THE UNIVERSITY OF CALGARY

THE ROLE OF COGNITIVE EXPECTANCY IN VICARIOUS CONDITIONING

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Role of Cognitive Expectancy in Vicarious Conditioning" submitted by Karen M. Ogston in partial fulfillment of the requirements for the degree of Master of Arts.

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ABSTRACT

The development of the concept of vicarious classical conditioning was reviewed, from Allport's (1924) discussion of the mechanisms of sympathy, to Berger's (1962) demonstration of a paradigm for its investigation. The present study adopted a modification of Berger's paradigm, which was as follows: A subject observed a model (a confederate of the experimenter) who appeared to be receiving a shock while a light was on. The subject's GSR was recorded, and the number of conditioned GSR responses to the light CS in anticipation of the model's shock reaction was scored. In the present study, the effects of experience prior to conditioning of a high, a low, or no shock were compared to determine whether experience with shock provides a cognitive expectancy which alters the conditioning process. Scores on the Neuroticism and the Extraversion scales of the Eysenck Personality Inventory were also recorded.

The results showed that the group receiving a high shock prior to conditioning demonstrated better conditioning than the groups receiving a low shock or no shock. The no shock and low shock groups did not differ except in the first ten trials. After ten trials the groups tended to habituate at differential rates, such that by the last ten of the 45 trials given, there were no differences between groups. Due to the scoring procedure employed, the initial differences were unlikely to be caused by sensitization or reactivation of

the orienting response, but seemed due to the subject's prior experience of shock. The possibility that subjects adopted avoidance procedures during conditioning was discussed in relation to this habituation effect, and the value of adopting an operant paradigm for investigating vicarious conditioning was discussed. The possible effects of cognitive dissonance on the present study was mentioned. Extraversion and Neuroticism were found to be of little help in accounting for the individual differences observed. The suggestion was made that drive level may play an important role in the level of conditioning and the rate of habituation. Ideas for further research into vicarious classical conditioning are suggested.

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I. INTRODUCTION

Development of the Concept of Vicarious Conditioning

An area of personality study which has been little pursued for many years has again gained a measure of popularity. This is the study of what Allport (1924) called the "conditioned emotional response", and what today is known as vicarious conditioning[1]. Since 1924, the study of vicarious conditioning in humans had received little attention until the 1960's, when Berger (1962), Barnett and Benedetti (1960), and Haner and Whitney (1960) reintroduced the concept, modifying it through operational definition, and providing a paradigm for its investigation. With Berger's (1962) explicit demonstration of the basic paradigm for the investigation of the phenomenon, there now remains the investigation of the factors by which the paradigm may be extended, and upon which it may be elaborated. The present research was proposed as an attempt to investigate some of these extending factors.

Before proceeding, it seems useful to outline clearly what Allport and later investigators had in mind when they used the term "conditioned emotional response."

Allport (1924) began his discussion of "conditioned emotional

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[1] The present investigation will refer to the phenomenon under consideration as vicarious classical conditioning throughout, as the term "conditioned emotional response" has been adopted by workers in the field of emotional responses in animals, such as Church (1959), and Murphy, Miller and Mirsky (1955). "Vicarious" in the present use of the word, refers to the observation by one person of another's experience, as opposed to direct experience with the situation.

responses" by reviewing the previous theory of sympathetic induction of emotion proposed by McDougall, which is as follows: ". . . the facial expression, cries, and movements of fear directly arouse fear in a person witnessing them, and arouse it, moreover as an instinctive response" (Allport, 1924, p. 234).

Allport strongly objected to McDougall's instinct theory approach to sympathy, and suggested that the emotion aroused in the sympathizer is not necessarily a replica of that in the person who provides the stimulus. In stating his principle of conditioned emotional responses, Allport said: "We fear not because we see expression of fear in others, but because we have learned to read these expressions as signs that there really is something to be afraid of" (Allport, 1924). He suggested that our perception, or conception of the emotion involved has a very great bearing on how we react to emotion in others.

> . . . it is not the direct emotional behavior of the person, so much as the knowledge of the conditions affecting him that make it impossible for us to understand (and indeed to sympathize) with his state of mind.
>
> It is not fear induced by others that we experience, but our own fear of dangerous situations which has been conditioned by social stimuli.
>
> . . . the closer the situation arousing sympathy to the past experience of the individual, the greater will be his sympathy with the person involved. (Allport, 1924, p. 235).

These statements, although perhaps having some intuitive merit, have not been experimentally supported. Allport's basic approach has been modified and an appropriate experimental design suggested by Berger (1962).

Berger's investigation of "conditioning through vicarious instigation", the term which he uses to include all forms of vicarious conditioning, began with an explicit explanation of the terms used in his investigation, and with the drawing of clear distinctions between the kinds of phenomena which meet his criteria, and those which do not. His description of vicarious instigation is as follows:

> . . . if an observer responds emotionally to the performer's unconditioned emotional response (UER), then vicarious instigation has occurred. The performer's UER requires more precise definition. It is meant to refer to the performer's emotional state following the presentation of an unconditioned stimulus (UCS), as perceived by the observer. (Berger, 1962, p. 450)

Berger criticized earlier studies (Barnett and Bernedetti, 1960; Haner and Whitney, 1960), by distinguishing between vicarious and pseudovicarious conditioning, suggesting that for conditioning to be vicarious, rather than pseudovicarious, the observer must not automatically react to the CS, but must react only to the emotional response of the performer.

He also makes the distinction between vicarious classical conditioning, and vicarious instrumental conditioning. Berger preferred to refer to phenomena similar to that described by Allport (1924) as vicarious classical conditioning, rather than as "conditioned emotional responses". Vicarious classical conditioning would occur when the performer's unconditioned emotional response (UER) to what appears to be a shock following the presentation of a light (CS), serves as a UCS for the observer's emotional response (ER). Providing that the CS alone does not elicit the observer's ER, then conditioning occurs when a CS comes to elicit the observer's ER in the absence of the performer's UER.

In considering how operant conditioning could be approached as a vicarious conditioning problem, he suggested that "vicarious instigation may serve as either a positive or a negative reinforcement for observer responses in instrumental conditioning situations" (Berger, 1962). He described vicarious instigation acting as a positive reinforcer as strengthening the observer response it follows. As a negative reinforcer it would strengthen responses which are "followed by the removal or reduction of vicarious instigation". This would occur "when the vicariously instigated emotion is negative". (Berger, 1962, p. 454).

With this conceptual framework, Berger went on to describe his studies on vicarious classical conditioning. The design for all experiments consisted of having a subject connected to GSR electrodes observe a model (also connected to GSR electrodes) whose hand was placed on a shock inductorium. A buzzer was presented for 1 second, followed by the dimming of a light for 1 second. Subjects were told that each time the light dimmed, the model was being shocked, although the model, a confederate of the experimenter, was in fact never shocked. Adaptation trials to the CS preceded 10 conditioning trials and 3 extinction trials. His first experiment was an attempt to see if subjects would respond to withdrawal movement by the model alone, or whether subjects had to also believe through the instructions given to them that the model was being shocked. On the test trials, the group which had been instructed that shock would occur was more responsive. Thus, conditioning was somewhat dependent upon whether the instructions included apparent shock as a variable.

The next experiment further investigated the variables of the first experiment using a 2 x 2 factorial design with shock, no shock, movement, and no movement. The results indicated that shock instructions are only effective when accompanied by movement. Arm movements alone were found to elicit a GSR, but the results clearly indicated that when movement was accompanied by shock instructions, GSR responses were reliably more frequent. It is interesting to note that despite such differences in responsiveness, no significant differences were found when test trials were analyzed, although differences were in the same direction as in Experiment I. When questioned after the experiment, subjects in the no movement group did not think that the model was being shocked. Most subjects in the movement groups thought that they would be given a shock as well as the model.

The second experiment was repeated with some further refinement of techniques. Latencies of the CR were used for establishing criteria of conditioning in this experiment. Again, a buzzer and the dimming of a light were used as stimuli. Here, too, movement of the model was found to be essential for vicarious conditioning. Berger raised the possibility that after the adaptation trials, subjects were resensitized to the buzzer, which he suggests may have mitigated the reliability of the differences he found.

Allport (1924) had originally claimed that for vicarious conditioning to occur, the subject had to fear the situation himself. Berger (1962) suggested that his form of vicarious conditioning may differ from Allport's in that observers in his situation were reassured that they had nothing to fear themselves as they would not be shocked. However, from the self reports of his subjects, and of subjects in similar studies (Berger, 1962; Bandura and Rosenthal, 1966), it was evident that despite reassurances, there were subjects in both groups who felt that they would be shocked. They did have what Allport called "their own fear of dangerous situations conditioned by social stimuli". All the signs from the model indicated that the situation was for him a dangerous situation. Berger acknowledged that the distinction between the two approaches is not entirely clear, and suggested a possible method for studying the problem. He maintained that verbal instructions limited the kind of subjects to which his paradigm might apply, and recommended that specific training histories, i.e., experience with the condition that the performer will undergo, might serve to clarify this problem. This would seem to be in accordance with Allport's statement that the closer a relevant situation is in the past experience of a sympathizer, the greater will be his sympathy. Allport advised that for sympathy to be aroused, we must know the conditions affecting the person with whom we sympathize, and that it is our own reactions to such stimuli which lead us to be able to respond appropriately.

Factors That Could Affect Vicarious Conditioning

Cognitive factors. It is well known that several variables affect conditioning in humans (Franks, 1961). Particularly relevant to vicarious conditioning could be the effect of cognitive expectancies. Studies which give evidence to support such a suggestion would include Nichols and Kimble (1964), who found that if subjects in an eyelid conditioning experiment were given inhibitory instructions by which they were told to concentrate on not blinking until they felt the puff of air, they developed rapid habitutation to the UCS.

In the area of verbal conditioning, Dulaney (1961), and Kanfer and Marston (1962) showed that giving subjects information relevant to the task facilitates learning. Where no task relevant information is given, Dulaney suggested that subjects form hypotheses as to what is being reinforced, and those with correct hypotheses condition best.

Wickens, Allen and Hill (1963) have shown in GSR conditioning that telling subjects before extinction trials that the UCS would not reoccur produced almost immediate extinction of the GSR response, as compared with the extinction rate in subjects who were not given this information.

Strength of the UCS. Another variable which has frequently been shown to be important in conditioning studies is the strength of the UCS (Beck, 1963; Burstein, 1965; Walker, 1960). Spence and Platt (1966) have found that the intensity of the air puff in eyelid conditioning determines the proportion of the subjects who condition. With higher intensities of the puff of air, more subjects will condition.

Since the subject in a vicarious conditioning paradigm is not directly experiencing the shock, the strength of the UCS for him may be a function of his cognitive expectancies of how painful the shock is to the model. Studies in areas other than conditioning have shown that this kind of cognitive expectancy can significantly alter the responses of the subject. For example, in a study of autonomic responses to pain, Craig (1967) used three groups. The first group was given direct experience with immersion of the hand in cold (2° C) water. The second group was given vicarious experience which consisted of watching another person put their hand in cold water. The third group placed their hand in water which was slightly cool, and were asked to imagine that it was painfully cold. His most relevant finding for the present study was that heart rate deceleration occurred with the vicarious experience of immersion, while heart rate acceleration occurred in the other two conditions. This led him to conclude the following:

> The possibility that cardiac deceleration relects increased sensitivity to environmental input suggests that central or cognitive processes play an important role in determing the behavioral consequences of vicarious experience. (Craig, 1967, p. 16)

Individual differences. The variable of individual differences, which has received considerable attention in other conditioning studies, has been relatively neglected in vicarious conditioning studies. This is doubly surprising because of the known effects of personality variables on the rate of conditioning (Eysenck, 1965), and the known effects of personality variables on interpersonal interactions such as could occur between the subject and the model.

The first study of vicarious classical conditioning which attempted to take certain personality variables into consideration was that of Haner and Whitney (1960). The variable which they investigated was that of anxiety. They found that scores on the Taylor Manifest Anxiety Scale were somewhat related to their results. Significant differences were found between high anxious and low anxious subjects on the last 3 of 5 vicarious conditioning trials, and trials 3 and 5 of the 5 extinction trials. These differences appeared to indicate that high anxious subjects showed a greater GSR than low anxious subjects to the observation of another person presumably being subjected to traumatic stimulation.

Bandura and Rosenthal (1966) have shown somewhat more conclusively that arousal level is related to the vicarious classical conditioning situation. They administered either an epinephrine injection, placebos with stress or no stress, or no injection to subjects to demonstrate that vicarious classical conditioning is positively related to the degree of psychological stress.

Eysenck (1957) argued that a variable which has more relevance than anxiety or arousal for conditioning is that of introversion-extraversion. From his theory, based on cortical excitation and inhibition of the central nervous system, he defines the relationship between these properties of the nervous system and conditioning and personality variables. He links those persons who develop inhibitory potential slowly with introverted patterns of behavior and rapid conditioning. Those who develop inhibitory potential quickly show extraverted patterns of behavior and poor conditioning.

Eysenck states that "the socialization process is mediated to a considerable extent by conditioning reactions of an autonomic type" (Eysenck, 1957, p. 210). Since extraverts condition poorly, and introverts condition quickly:

> . . . under conditions of equal environmental pressure, we would expect extraverts to be undersocialized, introverts to be oversocialized, with people in less extreme positions on the extravert-introvert continuum showing intermediate degrees of socialization. (Eysenck, 1957, p. 210)

The Relationship of Vicarious Learning to the Socialization Process

The relationship of vicarious conditioning to social learning has only recently been considered. The studies of Bandura and his coworkers have shown the effects of vicarious experience on the learning of social attitudes and responses (Bandura, 1962; Bandura, 1965a; Bandura, 1965b; Bandura, Grusec and Menelove, 1967; Bandura, Ross and Ross, 1963; Bandura and Walters, 1963; Grusec and Mischel, 1966). Generally, Bandura stressed the importance of reinforcement contingencies to the model in changing the subject's behavior, indicating that this is an important variable in social learning.

However, vicarious learning has a limitation which Bandura (1965a) described in the following study. He pointed out that children who watched a model punished for undesirable acts did not engage in those acts in subsequent testing to the extent to which children who watched a model rewarded for the same undesirable behavior imitated that behavior. However, if the same children who watched the model punished were directly offered positive reinforcement for the same behavior, differences between the groups were nullified. The potency of learning from a model, however, was shown by Bandura (1967) in a study on vicarious extinction of avoidance behavior. In this study, Bandura took children who had a fear of dogs, and exposed some children to a model playing with a dog, exposed others to a dog alone, and exposed others to pleasant toys. In subsequent exposure to a dog, he found that the aversion to dogs was greatly reduced in the group who had watched the model play with dogs, as compared to the other groups.

Studies by Schachter and his coworkers (Schachter, 1959; Schachter and Singer, 1962; Schachter and Wheeler, 1962; Latané and Schachter, 1962) have demonstrated the importance of cognitive factors on social learning. In the study by Schachter and Singer (1962) subjects were injected with adrenalin and sent into a waiting room where they were told they must wait for the drug to take effect before taking part in an experiment on vision. In the waiting room was a confederate of the experimenter who was performing many antics. Some subjects were previously correctly informed about the physiological effects that the drug would have, while others were misinformed or uninformed. Those who were misinformed joined the confederate in his antics, while those who were correctly informed did not. Subjects who were uninformed, but who correctly perceived the effects of the drug behaved more like the informed group than like the misinformed group. Those who did not perceive the effects of the drug behaved like the misinformed group. In a second part of the study, it was shown that if the confederate feigned anger, subjects who were uninformed about the effects of the drug generally became angry, while the correctly informed subjects did not. Those uninformed subjects who correctly guessed the effect of the drug behaved more like the informed group than like their uninformed fellow subjects.

Schachter has, in effect, demonstrated that modifying cognitive expectancies affects the amount of social learning. Berger has certainly recognized that cognitive expectancies are important in vicarious conditioning, but to date, no one has attempted to systematically investigate their effects in the vicarious conditioning paradigm.

II. STATEMENT OF THE PROBLEM

If the demonstration of vicarious classical conditioning may be viewed as a first and a basic step in developing a schema in which we can study some aspects of social learning, it would seem to be essential to next look at some of the factors which could account for variation in this conditioning process. One very important factor which seems to warrant investigation is the cognitive expectancies in this conditioning situation. With regard to the role of cognition in conditioning, Berger (1962) makes the following suggestion:

> Observers first may be given direct experience with the condition that the performer will undergo, and then be exposed to a performer in that condition. Subsequently, the observer may be tested to determine if his behavior was affected by exposure to the performer. Although it seems feasible to provide different training histories for each experimental and control condition used in studies of vicarious instigation, experimental evidence is needed to demonstrate the suitability of the training technique for investigation of vicarious instigation phenomena. (Berger, 1962, p. 465).

In Craig's (1967) study comparing direct, vicarious and imagined experience of immersion of the hand in cold water (as previously described), he also stressed the importance of the cognitive element in vicarious experience.

The purpose of the proposed investigation is to determine how variations in cognitive expectancies will influence the rate of vicarious conditioning of the subject. Differences in cognitive expectancies will be provided by direct experience prior to conditioning with the level of shock supposedly received by the model during conditioning.

It is predicted that prior experience of a strong shock will produce stronger vicarious conditioning than prior experience of a weak shock. A group that is given no experience with shock should fall in between the other two groups. This group would have no prior shock as a referent, and more variations may be found among subjects in their interpretation of the shock level received by the model. If the no experience group is given both levels of shock after the conditioning trials, and asked which shock they believed the model was receiving, it could be predicted on the basis of earlier studies that those subjects who had conditioned well would estimate that the model was receiving the stronger shock, while those who conditioned poorly would estimate that the model was receiving the weaker shock.

Another variable which could be expected to have some relationship to vicarious classical conditioning, and to the effects of experience with shock on vicarious conditioning is the personality dimension of introversion-extraversion. Consequently, it was decided in the present investigation to look at the relationship of this dimension to vicarious classical conditioning. It is predicted that, as in the usual conditioning paradigm, extraverts will condition more slowly than introverts due to the slow build up on inhibition in the extravert as compared with the introvert. With the experiencing of weak shock, this difference may be more pronounced than differences at the strong shock level (Eysenck, 1965). These differences should be especially clear in a vicarious conditioning situation as, not only would an extravert condition much more slowly, but he would also show less responsiveness to a model's emotional reaction due to his reduced capacity for socialization, and consequently, for empathy.

The group receiving no experience with shock prior to conditioning is a necessary inclusion in the present study, not only to serve as a control group, but in facilitate comparisons with the work of previous investigators, particularly that of Berger (1962).

The number of conditioning trials will be extended in this investigation in order to ensure that the effects obtained are not due to a reinstatement of the orienting response with every change in the stimulus presentation. In this way, it will be possible to establigh more conclusively whether vicarious conditioning of the GSR is occurring or not, and then to look at the variations in vicarious conditioning which may be attributed to the cognitive element provided by prior experience with shock, and by the personality dimension of introversion-extraversion.

III. METHOD

Subjects

Subjects were 60 female students from summer school classes at the University of Calgary and from nursing classes at the Foothills Hospital in Calgary. These 60 students were randomly assigned to three groups of 20 subjects each. Each subject was tested with a second person, who was a paid Model (M) assisting with the experiment, but who appeared to be just another subject. Group I was given preconditioning experience of a weak shock, followed by vicarious classical conditioning, while Group 2 received preconditioning experience of a strong shock, followed by vicarious classical conditioning. The third group (Group 3) underwent vicarious classical conditioning with no experience of shock given prior to conditioning. Members of this group were given a weak shock and a strong shock after the conditioning trials, and were asked to estimate which shock they believed M was receiving.

Procedure

When a subject (S) arrived, she was taken to a small testing room where she was asked to complete the Neuroticism (N) and the Extraversion (E) scales of the Eysenck Personality Inventory (EPI) (Eysenck and Eysenck, 1964). After she had completed the test, she was brought to the polygraph recording room by the Experimenter (E), and seated at one end of a trapezoidal table. Silver-silver chloride GSR electrodes were attached to S with the active electrode on the left palm and the neutral electrode on the left forearm. S was told that E was conducting a study in which physiological responses to a light stimulus were being recorded. Two subjects would be tested simultaneously, one of them under stress conditions, and one under nonstress conditions. S was informed that she had been selected to serve as the control subject, and that the other subject (in fact M) would be the stress subject. The stress was to take the form of electric shocks applied during a number of the trials while the light stimulus was on. Ss in Groups 1 and 2 (those given experience of shock prior to conditioning) were told at this point that it was necessary to give them one shock of the same size as the shock which was to be given to the other subject in order to establish the comparability of their emotional responses. The shocking electrodes, which consisted of two spring metal coils, were placed around the index and third finger of Ss right hand. The shock given to the weak shock group (Group 1) was 1.2 milliamps, while the shock given to the strong shock group (Group 2) was 4 milliamps.

In all groups, M was then brought into the recording room, and seated at the opposite end of the table at which S was seated. The electrodes and shocking apparatus were attached to M. An opaque circular light 7 1/2 inches in diameter, illuminated by a red bulb of 15 watts, was suspended on a stand behind the table, such that it was 10 inches above and at the center of the table. The room was slightly dimmed throughout the experiment.

Subjects were then given further instructions (See Appendix A) in which they were told that E was conducting an experiment to determine whether different kinds of stimulation produce different kinds of autonomic changes, and that in this case the stimulus was light. E then said that she was interested in another variable as well--the variable of stress. M was told in the presence of S that she would be shocked on a number of trials while the light was on to determine the effect of stress on autonomic responses, and that she would feel the shock as a brief, painful stimulation. M was asked to place her fingers under a recorder which would measure how often she flinched at the shock. Both S and M were told to rest their arms quietly on the table, and to move as little as possible. They were also told that the light would turn on and off quite a few times before any shocks would occur to M. Finally, both were asked to put on earphones to cut out any auditory distractions. Throughout the experiment, S and M were addressed as if both were subjects who knew nothing about the experiment.

At this point, E went to the polygraph room, and began recording the GSR of the S. Light stimuli alone were presented for at least ten trials, or until two trials were given with no occurrence of a GSR to the light alone. This was done to help ensure that the orienting response to the light alone had undergone adaptation. The adaptation trials were followed by 45 conditioning trials in which the intertrial interval ranged between 5 and 40 seconds, with an average interval of 20 seconds over trials. To reduce massed practice effects, the 45 trials were presented in three blocks averaging 15 trials each, with a few minutes break between each block.

The procedure for the conditioning trials was as follows: A five second light stimulus was presented. After four seconds of light, a soft tone was presented in the earphones of M for a duration of one second. S at no time heard a signal through her earphones. Every time M heard a tone, she reacted as if she had been shocked, giving a wincing withdrawal response. The responses of M were the same for all three groups. The 45 acquisition trials were presented with one test trial of light alone randomly interspersed among every five acquisition trials. This procedure closely follows that of Davidson, Payne and Sloane (1964). On these test trials of light alone, M received no tone, and so gave no reaction. After the 45 conditioning trials, ten extinction trials were given. Subjects in the group given no experience of shock prior to conditioning (Group 3) were asked if E could give them a weak shock and a strong shock, and if they would estimate which shock they believed M had been receiving.

IV. RESULTS

The number of conditioned GSR responses occurring in each block of 5 trials was determined for each S for both the acquisition trials and the extinction trials according to the scoring criteria established by Hammond (1967). These criteria allowed only responses occurring between 1.5 and 4 seconds following the onset of the light stimulus to be counted as conditioned GSR responses. GSRs given in this interval had to exceed .3% of the base level resistance immediately preceding the GSR.

The acquisition trials were analyzed using an Extended Alexander Trend Analysis (Grant, 1956). This analysis showed that the differences between the three groups in their overall conditioning scores were significant $F(2,57) = 8.00$, $p < .05$. The results of this part of the trend analysis may be seen in Table 1. When the overall conditioning scores were compared for the three groups using a Newman-Keuls Test (Winer, 1962), it became apparent that Group 1 differed significantly from Group 2 ($q = 3.83$, $df = 57$, $p < .05$), and that Group 2 differed significantly from Group 3, ($q = 5.522$, $df = 57$, $p < .05$), but that the difference between Groups 1 and 3 was not significant ($q = 1.69$, $df = 57$, $p > .05$). The results of this analysis are shown in Table 2, and graphs of the conditioning scores for each group are shown in Figure 1.

In looking at the linear, quadratic, cubic, quartic and quintic components of the groups X trials interaction for the acquisition scores,

TABLE 1

Analysis of Variance for Group Differences on Conditioning Scores for Total Acquisition Trials

Source	df	MS	F
Between Groups (A)	2	646.87	8.00**
Within Groups (W)	57	80.85	
Total	59		

Note - N = 20 for each group

** $p < .01$

TABLE 2

Newman-Keuls Range Test on Conditioning Scores

for Total Acquisition Trials

(a) Source (See Table 1)

(b) Treatments ordered in terms of totals and compared

	Group 3	Group 1	Group 2
Total	228	296	450
Group 3	-	(2) 68	(3) 222
Group 1	-	-	(2) 154
Group 2	-	-	-

(c) Critical differences necessary between groups

1	2	3
qr	2.83	3.41
$q_{(Gp2-Gp3)}$		5.52*
(Gp2-Gp1)	3.83*	
(Gp1-Gp3	1.69	

Note - N = 20 for each group

* $p < .05$

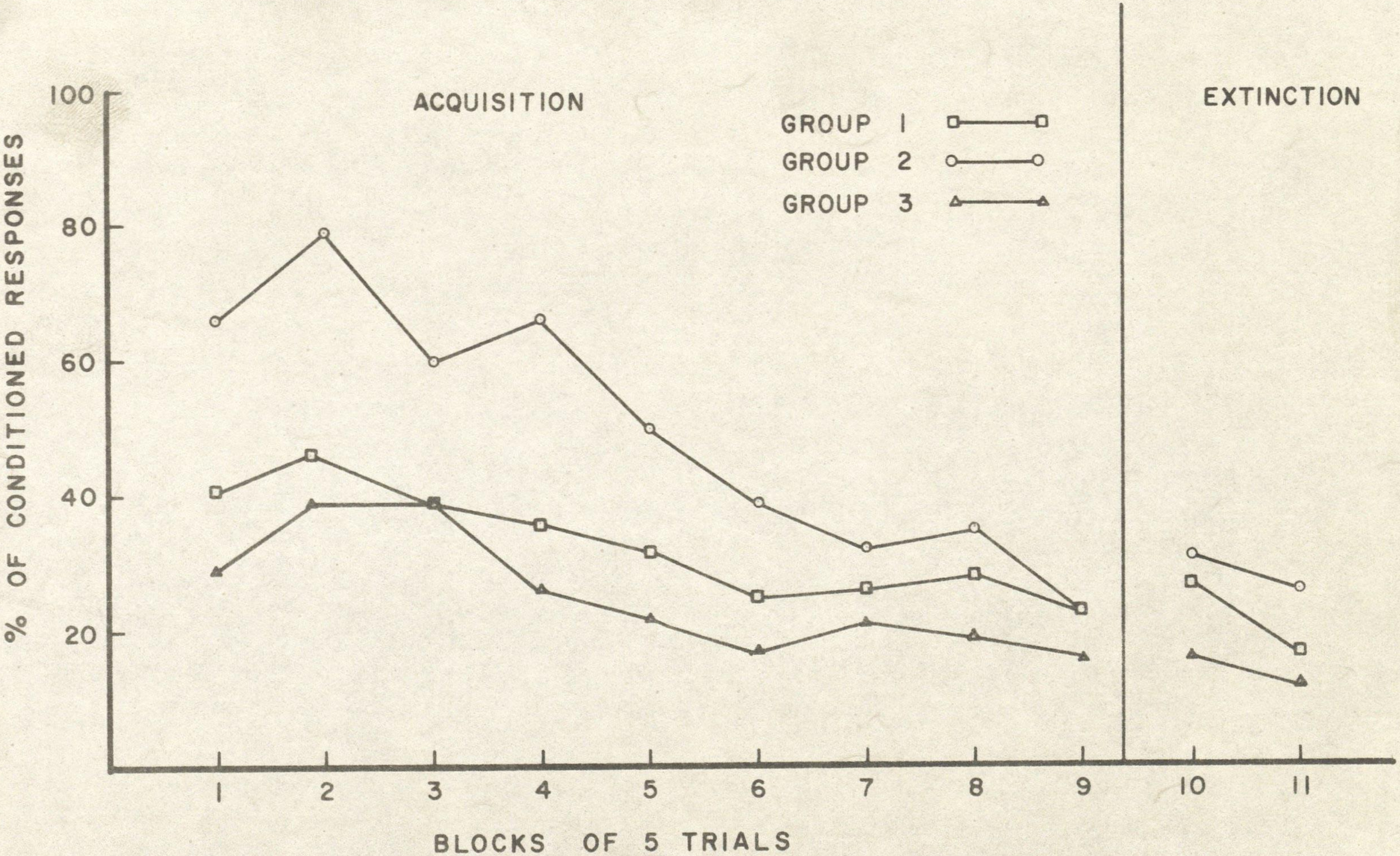

Figure 1. Conditioned Responses per block of 5 trials
Acquisition and Extinction trials.

it was found from the trend analysis that the differences between the linear components of the three groups were the only differences that were significant (F (2, 57) = 7.326, $p < .05$), indicating that the differences between the three curves were only significant in terms of their slopes. The details of this trend analysis are reported in Appendix C. This linear trend indicated a pronounced habituation effect over the course of conditioning.

The regression analysis between trials over all groups (trials effect) indicated that the linear, cubic, and quartic components of the trials trend were significant (See Appendix C). From these regression scores, the theoretical coordinates for each block of acquisition trials in all three groups were derived (Grant, 1956). The curves of best fit for these coordinates are shown in Figure 2, with the actual data points marked for each group.

The extinction scores were analyzed by a simple analysis of variance (Lindquist, 1953). This analysis indicated that there were no significant differences between groups (See Table 3). In looking at the extinction trials, it does not seem surprising that the groups were not significantly different, due to their almost identical levels at the end of the acquisition trials.

Scores on both the N and the E scales of the EPI were correlated with total scores on acquisition and extinction of the conditioned response. The resulting Pearson Product-Moment correlations (Ferguson, 1959) are shown in Table 4. The only correlation which was significant

TABLE 3

Simple Analysis of Variance of Extinction Scores

Source	df	MS	F
Between groups (A)	2	10.52	2.507
Within groups (W)	57	4.196	
Total	59		

Note: N = 20 for each group

TABLE 4

Pearson Product-Moment Correlation Coefficients

between Numbers of Conditioned Responses and EPI Scores

EPI	Group 1		Group 2		Group 3		Average	
Scores	Cond.	Ext.	Cond.	Ext.	Cond.	Ext.	Cond.	Ext.
E	.13	-.04	-.36	-.24	-.10	.01	-.12	-.09
N	.16	.40*	-.01	-.26	+.16	.20	.10	.11

Note: N for groups 1, 2 and 3 = 20; Average N is for 60 Ss.

* $p < .05$

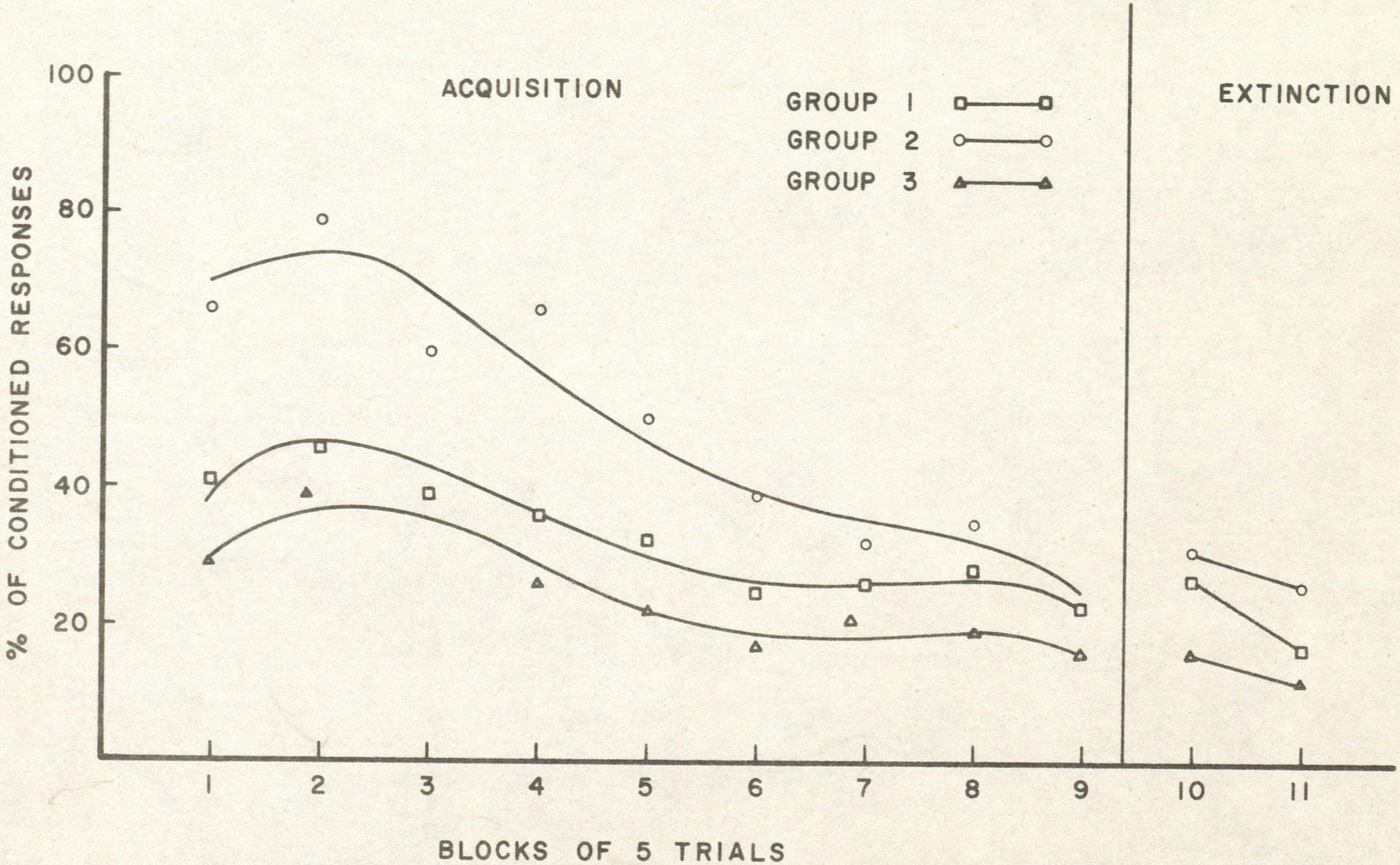

Figure 2. Curves of best fit for Conditioned Responses over blocks of 5 trials.

was the correlation between the N scale of the EPI, and extinction of the conditioned response (*r* = .397, *N* = 20, *p* < .05). With twelve correlations, this correlation was likely significant due to chance alone.

When the Group 3 judgments, as to the shock level received by the model, were scored all but one subject judged that the model was receiving the strong shock. Consequently, the hypothesis that rate of conditioning in this group would depend upon whether *Ss* perceived the shock to be weak or strong could not be evaluated statistically. It is interesting to note, however, that in spite of *perceiving* the shock as being strong, this group's level of conditioning was closer to that of the group that had *experienced* the weak shock.

The first nine acquisition trials were plotted separately for the three groups (see Figure 3). This allowed comparison with the distribution obtained by Berger (1962). A trend analysis (Edwards, 1960) was performed on the first nine trials for all three groups. This analysis, summarized in Table 5, indicated that the three groups were significantly different (F (2, 57) = 13.26, $p < .05$), but that the trials effect was not significant (F (2, 114) = 1.74, $p > .05$), nor was the groups X trials interaction significant (F (4, 114) = .89, $p > .05$). A Duncan Multiple Range test (Edwards, 1960) showed that all three groups differed significantly from each other. (See Table 6). It was decided to look at the differences between the groups in the last 10 trials using a Duncan Multiple Range Test. No differences

TABLE 5

Trend Analysis for Differences on Conditioning Scores for the First Nine Acquisition Trials

Source	df	MS	F
Groups (A)	2	20.69	13.26**
Error (A)	57	1.56	
Trials (B)	2	.92	1.74
Groups x trials (AxB)	4	.47	.89
Error (B)	114	.53	
Total	179		

Note: N = 20 for each group. Trials were grouped in blocks of 3.

$^{**}p < .01$

TABLE 6

Duncan Multiple Range Tests Between Groups

for Blocks of Trials

	1 - 9		11 - 25		26 - 35		36 - 45	
Groups	R_k	diff	R_k	diff	R_k	diff	R_k	diff
1 - 2	.7912	2.5 *	2.54	4.90*	1.54	1.00	1.60	1.30
1 - 3	.7912	.90*	2.54	1.00	1.54	.65	1.60	.95
2 - 3	.8192	3.40*	2.68	6.10*	1.62	1.65*	1.69	.35

Note: N = 20 in each group

* $p < .05$

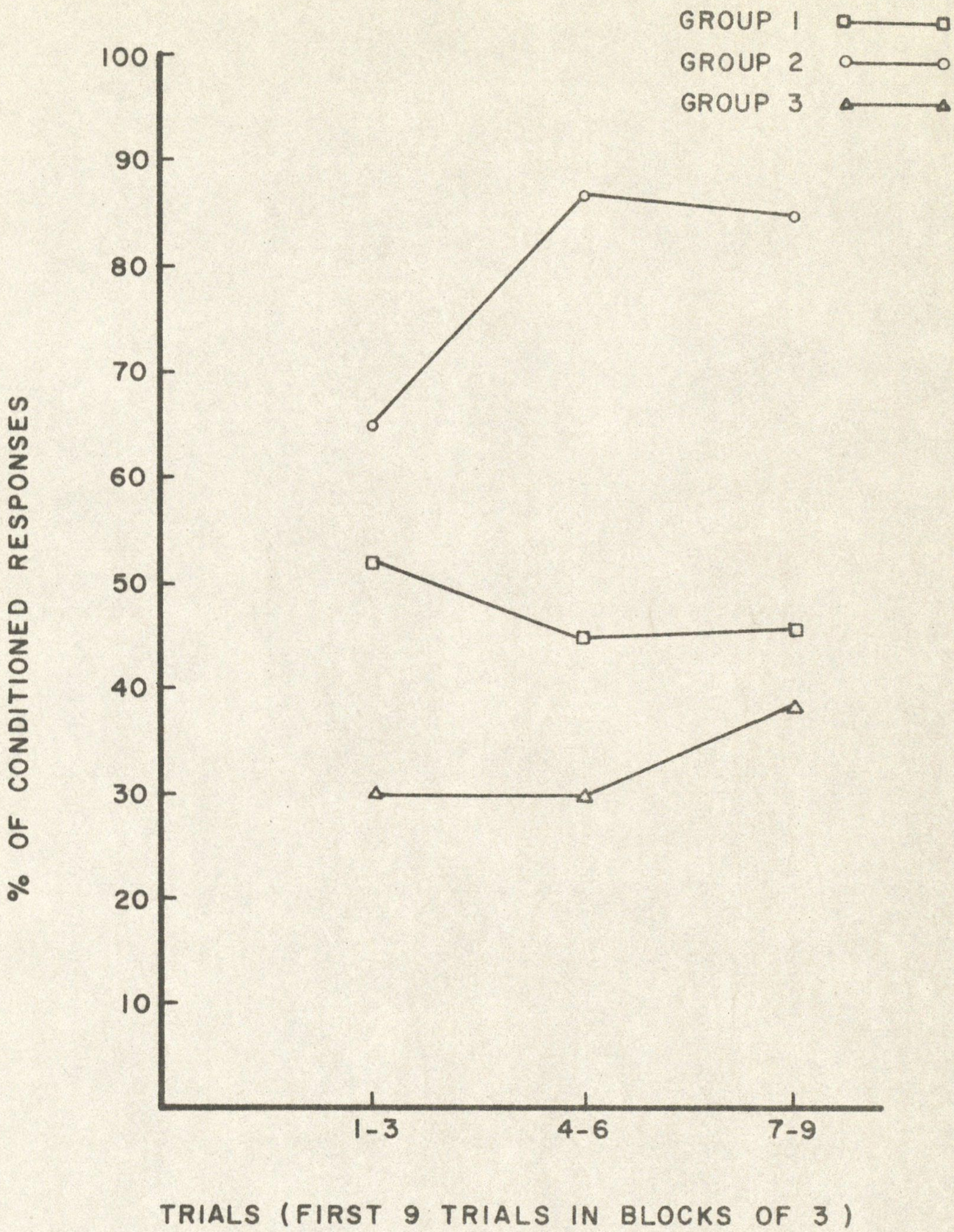

Figure 3. Conditioned Responses in the first nine trials for blocks of three trials.

here were significant (see Table 6). To determine at what points the differences became significant, Duncan Range tests were also done on trials 11-25 and 26-35. These analyses indicated that group 2 maintained its difference from Groups 1 and 3 in trials 11-25, but Groups 1 and 3 were no longer different. From trials 26-35, Group 2 was different from Group 3, but was no longer different from Group 1. In trials 36-45, no groups were different.

V. DISCUSSION

Generally, these results indicate that subjects who have some cognitive expectancy established through experience of shock prior to conditioning will condition better than those who have had no prior experience of shock. The group given no shock experience did not differ from the weak shock group in the overall acquisition trials. However, if just the first nine trials are considered, the level of conditioning of this group fell significantly below the low shock group.

Thus, the results can be taken as indirect support for Allport's (1924) contention that it is the direct knowledge of the situation affecting another person that makes it possible for us to understand and to sympathize with his state of mind. Furthermore, Allport states that "the closer the situation arousing sympathy is to the past experience of the individual, the greater will be his sympathy with the person involved" (Allport, 1924). As shock was a relatively novel experience to most of the subjects in this experiment, those who were not given prior experience of shock had little direct knowledge of the situation affecting the model. Although they reported feeling sorry for the person being shocked and glad that they were not being shocked, this sympathy was seldom reflected in their physiological responses. The stronger the shock, the greater the amount of physiological responding, at least in reference to GSR conditioning.

The fact that the higher intensity of the shock given prior to conditioning led to better conditioning is analogous to the findings of Spence and Platt (1966) and others (cf. Beck, 1963; Burstein, 1965; Walker, 1960) in their studies of direct classical conditioning which showed that the intensity of the UCS relates directly to the degree of conditioning.

It is difficult to define in vicarious conditioning just what constitutes the UCS, but presumably its effect is determined in a large part at least, by the observer's cognition based on his observation of the model, his evaluation of these observations, and his prior experiences. The observation of the model, as far as it was experimentally possible, was held constant in this study. The subjects' appraisal is difficult to measure or control, although some of its possible effects will be discussed later. The variable which was different for each group in the present study was the subjects' prior experience, and to the extent that the strong shock group had a more unpleasant experience, the aversive aspects of their cognition would be greater. In direct classical conditioning, the cognitive elements are generally ignored, and the objective level of the UCS is usually all that is considered. An increased attention to the cognitive elements in direct classical conditioning might account for many of the individual differences found in these studies.

Examination of trials 10 to 45 showed a significant difference in the rate of habituation of the conditioned response such that by trial 45 the groups do not differ. This habituation often indicates that the subject no longer perceives the at first painful stimulus as being painful, i.e., he adapts to the UCS. In this experiment, the subject may be adapting to the model reacting to the painful stimulus. This could result from the subject adopting protective avoidance mechanisms to the stressful situation (cf. Lazarus, Speisman, Mordkoff, and Davison, 1962). This suggestion is supported to some extent by comments of some subjects after the experiment was over. For instance, a few subjects went so far as to shut their eyes for part of the time. Some tried to relax or not to think about the situation, while others reported that they tried to intellectualize the experimental situation (in the sense that they were attempting to become less emotionally involved).

The habituation effect in GSR conditioning is not unusual (Grim and White, 1967), but there is a continuing controversy in the recent literature regarding its cause. It was at one point thought to indicate a pseudoconditioning effect due to sensitization from the use of a noxious stimulus (Kimble; Mann and Dufort, 1955), or to reactivation of the orienting response (Sokolov, 1963). Pseudoconditioning can not easily be separated from classical conditioning effects when short inter-stimulus intervals are used. However, for longer inter-stimulus intervals, a criterion was developed by Stern, Stewart, and Winokur (1961) for distinguishing conditioned responses from pseudoconditioned responses due to sensitization or disinhibition of the orienting response. Prokasy and Ebel (1967), elaborating on the original criteria of Stern, Stewart and Winokur (1961), note that there are three components to GSR conditioning, defined by latency criteria. The first of these appears to be sensitization, or recovery of the orienting response, and is similar in many respects to the alpha response in eyeblink conditioning (Grant and Norris, 1947). For the interstimulus interval used in the present study, the scoring criteria recommended by Hammond (1967) was used, which excludes this first component. Consequently, there is less likelihood that the results obtained in this study could be due to pseudoconditioning resulting from a noxious stimulus. Inspection of the raw data indicated that in fact many subjects did give orienting responses to the light as well as conditioned responses. These orienting responses were not scored. Failure to eliminate these orienting responses may have resulted in spuriously high levels of conditioning in earlier studies (cf. Berger, 1962) as compared to the present study.

One of the possible reasons that previous studies were not as concerned with the problem of pseudoconditioning was that their conditioning curves did not show marked habituation effects. This probably resulted from the fact that they typically used only ten acquisition trials. The present results clearly indicate that the habituation effect is most marked after ten trials.

Considering just the first nine conditioning trials of the present study, all three groups were significantly different. They did not appear to differ in their rate of conditioning, as conditioning was almost immediate in all three groups (a finding which is not unusual in GSR conditioning--Mandel and Bridger, 1967; Kimmel and Sternthal, 1967). The difference appeared in the level of conditoning. To compare the results with Berger's results, it is necessary to look at his third experiment, and at the conditioned anticipatory response categorization of his results. These results can be compared with the acquisition scores obtained for Group 3 (the no shock group) in the first ten trials of the present experiment. Acquisition scores in both studies vary between 30 and 40 per cent conditioned responses during these first ten trials. The other groups in the present experiment show significantly more conditioned responses, with Group 1 showing 45 to 55 per cent, and Group 2 showing 65 to 75 per cent. The comparability of the results of Group 3 with other studies further supports the conclusion that prior experience leads to better conditioning.

The differential prior experience of the three groups could result in differential cognitive evaluation of the UCS. The most widely used theory for predicting what these effects might be is Festinger's (1957) theory of cognitive dissonance. There are three aspects of this theory relevant to the present discussion:

(1) Dissonance can be produced if a person's expectancies are inconsistent with a current perception of that event.

(2) Dissonance, being psychologically uncomfortable can act as a motivation (perhaps anxiety).

(3) When dissonance is present, the person will actively avoid situations or information which will maintain or increase the dissonance. (Festinger, 1957).

In the present experiment, a dissonance situation may have been produced for Group 1. The model's reactions were rehearsed so as to be similar to that which would be given by a subject to a strong shock of about 4 milliamps on its first presentation. The reaction was in fact very similar to that given by many of the subjects who received the strong shock prior to conditioning, but was much greater than the reactions of those persons receiving the weak shock. The model's extreme reaction to the shock would probably not have been dissonant with the expectancies of the strong shock group after their experience of shock. However, it would probably have been dissonant from the expectancies of the group receiving prior experience of weak shock. The weak shock group would therefore be most apt to avoid the dissonance producing situation (i.e., the model's strong shock reaction). To the extent that these avoidance responses were successful, it would be expected that this group would show poorer conditioning than Group 2, who, lacking dissonance would be less apt to make avoidance responses. The comments of a number of subjects tend to support this avoidance of dissonance explanation. The only two subjects who reported closing their eyes through much of the experiment were, in fact, in Group 1. Others in this group reported trying to look at the light and not at the model, or concentrating on other things.

Unfortunately, one of the weaknesses of cognitive dissonance theory is clearly evident in the fact that it can at the same time predict both superior and inferior condititioning for Group 1. Superior conditioning of Group 1 would be accounted for in cognitive dissonance theory by their high drive level (anxiety?) produced by their high dissonance.

The fact that the subjects may have been using avoidance procedures, as predicted by dissonance theory and underlined by the occurrence of GSR habituation and the subjects' reports, presents somewhat of a paradox to the experimental paradigm used in this study. While the experimental paradigm appears to be one of classical conditioning, it is unlike the usual direct classical conditioning study in that the subject can avoid the UCS. In the direct classical GSR conditioning situation, a nonavoidable electric shock is typically used. In vicarious classical GSR conditioning, the presentation of the UCS to the model is controlled by the experimenter, but not necessarily the presentation to the subject. Since the UCS can be avoided, it may not reliably evoke a UCR to be conditioned. Depending on whether or not the individual chooses to attend to the behavior of the model, a GSR may or may not be emitted. Production of a GSR to the model's behavior would depend in part upon some relatively uncontrollable and subjective cognitions within the subject. Once emitted, however, (for whatever unknown and uncontrollable reasons) the response may be brought under experimental control. The implication of the above discussion is that the operant paradigm may in fact be more appropriate for exploring the parameters of vicarious conditioning.

Instrumental conditoning of autonomic responses has been demonstrated (cf. Greene, 1966; Grings and Carlin, 1966, Kimmel and Kimmel, 1960), and an experimental paradigm for demonstrating vicarious operant conditioning can be constructed. Specifically, the model would receive a shock (or alternatively, not receive a shock) provided that the subject gave an anticipatory GSR in the first 4 seconds after the light came on. Such a study has not as yet been attempted.

The analysis of the EPI scores in relation to conditioning and extinction showed that neither the extraversion scale nor the neuroticism scale relate to the scores obtained. Purohit (1966) provides a possible explanation for this when he states:

> . . . if the principle of autonomic response specificity applies to autonomic response conditioning, it is questionable whether theories which presume a general factor of conditionability should use autonomic response conditioning to verify their predictions. (Purohit, 1966, p. 166)

Until the relationship between conditionability and specific autonomic responses is subjected to further clarification, it seems unnecessary to investigate this aspect of vicarious GSR conditioning further.

From the overall analysis of the conditioning scores, it appeared that vicarious classical conditioning did occur. If just the first ten trials are considered, there appears to be no doubt that this is a clearly definable conditioning situation, and such has been the conclusion of previous investigators. Furthermore, from this study it seems evident that prior experience of shock significantly increased the level of conditioning. However, over 45 trials the conditioning is not as stable as might be expected. The implication of the lack of difference toward the end of conditioning could be that there are no differences in habit strength between the three groups. It could be that another variable, possibly drive (in this case anxiety?) is inflating the differences in performance levels of the three groups during the initial trials. This would appear to be reasonable considering the noxious stimulus (shock) given before conditioning began. Any differences in drive level could act in conjunction with habit strength to increase the differences between groups in the first part of conditioning. Toward the end of the 45 trials this drive may have subsided, decreasing the differences between groups.

Further studies done in this area must carefully consider the number of trials to be used. More research is needed in both direct and vicarious classical conditioning on the habituation effect itself. For example, the effect of administering the noxious stimulus 24 hours prior to conditioning could be determined to see if this affects the rate of habituation. The effects of massed, as opposed to spaced, trials could be examined, possibly even spacing the blocks of trials over successive days. A control group in which a shock is given, followed by random pairing of the UCS and the CS could help to test the extent of any pseudoconditioning effects.

Many kinds of social behavior may be mediated by conditioned autonomic responses (Sloane, Davidson, Staples and Payne, 1965) and certainly many responses in humans are acquired through vicarious rather than direct experience (Bandura and Walters, 1963). To the extent that autonomic responses can be acquired through vicarious learning, this paradigm--in spite of its technical difficulties--may be useful in furthering the understanding of social learning processes.

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APPENDIX A

Instructions to Subjects

S was shown into a testing room by E, seated at a table, and asked:

"Would you please answer this questionnaire which is supposed to relate to what I am doing. Put your name there, (E indicated appropriate place on the answer sheet) and I will be back in a few minutes." E left, and returned when S had finished. Then E took S into the recording room and said:

"Would you please sit in that chair (E indicated a chair at one end of a trapezoidal table), and I will tell you what I am doing. I am conducting a study in which I am looking at the physiological responses to different kinds of stimuli. In this case, light is the stimulus, and the GSR is the response. Could I please put these recording electrodes on your left hand. (E applied recording electrodes). I am also investigating another variable, and for this, I have another subject who is finishing the test in the next room. With her, I will be looking at the effect of stress on perception. To do this, I will be giving her a shock on a number of trials while the light is on. With you, I will be looking at the basic response to light, and with her at the response to light and stress.

To subjects in Group 3, E then said:

"I will go and get the other subject now."

To subjects in Groups 1 and 2, E then said:

"In order for me to make a comparison between your results and hers, could I please give you one shock, the same as I will be giving her. This will allow me to determine how comparable your responses are. These shocking electrodes go on the fingers of your right hand. (E placed electrodes around the index and third finger of the right hand). Now, I will go and turn on the shock and be right back. (E went and administered the appropriate shock and returned immediately.) Now, I will go and get the other subject."

In all three groups, M was then brought into the room and asked.

"Would you please sit at this chair (E indicated the chair at the opposite end of the table to S). I was explaining to your fellow subject that I am looking at the physiological responses given to different stimuli. The stimulus I am using is light, and the response I am measuring is the GSR. I am also looking at another variable, and that is the variable of stress. To do this, I will be giving you a shock on a number of the trials while the light is on. Now could I put these recording electrodes on your left hand (E applied the electrodes to M). Now would you put the fingers of your right hand in here. (E put shocking electrodes on M). These are what the shock comes through. Now would you please put your hand on this. (E indicates pressure guage). This will measure how often you flinch at the shock, if you do so."

To both S and M, E then said:

"You will see the light go on and off several times before you (E addresses M) will feel any shock. Then shocks will come on most of the trials, but not on every trial. Would you please put on these earphones to keep out noises from the outside office or upstairs." After the earphones were on, E said: "Please rest your left arm on the table, and try not to move it, or I get muscle movements instead of GSRs on the polygraph."

APPENDIX B

Raw Data

Subject No.	EPI Score		Conditioning Trials 1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	Extinction	
GROUP #1	E	N										46-50	51-55
1	14	9	2	1	2	1	1	1	4	0	0	2	1
2	12	11	3	1	1	2	2	0	0	2	3	2	0
3	12	11	0	0	0	0	0	0	1	0	0	1	0
4	13	21	3	1	4	4	3	4	3	3	3	4	4
5	8	15	0	0	2	2	1	1	1	0	1	2	0
6	20	6	3	4	4	3	2	0	0	0	0	0	0
7	11	7	1	5	0	1	0	0	0	0	0	0	0
8	12	10	0	2	0	0	0	1	0	0	0	0	3
9	13	5	5	4	3	3	1	4	1	3	0	4	1
10	18	7	3	4	2	1	1	1	1	1	1	0	0
11	15	15	3	3	0	3	4	1	1	3	2	2	0
12	12	9	3	3	3	4	4	1	3	3	4	2	4
13	15	5	3	1	4	0	0	0	1	2	2	1	1
14	11	7	4	4	3	2	3	2	1	1	0	1	0
15	16	9	1	1	0	0	0	0	1	0	0	0	0
16	17	15	1	2	2	2	2	0	2	1	1	1	0
17	13	4	2	4	4	3	4	3	1	4	2	3	1
18	11	16	1	4	3	4	4	4	5	4	3	2	2
19	8	5	0	0	0	0	0	0	0	0	0	0	0
20	5	9	3	2	2	1	0	2	0	1	1	0	0
GROUP #2													
21	22	15	2	4	4	3	0	4	3	0	0	0	1
22	7	15	4	4	5	5	4	2	2	4	4	3	2
23	14	5	3	5	3	2	0	0	0	1	0	3	1
24	9	14	4	5	3	5	4	3	4	2	1	1	0
25	17	12	1	2	0	1	2	1	4	1	0	1	2
26	10	6	5	3	2	2	4	3	2	0	1	3	1
27	10	9	4	4	3	4	2	2	1	2	0	0	1
28	6	4	4	3	3	5	3	2	0	2	3	3	2
29	17	5	4	5	4	5	3	1	2	2	0	2	1
30	13	9	0	1	1	0	0	1	1	2	0	1	1
31	11	7	5	4	1	5	3	4	2	4	5	4	4
32	13	13	2	3	3	1	2	0	0	0	0	0	0
33	14	9	3	4	5	4	4	5	0	3	2	2	2

Subject No.	EPI Score E	EPI Score N	1-5	6-10	11-12	16-20	21-25	26-30	31-35	36-40	41-45	Extinction 46-50	Extinction 51-55
34	12	2	5	5	5	5	3	2	0	1	1	1	1
35	6	10	3	5	5	5	5	5	4	3	3	2	1
36	8	10	3	4	0	0	1	0	0	1	0	0	0
37	10	5	2	5	4	4	2	2	3	0	1	2	2
38	11	13	4	4	2	4	2	2	2	2	1	1	2
39	15	4	4	5	3	2	3	0	1	3	1	0	1
40	13	13	4	4	4	4	3	0	1	2	0	2	1
GROUP #3													
41	17	19	3	4	1	0	0	0	0	0	0	0	0
42	18	15	0	0	0	0	0	1	0	0	2	1	0
43	9	14	2	4	3	5	4	3	2	3	1	1	1
44	16	6	1	4	1	0	0	0	0	1	1	0	0
45	7	3	0	0	0	0	1	0	0	0	0	0	0
46	10	15	3	2	1	1	0	0	1	1	0	1	1
47	12	14	1	2	2	3	2	2	3	1	1	2	2
48	11	11	4	4	4	2	3	4	1	4	2	1	0
49	21	9	2	1	2	2	2	0	0	0	1	1	0
50	8	12	1	5	3	3	2	2	1	2	0	0	1
51	12	16	3	4	4	4	3	0	2	2	4	3	3
52	10	8	1	0	1	0	0	0	0	1	0	0	0
53	13	7	1	0	0	0	0	1	0	0	0	0	0
54	7	13	1	1	0	1	1	0	2	1	0	0	0
55	10	8	1	3	3	1	2	1	4	2	1	3	2
56	13	17	1	0	1	0	0	0	0	0	0	0	0
57	13	4	1	1	3	1	0	2	1	1	1	0	0
58	9	17	1	1	3	0	0	0	1	0	0	0	1
59	15	8	2	2	4	2	2	1	3	0	1	3	1
60	7	8	0	1	3	1	0	0	0	0	1	0	0

Means and Standard Deviations for the Experimental Variables

Conditioning Scores

Group 1.	$\overline{X} = 14.8$	$\sigma = 9.36$
Group 2.	$\overline{X} = 22.5$	$\sigma = 8.45$
Group 3.	$\overline{X} = 11.4$	$\sigma = 8.46$

Extinction Scores

Group 1.	$\overline{X} = 2.1$	$\sigma = 2.23$
Group 2.	$\overline{X} = 2.85$	$\sigma = 1.91$
Group 3.	$\overline{X} = 1.4$	$\sigma = 1.83$

Extraversion Scores

Group 1.	$\overline{X} = 12.8$	$\sigma = 3.44$
Group 2.	$\overline{X} = 11.9$	$\sigma = 3.9$
Group 3.	$\overline{X} = 11.9$	$\sigma = 3.82$

Neuroticism Scores

Group 1.	$\overline{X} = 9.8$	$\sigma = 4.42$
Group 2.	$\overline{X} = 9.0$	$\sigma = 3.97$
Group 3.	$\overline{X} = 11.2$	$\sigma = 4.53$

Raw Data for Trials 1 to 9

Subjects	Trials 1	2	3	4	5	6	7	8	9	
1	1	0	1	0	0	1	0	0	0	
2	0	1	1	1	0	0	0	1	0	
3	0	0	0	0	0	0	0	0	0	
4	0	1	1	0	1	1	0	0	0	
5	0	0	0	0	0	0	0	0	0	
6	0	0	1	1	1	1	1	1	0	G
7	0	1	0	0	0	1	1	1	1	R
8	0	0	0	0	0	0	1	1	0	O
9	0	1	1	1	1	1	1	1	0	U
10	0	1	1	1	0	1	1	0	1	P
11	0	0	1	1	1	0	1	1	1	
12	0	1	1	1	0	1	0	1	0	#1
13	1	1	1	0	0	0	0	0	1	
14	1	0	1	1	1	1	1	1	0	
15	0	0	1	0	0	0	0	0	1	
16	0	1	0	0	0	0	0	1	1	
17	0	0	1	0	1	1	1	1	0	
18	0	0	1	0	0	1	0	1	1	
19	0	0	0	0	0	0	0	0	0	
20	0	1	1	1	0	1	0	0	1	
21	0	1	0	0	1	1	0	1	1	
22	0	1	1	1	1	1	1	1	0	
23	1	1	0	0	1	1	1	1	1	
24	0	1	1	1	1	1	1	1	1	G
25	0	0	0	0	1	1	0	1	0	R
26	1	1	1	1	1	1	0	1	1	O
27	0	1	1	1	1	1	0	1	1	U
28	1	1	1	0	1	1	0	0	1	P
29	1	0	1	1	1	1	1	1	1	
30	0	0	0	0	0	1	0	0	0	#2
31	1	1	1	1	1	0	1	1	1	
32	0	0	1	0	1	1	0	1	0	
33	0	1	1	0	1	0	1	1	1	
34	1	1	1	1	1	1	1	1	1	
35	0	1	1	0	1	1	1	1	1	
36	0	1	0	1	1	1	1	0	1	

Subjects	Trials 1	2	3	4	5	6	7	8	9	
37	1	0	1	0	0	1	1	1	1	
38	0	1	1	1	1	0	1	1	1	
39	0	1	1	1	1	1	1	1	1	
40	0	1	1	1	1	1	1	0	1	
41	0	1	1	0	1	1	1	1	1	
42	0	0	0	0	0	0	0	0	0	
43	0	0	1	1	0	1	0	1	1	
44	0	1	0	0	0	1	1	1	0	
45	0	0	0	0	0	0	0	0	0	
46	1	1	1	0	0	0	0	1	0	G
47	0	0	0	0	1	0	1	0	1	R
48	0	1	1	1	1	0	1	1	1	O
49	0	0	1	0	1	1	0	0	0	U
50	0	1	0	0	0	1	1	1	1	P
51	0	1	1	0	1	0	1	1	1	
52	0	1	0	0	0	0	0	0	0	#3
53	0	0	0	0	1	0	0	0	0	
54	0	0	0	0	1	1	0	0	0	
55	0	0	0	0	1	1	0	0	1	
56	0	1	0	0	0	0	0	0	0	
57	0	0	1	0	0	0	0	1	0	
58	0	0	1	0	0	0	0	0	1	
59	0	0	1	1	0	0	1	1	0	
60	0	0	0	0	0	0	0	0	0	

APPENDIX C

(a) Summary Table of the Components of the Trend Analysis

Component	MS	F
Linear	859.266	7.326**
Quadratic	1570.466	0.435
Cubic	400.016	0.393
Quartic	617.316	0.315
Quintic		

Note: N = 60

(b) Summary Table of the Regression Analysis of the Components

Component	MS	F
Linear	71.26	71.26 **
Quadratic	0.049	0.049
Cubic	8.669	8.669**
Quartic	8.994	8.994**
Quintic	0.121	0.121

Note: N = 60