12-1968

Classical Conditioning of Aggression: A Developmental Study

Gideon

CLASSICAL CONDITIONING OF AGGRESSION: A DEVELOPMENTAL STUDY

by

Bruce E. Gideon, Jr.

A Thesis
Submitted to the
Faculty of the School of Graduate
Studies in partial fulfillment
of the
Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
December 1968

ACKNOWLEDGEMENTS

The author would like to express his gratitude to the members of his committee, Drs. Roger Ulrich, Howard Farris, and Scott Wood, for their aid and guidance in the development and completion of this thesis. Special thanks go to Roger Ulrich, chairman of my committee, whose direction and aid guided this thesis forward and to Howard Farris whose planning and direction not only aided in the completion of this thesis but made the study possible.

Finally, the author would like to thank members of the staff of the Behavior Research Laboratory whose aid and verbal support helped to diminish the more frustrating moments created by this study.

MASTER'S THESIS M-1732

GIDEON, Jr., Bruce E.
CLASSICAL CONDITIONING OF AGGRESSION: A DEVELOPMENTAL STUDY.

Western Michigan University, M.A., 1968
Psychology, experimental

University Microfilms, Inc., Ann Arbor, Michigan

TABLE OF CONTENTS

INDEX OF FIGURES

INTRODUCTION

In the continuing effort of researchers to elaborate the cause-effect relationship of events and behavior considerable research has been devoted to the classical or respondent conditioning of behaviors (Pavlov, 1927). Pavlov provided the classical conditioning paradigm upon which current research is based. In demonstrating the methodology through which a secondary stimulus acquires the eliciting properties of a primary stimulus with which it has been repeatedly paired, Pavlov provided one of the initial steps in the continually develcping empirical analysis of behavior.

Pavlov's research in conditioning was directed principally at the salivary response of his research animals. Subsequent research in respondent conditioning has dealt with cardiac response, eyeblink and nictitating membrane conditioning (Gormezano, 1966), galvanic skin response (Prokasy, 1965) as well as leg flexion (Pavlov, 1927). These responses require the activity of only a small portion of the total organism. Thus, these responses might best be described as molecular as opposed to molar.

Further research in classical conditioning has been directed at more molar response patterns such as avoidance responding (Behrend and Bitterman, 1964; Estes and

Skinner, 1941), courting behavior of Japanese quail (Farris, 1968) aggressive display of Siamese fighting fish (Adler and Hogan, 1963; Thompson and Sturm, 1965) and conditioned aggression in rats (Vernon and Ulrich, 1966; Creer, Hitzing and Schaeffer, 1966).

As in most cases of conditioning, both classical and operant, acquisition of the conditioned response, the level at which the response is maintained, and the reliability with which the response occurs when the controlling stimulus is introduced are functions of the complexity of the response to be conditioned. The relationship between complexity (molarity) of the behavior and the speed and ultimate success of controlling the response as desired is further and more importantly a function of and highly dependent upon the procedure employed. The defining characteristic as to how the conditioning will be acquired and its ultimate stability is not predicated solely on the complexity of the response to be conditioned but is rather a function of the response and the methodology used to establish the conditioned response.

Among the variety of behaviors subjected to investigation using classical conditioning procedures is aggression, a response related to man since the beginning of recorded history. Investigations have ranged from strict observations of the phenomenon with little control

of its occurrence to tightly controlled experimentation where the variables influencing the behavior have been identified and, for the most part, controlled and manipulated.

Early laboratory studies demonstrated aggression to be a response evoked by the presentation of electric shock to the feet of pairs of experimental animals (O'Kelly and Steckle, 1939; Daniel, 1943). Ulrich and Azrin (1962) continued the investigation and further demonstrated that the aggressive response to aversive stimulation was a function of shock density, shock frequency, shock intensity, spatial proximity of subjects at the onset of shock, size of the shamber, sex of the subject and the mode of delivery of the aversive event.

Subsequent research demonstrated that the aggressive response to pain was consistent both within and across a wide variety of species (Ulrich, Wolff and Azrin, 1964; Ulrich, Hutchinson and Azrin, 1965), and that the age of the organism when placed in the shock situation is directly related to the probability of the occurrence of an aggressive response (Hutchinson, Ulrich and Azrin, 1965).

The data thus far indicate that the aggressive response investigated in these studies is best defined as a reflexive response to aversive stimulation. Following this premise, further research was conducted in the

investigation of the respondent conditioning of the relfexive aggressive response in rats (Vernon and Ulrich, 1966; Creer, Hitzing and Schaeffer, 1966). These studies utilized mature rats and using classical Pavlovian techniques demonstrated success in the conditioning of an aggressive response. However, in all cases the reliability of the stimulus to evoke the response was variable. For example, Vernon and Ulrich (1966) reported a maximum of fifty-three percent responding to the conditioned stimulus. Ulrich, Hutchinson and Azrin (1965) indicated that the inconsistency of successive elicitation of aggressive responding by a conditioned stimulus necessitated further investigation of respondent conditioned aggression. Creer, Hitzing and Schaeffer (1966) found it necessary to use an unusually loud (80db) conditioned stimulus, a factor which may have confounded the results (Farris, Gideon and Ulrich, 1968). The problems related here required further investigation of the respondent conditioning of aggression.

As data indicate, the number of variables related to the elicitation of an aggressive response is considerable. However, data reported by Hutchinson, Ulrich and Azrin (1965) demonstrated the elicitation of aggression in young rats, thirty-seven days old. These authors further stated that the contact the organism has with the aversive eliciting stimulus (his history of aversive stim-

ulation) is a critical factor in the magnitude of the unconditioned aggressive response.

The current study is the result of an effort to condition a molar response using classical Pavlovian techniques. The purpose of the study was (1) to clarify questions regarding response strength raised by previous studies and more importantly, (2) to explore the relationship between the age of the subject and the acquisition of the conditioned aggressive response.

METHOD

Subjects

Subjects successfully maintained to the study's completion were twelve male Hooded Long-Evans rats experimentally naive at the beginning of the study. The twelve subjects composed two age groups, six subjects being 34 days old and six being 90 days old at the beginning of conditioning. Subjects were assigned to three pairs within each group and remained in pairs for the duration of the experiment. Animals were housed in the colony room of the Behavior Research Laboratory, Western Michigan University, and had free access to food and water at all times other than during the experimental session.

Twenty-one other subjects, seven in the 34-day old group and 14 in the 90-day old group, were eliminated from the study due to severe injury or death as a function of the unconditioned aggressive response.

Apparatus

The apparatus was identical to that used by Vernon and Ulrich (1966). The experimental chamber measured $8\frac{1}{4}$x$8\frac{1}{2}$x$11\frac{1}{2}$ inches with the front and two adjacent sides constructed of clear plexiglass, permitting an unob-

structed view of its interior. The back and top were of quarter-inch masonite. This compartment was enclosed in a sound-attenuated chest 36x24x18 inches equipped with an eight ohm loudspeaker mounted in the upper right hand quarter of the side wall. A 7.5 watt light was mounted in the center of the same side wall and served as the source of the "house light." A second light, 45 watt, was mounted in the center of the ceiling of the outer chamber and served as part of the conditioned stimulus. A tone of 60 db at 130 cycles per second programmed to the loud-speaker completed the conditioned stimulus complex.

The inner chamber was clamped to the outer chamber floor which was composed of one-sixteenth inch steel rods mounted on one-half inch centers and wired for shock. Shocks were delivered to the steel rod floor by a Grason-Stadler shock generator and scrambler. Shock was used as the unconditioned stimulus in the conditioning procedure.

A small compartment, 10x24x18 inches, extended to the right of the side wall of the outer chamber and contained terminal strips and electrical connectors utilized in programming stimuli to the chamber. Also contained in this end compartment was a Venco 110 volt air blower which ventilated the experimental chamber and also provided a constant low level "white" noise.

Observers viewed the behavior of subjects in the

inner chamber through the plexiglass door and recorded responses by depressing a microswitch that recorded the counts on control and programming equipment located in an adjacent room.

Procedure

Tests for sensitization and the establishment of an unconditioned aggressive response comprised the first four sessions. Session one consisted of 500 presentations of a 130 cycles per second tone and a 45 watt light (conditioned stimulus complex) alone, followed by 175 presentations of two milliampere (ma) foot shock (unconditioned stimulus) spaced every ten seconds. Sessions two and three consisted of 175 and 150 presentations of shock alone respectively. Fighting responses were obtained for each session by an observer depressing a microswitch, recording the event on a counter. A fight was recorded when one or both subjects struck, hit, bit, or pawed at the other, and produced identifiable contact between the subjects.

Session four, utilizing a delay procedure with a one second conditioned stimulus (CS) and a one-half second unconditioned stimulus (UCS), began conditioning. One-half second after the onset of the CS a 2 ma shock (UCS) was presented. The CS and UCS terminated simultaneously one second after the UCS onset. The inter-trial interval

was ten seconds, and one presentation of the CS represented one trial. Every eleventh trial the CS was presented alone (no UCS was presented) to test for conditioning and to track the development of the conditioned aggressive response. Each conditioning session consisted of 200 trials, 18 being CS alone presentations. One session was run per day on a five-day week schedule for a total of at least 33 conditioning sessions.

Avoidance responding by the subjects lying on their backs on the grid floor was punished with an increase in shock amperage on the next one-half second UCS presentation and was returned to 2 ma at the termination of the avoidance behavior. The increase was made in one-half ma increments on each successive presentation of the UCS which was avoided. A level of sufficient punishment, (a shock intensity at which subjects consistently discontinued avoidance responding), was established after several sessions and was then the only intensity used to punish avoidance. A further measure to decrease avoidance behavior was to shave the hair off the subjects' backs and apply a hair removal product to decrease the animal's probability of successful avoidance by lying on his back.

RESULTS

Baseline data are represented in single sessions while conditioning data are averaged in blocks of five sessions for the three pairs of subjects in each of the two groups. All data are shown in percentages of fights: number of fights to the UCS over the number of UCS presentations for UCS fights, and the number of fights to the CS alone presentations over the number of CS alone presentations for CS alone fights.

No fighting was observed in response to the initial 500 CS alone presentations. Subjects were observed to "freeze" during the first few presentations of the CS alone but readily adapted to the novel stimulus. The stereotyped aggressive response was observed to occur by no later than the fifteenth presentation of the UCS for both members of each pair of both mature and immature groups. Fighting responses in the immature group during the UCS test trials were noted to begin at 57 percent, 63 percent, and 28 percent for pairs 100, 102, and 103, respectively, and unconditioned aggressive responding increased across sessions to 85 percent, 96 percent, and 84 percent for the same pairs at the end of the study (figure 1). Fighting responses to the 500 pre-conditioning UCS alone trials of mature subjects were pair 300 beginning at 44 percent, pair 302 at 28 percent. Pair

303 began at a lower rate of 19 percent fights. Unconditioned aggressive responding increased across sessions to 90 percent, 88 percent, and 93 percent for pairs 300, 302, and 303, respectively (figure 2). The conditioned response was evident in all pairs of both groups by the second block of sessions. Asymptotic level of responding was 48 percent, 84 percent and 61 percent for immature pairs 100, 102 and 103, and 71 percent, 70 percent and 58 percent for mature pairs 300, 302 and 303.

The data for all subjects present a similar pattern of acquisition of the conditioned aggressive response (figures 1 and 2). All pairs fought to the UCS in all sessions, and the response probability increased with each session. The conditioned response developed similarly in all pairs with little difference in either frequency or magnitude. A statistical test of difference (Kolmogorov-Smirnov K_D=.05) failed to show any significant difference between groups for either acquisition or asymptotic level of the conditioned response. The acquisition of the conditioned response was essentially the same for mature subjects as for immature subjects.

DISCUSSION

The results clearly demonstrate that aggression, as an attack response to aversive stimulation, is amenable to respondent conditioning. There seems to be little doubt that the response being investigated herein is aggression. Beyond its operational definition, specific to this study, the behavior of the experimental animals both as a result of the unconditioned stimulus and to the conditioned stimulus impresses the observer with the fact that the behavior inside the experimental chamber is aggression. The aggressiveness of the shock-produced response is attested to by the fact that a total of thirty-four animals were used for the experiment, and only seven finished the study. The loss of subjects was attributable almost solely to injury or death brought on by attack and counterattack in the experimental chamber.

The data here are in agreement with earlier studies (Vernon and Ulrich, 1966; Creer, Hitzing and Schaeffer, 1966): the conditioned response was acquired at a nearly stable rate with some session to session variance. However, the asymptotic level of responding, with the exception of one experimental pair for one session, never reached one-hundred percent responding to conditioned stimulus test trials. The level of conditioned responding attained for any one session, 100 percent, was higher

than reported by Creer, Hitzing and Schaeffer (1966), 90 percent, and higher than that reported by Vernon and Ulrich (1966), 53 percent.

Recent research indicates that a loud auditory stimulus not sufficient, by itself, to produce aggressive responding in rats may facilitate a higher rate of aggressive responding to shock than that produced by the shock alone (Farris, Gideon and Ulrich, 1968). This study raises a question concerning the unusual loudness of the Creer, Hitzing and Schaeffer (1966) conditioned stimulus, an 80db auditory stimulus. If a loud auditory stimulus will facilitate aggression, it is conceivable that the loud stimulus isolates the prerequisite for stimulus neutrality. In speculating as to the higher rate of fighting in the present study as compared to Vernon and Ulrich (1966), the experimental subjects were exposed to considerably more CS-UCS pairings and thus had what Hutchinson, Ulrich and Azrin (1965) described as a history of contact with the aversive stimulus, a factor important in the ultimate magnitude of the aggressive response.

It would not be unreasonable to conclude that the less than one-hundred percent conditioning to the stimulus complex is in part a function of the complexity of the response to be conditioned. The aggressive response can be considered a total organismic response. The variables involved in the elicitation of aggressive behavior are not

few nor are they easily controlled. The interaction between the reflexive response, aggression, and its operantly reinforced consequences further adds to the complexity of the analysis of this behavior and the degree to which it can be respondently conditioned.

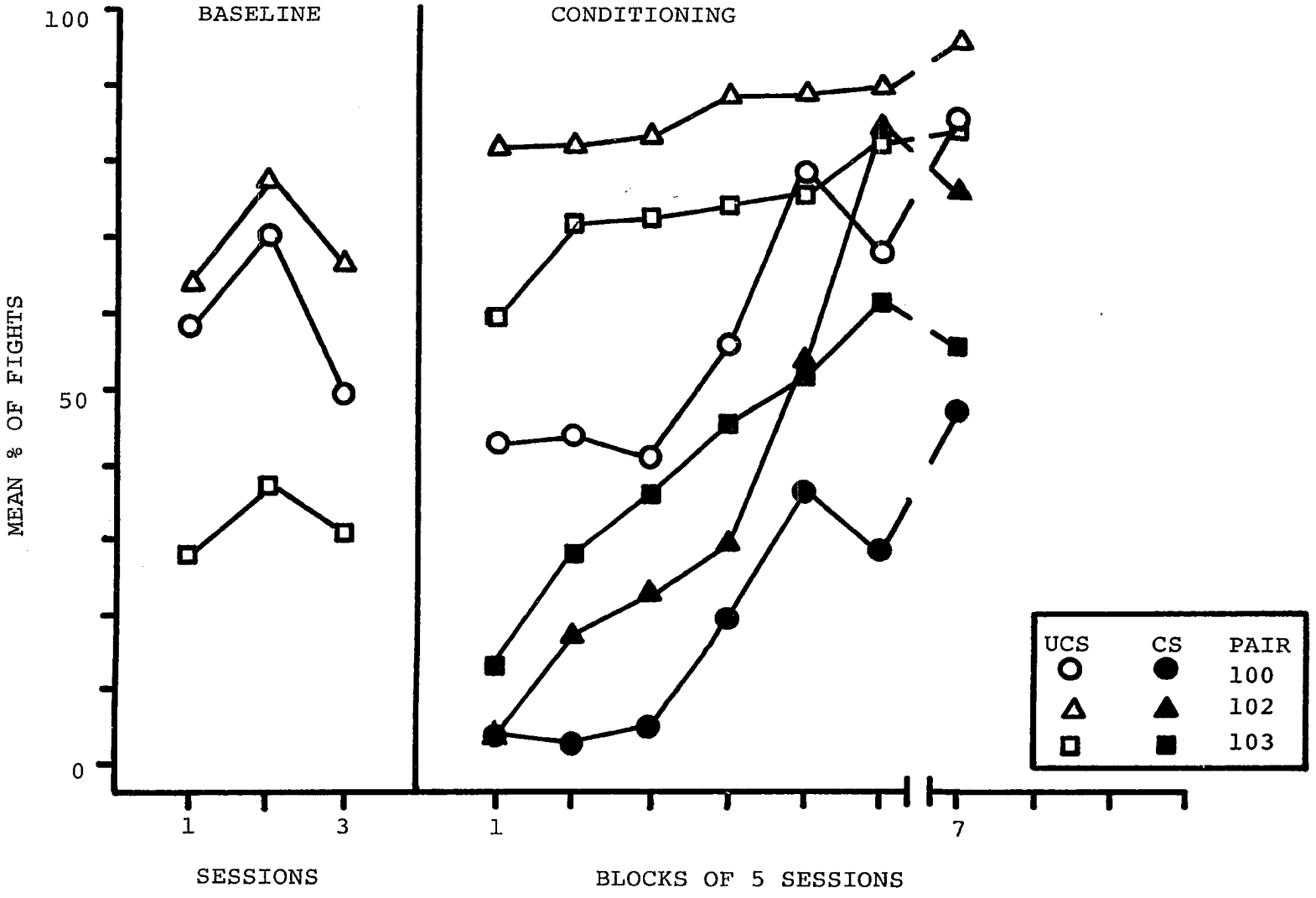
In accordance with the earlier stated premise that the success of conditioning is the relationship between the procedure and the complexity of the response, the classical conditioning of aggression clearly fits into the class of complex molar behavior. Because of its complexity, aggression, and the procedure utilized in respondent conditioning, presents a most difficult response to classically condition to a high probability low variance response, a conclusion with which the data of this study are in agreement.

In light of the major purpose of this study, the exploration of the relationship between age of the subjects and the acquisition and peak of the conditioned aggressive response, the data demonstrate no significant difference between the groups. The age at which the animals of this study first came in contact with the aversive event is not the most important factor in their acquisition of the conditioned aggressive response, either with regard to rate of its acquisition or its asymptotic level of elicitation. It would appear that the most important factor is the extent of exposure to the conditioning

process (Pavlov, 1927; Hutchinson, Ulrich and Azrin, 1965). The history of aversive stimulation, number of pairings of CS and UCS over time, may well be the most critical factor in the development of the conditioned aggressive behavior, a question needing further research investigation.

Research of this type certainly has little value unless it ultimately provides knowledge relative to and stimulates investigation in human research. The phenomenon of aggression as the data indicate is a complex of stimulus response relationships not assessable in simple terms. It is, however, an important and pressing research problem as the current wealth of data indicate. The research progression has been from simple observation to controlled elicitation to both classically conditioned and operant conditioned control. What must be done now is to identify the variables permitting complete control and to generalize the control of aggressive behavior to the human level as well. Knowledge of the factors surrounding elicitation as well as means of differentially producing the aggressive response, both investigated in the present research will hopefully aid in this eventual control.

FIGURE 1



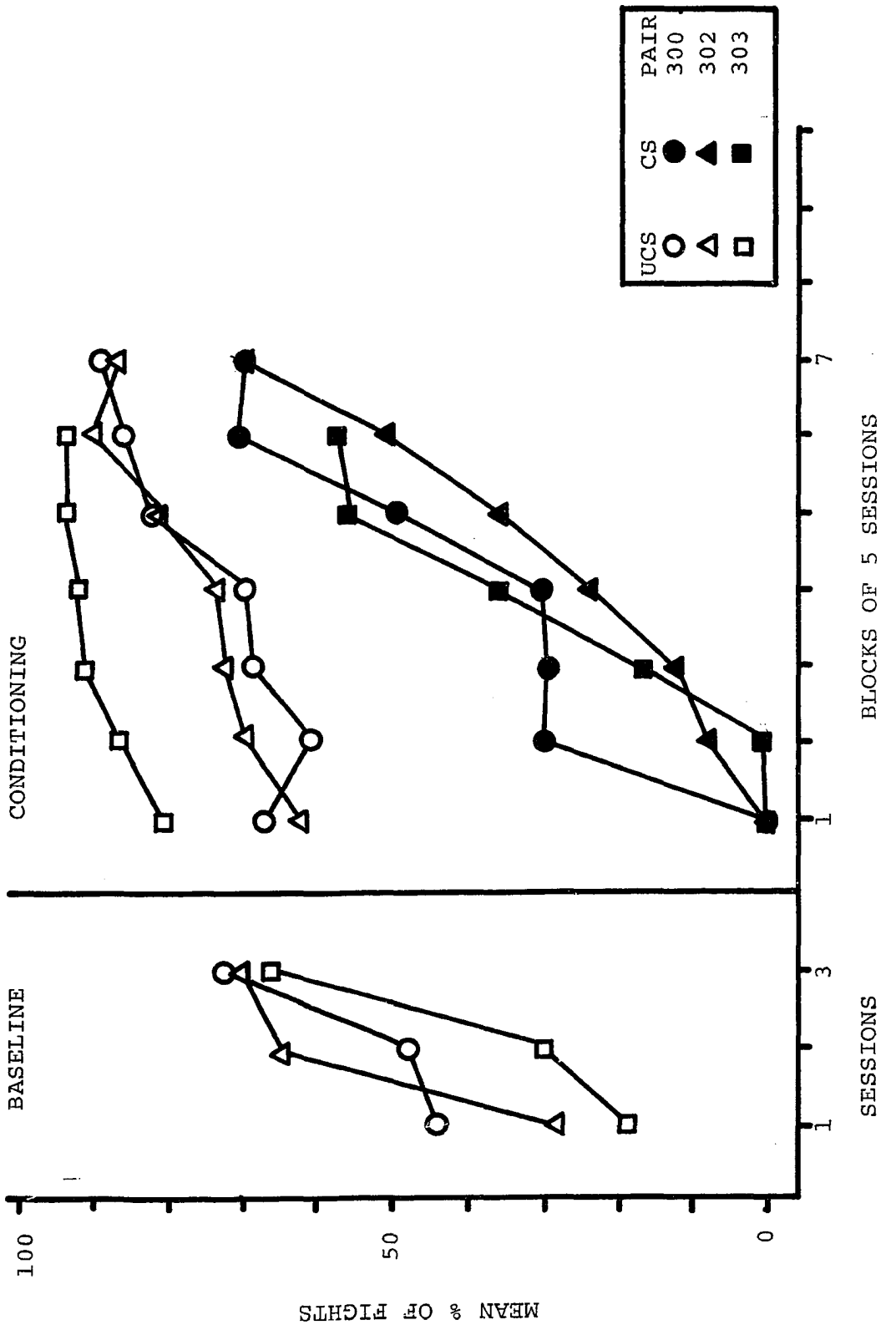


FIGURE II

REFERENCES

Adler, N. and Hogan, I. A. Classical conditioning and punishment of an instinctive response in Betta splendons. Anim. Behav., 1963, 11, 351-354.

Behrend, E. R. and Bitterman, M. E. Avoidance conditioning in the fish: Further studies of the CS interval. Amer. J. Psychol., 1964, 77, 15-28.

Creer, T. L., Hitzing, E. W. and Schaeffer, R. W. Classical conditioning of reflexive fighting. Psychon. Sci., 1966, 4, 89-90.

Daniel, W. J. An experimental note on the O'Kelly-Steckle reaction. J. comp. Psychol., 1943, 35, 367-368.

Estes, W. K. and Skinner, B. F. Some quantitative properties of anxiety. J. exp. Psychol., 1941, 29, 390-400.

Farris, H. E. Classical conditioning of courting behavior in the Japanese quail, Coturnix coturnix Japonica. J. exp. Anal. Behav., 2, 213-217.

Farris, H. E., Gideon, B. E., and Ulrich, R. E. Classical conditioning of aggression: A developmental study. Paper read at American Psychological Association, San Francisco, California, September, 1968.

Gormezano, I. Classical conditioning. In Sidowski, (Ed.) Experimental Methods and Instrumentation in Psychology. New York: McGraw-Hill Book Co., 1966.

Hutchinson, R. R., Ulrich, R. E., and Azrin, N. H. Effects of age and related factors on reflexive aggression. J. comp. physiol. Psych., 1965, 59, 365-369.

O'Kelly, L. W. and Steckle, L. C. A note on long-enduring emotional responses in rats. J. Psychol., 1939, 8, 125-131.

Pavlov, I. P. Conditioned Reflexes. New York: Oxford University Press, 1927.

Prokasy, W. F. Classical Conditioning: A Symposium. New York: Appleton-Century-Crofts, 1965.

Thompson, T. and Sturm, T. Classical conditioning of aggressive display in Siamese fighting fish. J. exp. anal. Behav., 1965, 6, 397-403.

Ulrich, R. E. and Azrin, N. H. Reflexive fighting in response to aversive stimulation. J. exp. anal. Behav., 1962, 5, 511-520.

Ulrich, R. E., Hutchinson, R. R., and Azrin, N. H. Pain elicited aggression. Psych. Rec., 1965, 15, 111-126.

Ulrich, R. E., Wolff, P. C., and Azrin, N. H. Shock as an elicitor of intra- and inter-species fighting behavior. Anim. Behav., 1964, 12, 14-15.

Vernon, W. and Ulrich, R. E. Classical conditioning of pain-elicited aggression. Science, 1966, 152, 668-669.