EFFECTS OF EXTERNAL STIMULI ON SHOCK-ELICITED AGGRESSION

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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

Craig E. Geis

December 1976

ABSTRACT

Male albino rats served as subjects in an investigation concerned with the role of external stimuli on shock-elicited aggression. Five groups were presented with a different external stimulus (control with no visual target, target rat, target rat with vocalization, inanimate object and inanimate object with vocalization) during the administration of inescapable tail shock. The results indicated that the highest aggressive response rate was attained when the subject was confronted with another rat without vocalization. This "target rat" group displayed significantly more aggressive responses than all other groups. No significance was found for the time of aggression. These results are seen as being supportive to the hypothesis that by placing a visual target (i.e., another rat) in front of the subject, greater levels of aggression would be measured and within group variability would be reduced.

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December 1976

To the Graduate Council:

I am submitting herewith a Thesis written by Craig E. Geis entitled "Effects of External Stimuli on Shock-Elicited Aggression". 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:

Garland E. Blair
Minor Professor

William A. Cunnunmuer
Third Committee Member

Accepted for the Council:

Wayne E. Stamp
Dean of the Graduate School

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CHAPTER I

INTRODUCTION

To many observers, man's aggressive behavior qualifies him as the most dangerous animal, controlled only by a thin veneer of society. Studies of aggression in recent years have focused on the causes yet there still remain many questions to be answered as to its measurement.

Since it was difficult to study aggressive behavior in peaceful organisms, early experiments by O'Kelly and Steckel (1939) found that two seemingly friendly rats, when subjected to electric shocks, began to fight defensively. This defensive fighting is applicable to other species as shown by Azrin, Hake, and Hutchinson (1965). These investigators found that the attack of a cloth covered ball was elicited by a tail pinch apparatus attached to squirrel monkeys. Other studies on the effect of shock-elicited aggression include those done by Dunstone, Cannon, Chickson, and Burns (1972) on gerbils and Azrin, Hutchinson, and Hake (1966) using pigeons.

In an attempt to better understand aggression Moyer (1968) applies the term to "behavior which leads to, or appears to an observer to lead to, the damage or destruction of some goal entity." Aggression may be further classified on the basis of the stimulus situation which will elicit it. Moyer (1968) tentatively suggests the following classes: predatory, inter-male, fear-induced, irritable, territorial, maternal and instrumental. Of particular concern to the present study are fear-induced and irritable aggression.

Fear-induced aggression, as described by Moyer (1968), is always preceded by the subject's attempt to escape. The intensity of the fear-induced aggression is relative to the degree of confinement in which the defensive animal is cornered and is unable to escape and the intensity of the threatning agent. Therefore, fear-induced aggression occurs only in cases where escape has been attempted but is not possible.

Irritable aggression, as studied extensively by Azrin, Hutchinson, Ulrich and their collaborators, is one in which the stimulus situation evokes an irritable aggression response. It is differentiated from fear-induced aggression in that it is not preceded by attempts to escape. Moyer (1968) found the conclusions which may be drawn about fear-induced and irritable aggression are tentative at best. The majority of studies use similar conditions which make it difficult to discriminate whether the aggression being studied is fear-induced or irritable because it is not possible to determine whether the subject would have escaped prior to aggressing had the opportunity been available.

In a study of shock-elicited aggression Ulrich and Azrin (1962) described the classical aggressive attack pattern where the rat exhibits what is known as elicited, reflexive, or respondent aggression. It consists of the rat's standing on its hind legs and striking and biting its victim. Thus reflex fighting was elicited between paired rats as a reflex reaction to electric shock. It appears that reflexive fighting can be elicited under a variety of circumstances. For example, electrode-shock to the back and extreme heat have also been found to elicit fighting in experiments done by Ulrich and Azrin (1962). Hence, the reflex is a reaction to always preceded by the subject's attempt to escape. The intensity of the fear-induced aggression is relative to the degree of confinement in which the defensive animal is cornered and is unable to escape and the intensity of the threatning agent. Therefore, fear-induced aggression occurs only in cases where escape has been attempted but is not possible.

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The fact that much of the aggressive behavior we observe is highly stereotyped tempts us to view it as something relatively simple. However in addition to the aversive stimulus which triggers reflexive fighting there are other factors which have been shown to effect the intensity of the reaction. It therefore seems fairer to conclude then that reflex fighting and aggressive behavior is neither completely rigid nor stereotyped. For example, Ulrich (1966) has shown that the number of attacks shown by a subject depends on the intensity of the shock, the size of the confining chamber, the duration of the session, and the age of the subjects. Powell, Francis, Francis, and Schneiderman (1972) concluded that response potential is also effected by the subject's dominance and history of avoidance. The fighting probabilities of animals with histories of avoidance and dominant animals with histories of fighting were higher than the fighting probabilities of non-dominant fighting even after prolonged sleep recovery. Certain types of drugs have also been found to alter the pattern of shock-elicited aggression. Bisbee and Calhoon (1973) investigated the effects of a nausea-inducing drug (lithium chloride) upon shock-elicited aggression. Results indicated that small amounts of the drug increased aggressive responding, while larger amounts inhibited aggression. Other drugs known for their ability to produce degeneration of catecholamine (CA) nerve terminals and depletion of brain CAs were studied by Thoa, Eichelman, and Ng (1972). They found that after intracisternal administration of 6-Hydroxydopamine (6-OHDA) there was an increase in shock-induced aggression in rats.

In conclusion we can see that many factors exist which influence the response to shock-elicited aggression and it is necessary to be as objective as possible in our viewing the data. One area which caused some problem was the early observation techniques used to record aggressive acts. Ulrich and Azrin (1962) used two observers simultaneously to score the fighting behavior of the subjects. It was obvious that this subjective evaluation of the subject's movements needed to be refined and an automatic, more objective, recording device designed.

The difficulty on deciding which type automatic device to use was compounded by research data which showed that not all subjects would attack inanimate objects. Ulrich and Azrin (1962) showed that reflex fighting was elicited between paired rats as a reaction to electric shock yet the shock did not cause the rat to attack inanimate objects such as a doll. Dolls that moved rapidly about the cage also failed to produce fighting. Fighting responses were elicited only when a dead rat was moved about the cage on a stick. Later studies by Knutson (1971) showed that if only one member of a pair is shocked, escape-avoidance responses will take priority over attack. Subsequently, Galef (1970b) concluded that attacks may be directed against anything handy, including inanimate objects.

Because of these disadvantages and realizing the need for more objective measurement, Azrin, Rubin, and Hutchinson (1968) developed an automated method for measuring shock-elicited aggression. They used a single restrained rat and recorded the biting of an inanimate target to define aggression. Thus, a restrained rat might receive an unavoidable tail shock of 5 mA intensity with a 200 msec duration every 10 sec. for 20 min. The results of this study clearly showed that shock could elicit attacks on an inanimate target. Consequently, the aggression reaction was made more readily measurable and objective.

It is clear from prior research that electric shock can disrupt behavior, but it is not clear what general conclusions can be drawn about the subsequent aggression. It must be pointed out that attacks caused by electric shock elicit fighting responses against anything handy, including inanimate objects and that rats may attempt to escape rather than attack as shown by Galef (1970b). Scott (1966) concluded that if shock is delivered through the tail, as in Azrin's apparatus, the subject may try to do the "logical" thing and bite the electrode rather than the target bar or inanimate object. Azrin et al. (1965) found that during one study there was a low overall probability of attack by two of the subjects. An explanation on the basis of individual differences in general docility does not appear plausible since one of the subjects did attack during use in a subsequent experiment. This failure to elicit aggression has also surfaced in experiments by Azrin, Hutchinson and Sallery (1964a) where tail shock and foot shock was applied to monkeys.

At present, there is no satisfactory explanation for the wide range of individual differences encountered. It may be that, the observed variability is being introduced into the experimental situation by the subject trying to "get at" the source of the shock (i.e., when exposed to tail shock, the rat may either strike forward at the bar in an aggressive reaction or try to turn his head in the apparatus and try to strike at the tail wires).

In light of the aforementioned research, a logical direction for shock-elicited aggression studies to follow would seem to be in the area of identifying and hopefully controlling this variability. The present study will essentially be a variation of the Azrin et al. (1968) experiment. The present study will systematically investigate the effects of five visible stimuli on shock-elicited aggression responding. The subjects will be presented an empty space (control situation), a rat confined in a box, a rat confined in a box with a tape of aggression vocalization, an inanimate object, and an inanimate object with a tape of aggression vocalization, respectively.

In view of previous research concerned with the effects of tail shock on the elicitation of aggression [i.e., a restrained rat administered a tail-shock is presumed to aggress toward a target bar as concluded by Azrin et al. (1968)] , it was specifically hypothesized that by placing a visual target (i.e., another rat) in front of the subject, greater levels of aggression would be measured. In addition it was hoped that some inferences could be made concerning the variation caused by the rat turning to aggress the tail shocking device.

CHAPTER II

METHOD

Subjects

Forty-one male albino rats, purchased from the Holtzman Company, Madison, Wisconsin, served as subjects. All subjects were approximately 100 days old at the experiments outset. During the experiment all animals were housed in individual cages with water and food available on an ad lib basis.

Apparatus

A rat restraining device similar to that described by Azrin et al. (1968) served as the apparatus in shock-elicited aggression testing. This apparatus consisted of an opaque plastic tube, measuring 21.5 cm in length and 7.5 cm in diameter, mounted on a plexiglas sheet. The plexiglas sheet was, in turn, stabilized on a wooden platform. However, the plexiglas sheet was easily removed from the wooden platform to facilitate placement of the subject into the tube and to permit easy removal of fecal material and urine that accumulated during testing. 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 to a wooden restraining rod by means of adhesive tape. The other end of the tube was open. Two pieces of No. 14 copper wire were permanently attached to the rod 7 cm apart served as tail electrodes. Thus, when the rod was secured in place it served as both a restraining device to prohibit unauthorized escape from the apparatus and as an electrode carrier. A 1.5 mA half-wave (pulsating) dc current was used and was monitored by a Jackson (Model 665-J-2) mA meter.

The aggression device consisted of an omnidirectional lever Lafayette (Model 80111). This lever was mounted on the wooden platform, perpendicular to the open end of the restraining tube and parallel to the wooden platform on which the tube was mounted. When the tube was in place on the platform, the lever extended across the open-mid portion of the end of the tube. The lever was 1.5 cm from the tube and required a movement of 1 cm to activate the attached microswitch. Closure of the microswitch, in turn, activated a Lafayette (Model 5707PS) impulse counter and standard electric timer.

Five "target" conditions were employed. These targets were placed in front, but beyond reach, of the restrained subject. The neutral or control situation consisted of a cardboard enclosure surrounding the end, top and sides of the apparatus. Enough space was left at the top to permit sufficient light to enter the enclosure. The second condition consisted of a plywood box which housed a target rat and measured 21.1 cm in length, 14.3 cm in width and 16.2 cm in height. The box was painted flat black and the front barred by 6 brass rods placed 1.8 cm apart. This box was placed inside the black cardboard enclosure. The third condition consisted of the same plywood box and rat, but also included a taperecording of a rat vocalizing during 1.5 mA foot shock. This box was also placed inside the cardboard enclosure. The fourth condition utilized a 10 cm square block of wood painted white and placed inside the cardboard enclosure. The final target consisted of the same white block of wood, but also included the taperecording of a rat vocalizing during 1.5 mA foot shock.

Procedure

Prior to the experiment, 40 of the subjects were randomly assigned to one of five equal groups: Group C (control, no visual target, cardboard enclosure only), Group TR (target rat), Group TRV (target rat with vocalization), Group IO (inanimate object), and Group IOV (inanimate object with vocalization). The subjects were secured in the restraining tube and electrode paste applied to the animals tail prior to taping to the restraining rod. The subject was positioned in the apparatus such that its nose was approximately 1 cm from the target rod. Each subject was permitted a 5 min. habituation period in the restraining tube without the appropiate target in place prior to the administration of shock. A 10 min. period of shock administration immediately followed habituation. During this time, 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 was recorded for each subject. The remaining subject served as the target animal for all subjects in Groups TR and TRV.

CHAPTER III

RESULTS

Prior to overall analysis all scores (both time and responses) were converted to $Log_{10}(X_i + 1)$ scores. These scores in turn were subject to Analysis of Variance. Figure 1 presents the group mean time of aggression. Analysis of Variance of this data failed to yield significance, $F(4,35) = 1.54$, $p > .10$. Group mean number of aggressive responses may be found in Figure 2. Analysis of this data produced a significant $F(4,35) = 3.49$, $p < .05$, result.

To further investigate the significant result the Newman-Keuls technique was used. Results of this analysis indicated that Group TR displayed significantly ($p < .05$) more aggressive responses than all other groups. Further it was found that the other groups did not differ between themselves. Thus the statistical analysis of the response data are supportive of the graphical impression (see Fig. 2) that Group TR was more aggressive.

CHAPTER IV

DISCUSSION

Considering the results of the responses (see Fig. 2) several striking effects are readily apparant. There is significant aggression displayed by the subject in the presence of a visible target rat. In other words the highest response rate was attained when the subject was confronted with another rat without vocalization. These results are consistent with the study done by Ulrich and Azrin (1962) in which electric shock did not cause the rat to attack inanimate objects but did elicit a fighting response when a dead rat was moved about on a stick. This aggression is also consistent with the Dreyer and Church (1970) study which showed that the opportunity to aggress is a reinforcer of the behavior of subjects receiving inescapable shock.

It is unfortunate that this result only achieved significance in the response measure but we can see that, for Groups TRV, C and TR, (see Fig. 1&2) the time follows the response but to a slightly lesser degree. For Groups IO and IOV (see Fig. 1&2) the time measure is a reversal of the response measure. This in part may be due to the high reflective quality of the white surface of the inanimate object acting as a painful factor in the albino rat which lacks the normal amount of pigment in the eye.

The difficulty in controlling variability, as shown in experiments by Azrin et al. (1965) and Azrin et al. (1964a), clearly indicates from the present study that the introduction of a target rat readily meets this end. One might ask the question why is the target rat effective? It would appear that the "target" animal causes the subject to attack outward and reduce the attempt to escape or turn in the apparatus and bite the electrode. It should also be noted at this point that subjective evaluation of animals in Group TR lends support to this evaluation. It was frequently observed that aggressive responses were being made by the subject to other than the target bar. There was considerable aggression displayed by teeth clacking, biting of the front portion of the restraining tube and a marked reduction of the subject attempting to turn in the tube.

Now one is faced with determining why the subject did not respond to the other three conditions, IO, IOV and TRV. The lack of response to the inanimate object, as mentioned previously, could be due to the bright color selected for this experiment. The other two conditions, IOV and TRV may have introduced a number of other factors. The possibility of competing responses must be considered because during the IOV and TRV conditions it was subjectively noted that the subjects showed a marked increase in vocalization. This vocalization may have taken the place of the aggressive response. The other factor which should be considered is the inhibitory nature of the vocalization tape and the fear it may have produced in the subjects. The subject's aggressive response pattern may have been curtailed or depressed by the sounds of another rat. Further research in this area would be interesting to see whether different intensities of vocalization or another type of sound altogether will effect the responding rate. In spite of the vocalization factors affecting the response rate it is worthy to note that all other stimuli beside TR were less than the control animals.

In summary the results of the present study indicate the presentation of an external stimulus may be an effective means by which the within group variability which has plagued this area of rat research (no pun intended) may be reduced. This study suggests that another rat is a highly effective stimulus. Further studies in this area may indicate more specifically the specific function of various external stimuli.

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