in a variety of species by aversive stimuli. Irritable aggression involves attack without any attempt to escape from the object being attacked. This "pain-induced" aggression appears to be increased by any stressor. According to Moyer, the basic tenent behind irritable aggression is the presence of any attackable organism or object. In paired-rat studies, of necessity, a stimulus is present - another animal. However, as seen in the Ulrich and Azrin (1962) study, an inanimate object does not cause a single rat to aggress while receiving foot shock. It has been assumed that because escape has been made impossible for the subject in the single restrained animal studies that the target lever in front of the animal is an appropriate target for its aggression. However, if the fear-induced aggression, and therefore its principle component of escape, is still prepotent in <u>some</u> of the subjects this would account for the low amount of aggression seen in some of the subject animals toward the target lever, and result in the large within-group variability.

A recent study by Voorhees, Davis, Geis, and Mollenhour (1977) was designed to determine what effect, if any, would be achieved by changing the external environment of the restrained rat during the shock sessions. An attempt was made to provide the restrained rat with an appropriate stimulus upon which to focus his irritable aggression. Two basic conditions and a control condition were used in the study. In the first condition a white block of wood was placed in front of the restrained rat, 7.5 cm beyond the aggression lever. In the second condition a stimulus rat, restrained in a wooden cage was placed in the same position as the block. In the control condition there was nothing in view of the test animal. The subjects having the stimulus rat as a stimulus to focus upon were found to be significantly more aggressive than the other two groups. This is seen as support for Moyer's (1968) contention that irritable aggression must have an appropriate attackable organism (e.g., Ulrich and Azrin, 1962) as a focal object.

A question arises as to what specific characteristics of the stimulus rat are being acted upon by the subject rat. In the Ulrich and Azrin (1962) study a doll failed to produce aggression, as did a recently deceased rat. It was only when the dead rat was moved around the cage on a stick did it elicit aggression in the subject undergoing foot shock. Since the albino rat operates with olfaction as the primary sense modality it might be expected that the odor of another rat would be sufficient to elicit attack. However, the dead rat (presumably providing olfactory cues of some type) did not produce aggression; nor did the presentation of visual cues alone (the doll being moved around the cage). The purpose of the present study was to determine what conditions are necessary for a stimulus rat to elicit aggression as seen in the Voorhees et al. (1971) study.

CHAPTER II

METHOD

Subjects

Thirty-three 150-day-old, male, albino rats purchased from the Holtzman Company, Madison, Wisconsin served as subjects. During the experiment all animals were housed in individual cages with food and water available on a free feeding basis.

Apparatus

A single animal restraint system similar to that described by Azrin et al. (1968) was used as the apparatus for shock-elicited aggression testing. The apparatus was composed of an opaque white plastic tube enclosed at one end, measuring 21.5 cm in length and 7.5 cm in diameter, mounted on a plexiglas sheet. The plexiglas sheet, was, in turn, mounted on a wooden platform by means of runners along each side. The plexiglas sheet and attached tube could be removed from the stabilizing wooden platform to facilitate placement of the subject as well as allowing the tube to be washed out between trials. A 1.5 cm hole at the enclosed end of the tube allowed the subject's tail to be extended from the apparatus and secured by means of adhesive tape to a wooden restraining rod 2.5 cm in diameter. Two pieces of No. 14 copper wire permanently attached to the rod 7 cm apart served as tail electrodes. Thus, when the rod was taped to the subject's tail it served as both a restraining device to prevent escape from the apparatus and as an electrode carrier. The other end of the tube was open. A 1.5 mA half-wave (pulsating) dc current was used and was continuously monitored by a Jackson (Model 5-J-2) mA meter.

The aggression target consisted of a Lafayette omnidirectional lever, (Model 80111), taped with a single wrap of white adhesive tape. This lever was mounted on the wooden platform, perpendicular to the open end of the restraining tube. With the tube in place on the platform the lever extended across the mid-portion of the open end of the tube. The lever was 1.5 cm from the open end of the tube and required a movement of 1 cm to activate the attached microswitch. Closure of the microswitch, in turn, activated a Lafayette (Model 5707 PS) impulse counter and a standard electrical timer calibrated in hundreths of a second.

A cylindrical clear plastic container (19.0 cm tall, by 15.4 cm in diameter) was used to contain the stimulus animal. Sixty percent of the exterior of the container was painted flat black, the remainder of the container was left clear. The clear portion formed a vertical patch from top to bottom of the container. Therefore, when the container was in place in front of the subject

(7.5 cm from the front of the tube) with the black side facing the subject he could not view the stimulus animal. Viewing of the stimulus animal was permitted by placing the container so that the unpainted patch faced toward the subject animal. Two tight fitting opaque plastic lids were also used with the container. One of the lids was perforated with 46, .5 cm holes and was used when olfactory cues were to be presented to the subject. The second lid was solid except for a hole in the center in which was cemented a brass fitting with an inside diameter of .5 cm. When the second lid was in use (i.e., no olfactory cues presented) a 1.524 m piece of black rubber tubing was attached to the fitting and extended outside of the test environment. This tube served to remove odor cues from the test area as well as provide air for the stimulus animal while inside of the container.

Procedure

Prior to experimental testing, four groups (*n*=8) were randomly formed; Group C (no stimulus animal present), Group OL-VI (olfactory and visual cues from the stimulus animal present), Group OL (olfactory cues only), and Group VI (visual cues only). The remaining animal served as the stimulus animal for all subjects. To determine what, if any, effect the cylinder itself had on the subject, one-half of the subject animals in Group C were tested with the clear portion of the *empty* cylinder facing them. The remaining subject animals in Group C were tested without the presence of the cylinder. The order for running the subjects was randomized. The subject was positioned in the apparatus such that its nose was approximately 1 cm from the omnidirectional lever. Each subject was permitted a 5-minute-habituation period in the restraint tube with the appropriate stimulus condition present. A 10 minute period of shock administration immediately followed habituation. During this 10 minute period of shock administration, each subject was exposed to a series of 300 msec duration 1.5 mA shocks administered at 3 sec. intervals. Thus each subject experienced a total of 200 shocks. The total number of aggressive responses and the total time of aggression were recorded for each subject.

CHAPTER III

RESULTS

Prior to overall analysis all measures (both time and frequency) were converted to $Log_{10}\ (X_1 + 1)$ scores. These scores were in turn subjected to analysis of variance. Prior to this procedure the two subgroups comprising Group C (the control group) were compared. As they did not differ, $\underline{t}(6)=.58$, $\underline{p} < .50$, their scores were pooled for further analysis with the other groups. Figure 1 presents the group mean time of aggression. Analysis of variance of this data failed to yield significance, $\underline{F}\ (3,28) = 1.62$, $\underline{p} > .05$. Group mean number of aggressive responses are shown in Figure 2. Analysis of variance of this data yielded a significant, $\underline{F}\ (3,28) = 2.96$, $\underline{p} < .05$, Groups effect.

The Newman-Keuls technique was used to further investigate the significant Groups effect obtained in the response measure analysis. Results of this analysis indicated that Group OL-VI was significantly ($\underline{p} < .05$) more aggressive than all other groups, which, in turn, did not differ significantly among themselves. Thus, the statistical analysis of the response data are supportive of the graphical impression (see Fig. 2) that Group OL-VI was more aggressive than the other groups.

CHAPTER IV

DISCUSSION

Considering the results of the response measure (see Fig. 2) some interesting effects are apparent. There was significantly more aggression displayed by the subjects which were presented with a stimulus animal emitting both visual and olfactory cues. The lack of a significant difference between groups OL, VI, and C indicated that without both visual and olfactory cues the stimulus animal apparently loses its ability to focus the aggression of the test subject. These results are compatable with the Voorhees et al. (1977) study in which the use of a stimulus animal housed in an open cage (providing both visual and olfactory cues) produced significantly more aggression than did the control group which had no stimulus animal.

The mean time of aggression (see Fig. 1) did not produce any significant results. The reason for this appears to be the manner by which the test animals aggressed against the target lever. Some of the subjects would seize the bar in their mouths and continue to bite and pull on it during several shocks. Others would release it at the onset of each shock and seize it again at the termination of the shock. Since the timer ran whenever the bar was held back, then different "types" of aggressive responses resulted in an increase in the amount of within-group variability, especially as measured by time of aggression. This finding is consistent with the other studies using this same apparatus. Neither the Mollenhour et al. (1977) study nor the Voorhees et al. (1977) study yielded any significant differences via the time of aggression measure.

These results, combined with the Voorhees et al. (1977) data indicate, quite strongly, that if within-group variability in single animal shock-elicited aggression studies is to be reduced attention _must_ be given to the external test environment. What the subject sees and smells while undergoing the shock session does have an effect on the amount of aggression that will be displayed. Hence, such questions as where the test subject is kept immediately prior to the test session, as well as the presence of previous subjects in the immediate area must be considered. Also, location and actions of the experimenter during the course of the experiment appears to be relevant. If the experimenter is visible to some of the subjects and not to others, then the test environment is not the same for all. Another possible problem concerns possible odor cues left on or in the test apparatus by the last subject. (They too are altering the test environment by providing cues.) Any of these factors could effect the amount of aggression shown by the subjects.

It is possible that the increase in aggressive responding seen when a stimulus animal is used might be the result of the type of aggression being measured. As has been demonstrated by the present experiment, introduction of an appropriate stimulus (another animal, e.g., Ulrich and Azrin, 1962) for the test subject to focus upon increases irritable aggression. Irritable aggression according to Moyer (1968) will manifest itself in attack, and it is felt that this is the type of aggressive response being measured by the biting attack on the target lever. The other type of aggression mentioned earlier, fear-induced aggression, has escape as the prepotent response. The escape-avoidance reaction seen in fear-induced aggression manifests itself in the subject attending to the locus of the shock and lunging at the restraint device rather than attacking the target lever. The use of a target animal as a focusing stimulus to reduce the fear-induced aggression and increase irritable aggression, might be seen as reducing the within-group variability of the subjects by increasing the aggressive responses to the target lever.

An interesting variation of this procedure that would help to establish the magnitude of the increase in aggression produced by the "stimulus animal" procedure, would be to replicate a study such as the Mollenhour, et al. (1977) REM-shock-elicited aggression study with the addition of a stimulus animal to focus aggression. It might be expected that the pattern of results would remain similar to the original results, but with less within-group variability. There should also be a higher amount of aggressive responses in the groups employing a stimulus animal.

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APPENDIX: FIGURES

Figure 1. Log Mean time of aggression

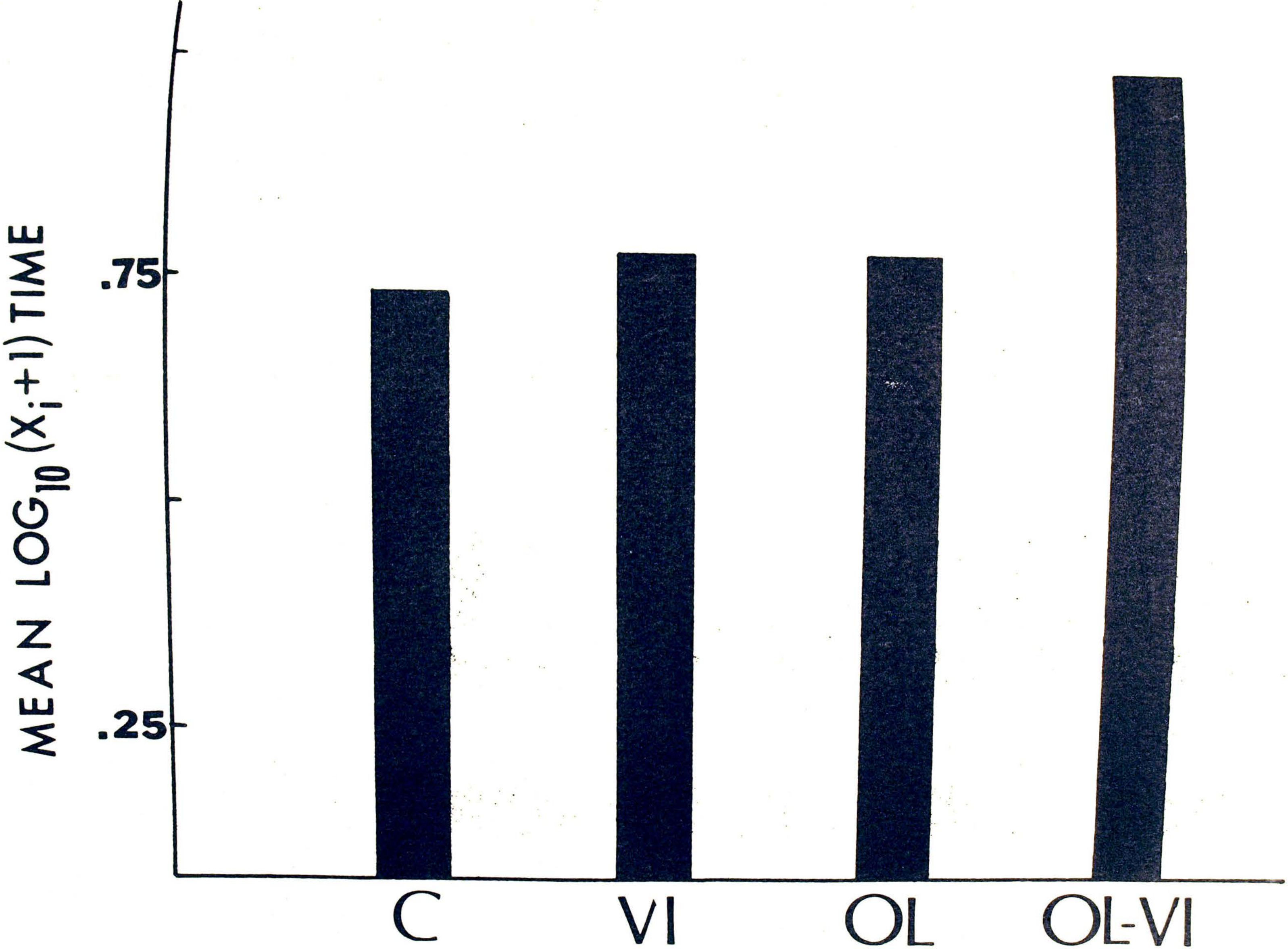
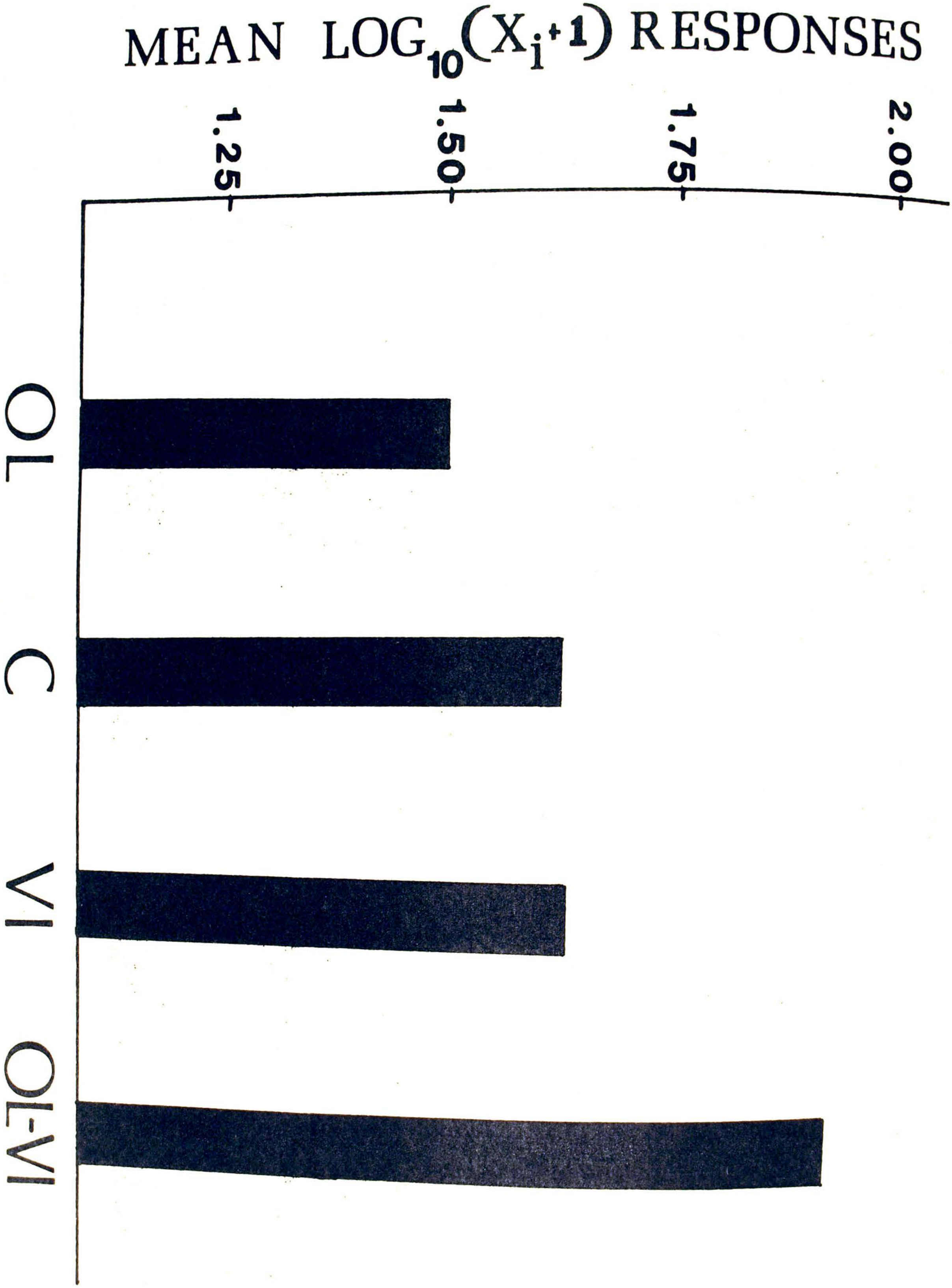

MEAN LOG10 (Xi+1) TIME
.75
.25
C
VI
OL
OL-VI

Figure 2. Log Mean number of aggressive responses


MEAN LOG10(Xi+1) RESPONSES
1.25
1.50
1.75
2.00
OL
C
VI
OL-VI