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ABSTRACT

Research was conducted to investigate the phenomena associated with an individual's having perceived control or actual control over aversive stimuli. In all, 10 studies were conducted, 7 of which were directly relevant to investigating variables affecting perceived or actual control, and 3 being "spin-off" experiments. The seven studies tested the following hypotheses: the effects of control cannot be accounted for strictly by the fact that when one has control he also often is able to predict; that increased amounts of prior no-control would interfere with subsequent effects of gain or control; that unpredictable events elicited more autonomic activity than predictable events; that differing degrees of no-control would have different effects upon the control phenomena; the effect of control and/or no control prior to either control or no control and the effect of predictability; that subjects could be misled as to whether or not they had control and that their perception was an important variable in the effect of control; and that subjects would more frequently elect to control under conditions that had increased control. The three spin-off studies were concerned with modeling. The methods used to evaluate the hypotheses were varied, and each involved an experiment manipulation to induce the condition under study. Results of the studies showed that: being able to predict or control aversive stimuli reduces the negative effects; prior experience with contol has the effect of modifying subsequent experience; the phenomena apply to those situations in which others are the recipients of the aversive stimuli; and to affect the phenomena, powerful variables must be employed as the control phenomena are robust. (DB)

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Project No. 00467
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THE EFFECT OF BEING ABLE TO CONTROL AVERSIVE STIMULI

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September 1973

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CONTENTS

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Summary

Research conducted under support from OEG-2-70-0041 was aimed at investigating the phenomena associated with an individual having perceived or actual control over aversive stimuli. During the period during which this work was conducted the topic continued to receive considerable attention by scientists and practitioners in education and psychology. As examples: the popular book Beyond Freedom and Dignity by Skinner dealt in part with the issue; a major review, The Function of the Illusions of Control and Freedom by Lefcourt, appeared in the American Psychologist; and Glass and Singer's book, Stress and Adaptation: Experimental Studies of Behavior Effects of Exposure to Aversive Events, reported much work in this area of study. The work conducted under support from the National Institute of Education adds information relevant to understanding the effects of prediction and control.

In general, the problem under study was to evaluate the effect of certain variables upon the basic phenomenon. The basic phenomenon is that individuals who can predict or control the occurrence or intensity of aversive stimuli are less affected by those stimuli than are those who cannot predict or control the same event. It is as if the intensity of aversive stimuli is greater if they are not predictable or controllable, and as if the negative anticipatory feelings are accentuated when prediction and control are reduced or missing. The research discussed in this report was aimed at identifying some of the variables that are related to those phenomenon.

There were 10 studies conducted under support from NIE. These experiments can be grouped into two categories. The first is those studies that are directly relevant to investigating variables affecting perceived or actual control. These experiments were outlined, in part, in the original grant request and were modified when experience indicated the necessity for change. The second set of studies were not outlined in the original application and represent the interest of students who became involved in this area of research. These "spin-off" experiments resulted in information of considerable value and interest.

The direct studies tested the following hypotheses: First, the effects of control cannot be accounted for strictly by the fact that when one has control he also often is able to predict. The experiment attempted to evaluate

the prediction-control confound. The second study examined whether the effects of control would be modified by increasing amounts of prior no-control. The prediction was made that increased amounts of prior no-control would interfere with subsequent effects of gain of control. The third experiment was a simple study that improved upon methodology investigating the effect of unpredictable aversive stimuli. The experimental hypothesis under study was that unpredictable events elicited more autonomic activity than predictable events. The fourth study investigated the prediction that differing degrees of no-control would have different effects upon the control phenomena. The fifth study investigated the effect of control and/or no control prior to either control or no control. In addition, the effect of predictability upon this situation was to be examined. The sixth study was designed to test the hypothesis that subjects could be misled as to whether or not they had control and that their perception was an important variable in the effect of control. The seventh study was designed in attempt to develop an independent indicant of control. Subjects were to select the potential to control in conditions where the percentage of actual control varied. It was predicted that subjects would more frequently elect to control under conditions that had increased control.

The final three studies comprised the "spin-off" category as they were to evaluate control phenomena in a more indirect manner. They were concerned with modeling. In the first, subjects were responsible for (could control) aversive stimuli delivered to a model. It was predicted that responsibility would activate behavior. In the second study, prior knowledge (predictability) of the occurrence of aversive events occurring to another was evaluated. It was expected that predictability would reduce activation. The final study was of the effect of a placebo upon control.

The methods used to evaluate the numerous hypotheses listed above were varied. Each involved an experiment manipulation designed to induce the condition under study. Since the procedures vary so widely from study to study, it is unreasonable to survey them in the summary. Reference to the Methods Section of the report will clarify the studies' procedure and the effects they produced. The specific results of each study is included in its description in the body of this report. Again, it would be cumbersome and confusing to list each finding. Rather, a general survey of highlights and their potential importance follows.

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In general, the studies replicated previous findings that controlling or predicting aversive events results in those events producing less arousal and in subjects preferring to have control. The studies found that certain variables were related to the strength of that phenomena. The first important result was the determination that control has an effect beyond that associated with prediction alone. Subjects who could control the occurrence of aversive stimuli were aroused less than subjects who could predict but not control the same stimuli. Several studies were aimed at determining the effect of prior experiences with control or no-control upon subsequent control or no-control. In general, it was found that prior no-control resulted in interference with the positive effects of control; once control was possible. The phenomena of effects upon arousal via control has been extended by several studies evaluating the effects of aversive stimuli delivered to another. In addition to subjects being vicariously aroused by the sight of "apparent pain" in a model, when the subject had control of the pain delivery there was a strong tendency to delay delivery of the stimulus. A major finding developing across studies is that the phenomena of control is not affected by some manipulations of an indirect nature. It appears that attempts to change the effects of control are most effective if the manipulations are directly involved with control. As examples, drug placebo effects were not found, nor did the attempt to misdirect subjects' understanding prove to be an effective variable in studying the effects of control.

In summary, the studies conducted under support from NIE revealed: first, being able to predict or control aversive stimuli reduces the negative effects of those stimuli; secondly, prior experience with control has the effect of modifying subsequent experience; thirdly, the phenomena apply to those situations in which others are the recipients of the aversive stimuli; fourthly, to affect the phenomena, it is necessary to employ powerful variables as the control phenomena is robust.

Introduction

The research reported in this document concerns itself with the phenomena surrounding the prediction and control of aversive stimuli. As will become clear, a number of definitions of control were employed and a number of different experimental procedures were utilized to study the phenomena. In an attempt to clarify for the reader the general problem under study and to bring to the reader a survey of relevant literature, a review is presented below.

Psychologists have long concerned themselves with man's reaction to stressful stimuli in his environment. In many cases, this reaction is maladaptive, and it would, therefore behoove us to know more about the varialbes which modulate the effects of stressful stimuli. This study will concern itself with two such variables: control over exposure to aversive stimulation and certainty about (prediction of) stimuli.

Investigators from diverse backgrounds and varied oreintations have studied the variables of control and prediction: Mowrer's fear from a sense of helplessness (1948), Rotter's (1966) internal and external control, White's (1959) concept of "competence," Berlyne's (1966) view of the relationship between certain collative variables and arousal, and Mandler's (1966) theory about control and anxiety—all attempt to describe the degree to which an individual can predict and/or control the stimuli which impinge upon him and the effects of such control (prediction).

The experimental work which has been done in this area covers almost as broad a spectrum as the theoretical positions mentioned above. Studies have employed animal subjects and human subjects; dependente measures have included performance on perceptual, cognitive, and motor tasks, psychophysiological indices of arousal, responses to questionnaires, and verbal report; the range of aversive stimuli has included exposure to shock, to noise, to test-taking situations, and to photos of dead bodies.

A study by Mowrer & Viek (1948) is an early approach to the question of control in the animal literature. These investigators found that the feeding responses of rats which were able to terminate (i.e., control the duration and offset of) shock were less inhibited than the responses of rats which were unable to influence the administration of shock although both groups received the same amount of shock.

Seligman & Maier (1967) reported that dogs which were exposed to inescapable (uncontrollable) shock in a Pavlovian harness subsequently revealed impaired learning of an adaptive response in a shuttlebox. In contrast, animals which were first exposed to a control experience subsequently showed normal acquisition of the escape behavior. Both Mowrer and Viek and Seligman & Maier involve a concept of "helplessness" to explain their data.

Investigators who have employed human subjects (Ss) also report either disruptive effects occasioned by experiences of no control or enhanced performance in conjunction with control experiences. Haggard (1943, reviewed in Mandler & Watson, 1966) found that Ss who could administer an electric shock to themselves showed less anxiety (measured by GSR deflection) than Ss who had the shock administered by the experimenter (E).

Stotland & Blementhal (1964) also used GSR as a dependent measure, however, their control manipulation involved a test-taking situation. Two groups of Ss were told that they were going to take an IQ test composed of several subtests. One group was informed that the subtests could be taken in any order the S desired, while the second group was informed that the tests had to be taken in a prescribed order. The group which was to have no control over test order showed a significant increase in GSR whereas the group which was offered a choice showed no increase during the instruction period. (The tests were never actually administered; it was the expectation of having control which was responsible for the observed differences between groups).

Mandler & Watson (1966) employed a similar test-taking manipulation to create feelings of control and no control, however, the dependent measure in this tudy was quality of performance on one of the tests and post-test recall of test items. Those Ss who had control over test-order performed significantly better than Ss who had no control on the stressful task.

A study by Phares (1962, reviewed in Lefcourt, 1966) expolored the differential effects of skill (control) vs chance (no control) instructions on performance of a perceptual recognition task. Expectations of control in a shock-escape situation lead the Ss in the "skill" group to behavor in a manner most likely to capitalize on their ability to control the situation, which in this experiment consisted of lowering their recognition threshold. They performed similarly to a group of Ss whose performance was not instrumental in escaping pain (no threat of shock for this group). Ss who were led to believe that escape from shock only occurred on a random basis (no control), however, performed more poorly than the control and no-shock groups.

Glass, Singer & Friedman (1969) also found that the expectation of control resulted in implications for quality of performance. Ss who believed they had control over stressful experimental noise showed greater post-stress tolerance for frustration and superior performance on a proof-reading task than Ss who belived they had no control over exposure to the noise.

Geer, Davison & Gatchel (1971) reported both behavioral and psychophysiological effects resulting from the manipulation of expectations of control. Ss who believed they had control over shock duration decreased their latencies on a reaction time task and showed less autonomic arousal than a comparable group of Ss who were told that shock duration was unrelated to their performance.

The availability of control has also been found to influence S's perception of pain. Bowers (1968) reported that Ss who were told that shock was randomly administered (no control) identified as painful a significantly lower level of shock than Ss who were told that they could and should avoid the shock.

In addition to the reports of performance deficit, psychophysiological arousal, and lower tolerance for frustration and pain when experiences of no control are compared with control experiences, the literature also reveals that Ss say they prefer situations in which they have control (Pervin, 1963; Elliott, 1969) and experiences in which they have knowledge about onset of aversive stimulation to those in which they lack predictability (Perkins, Levin, and Driscoll, 1963; Pervin, 1963; Lanzetta & Driscoll, 1966; Elliott, 1969). Presumably such preferences for control and predictability reflect preferences for situations which Ss have learned through past experience maximize their outcomes and make them feel most comfortable.

Methods

This portion of the report described the experimental tasks and procedures that were employed in the research. The material is presented study-by-study so that the reader may refer to any given experiment. The sequence is also used in the following section on results so that the reader may refer back and forth as desired.

Evaluating the Effects of the Prediction-Control Confound

Subjects in the present investigation were undergraduates enrolled in the introductory psychology course of the State University of New York at Stony Brook. Sixty-five subjects participated in the experiment, with 5 subjects being discarded when procedural or recording errors made their data uninterpretable.

The color photographs of victims of violent death, which comprised the aversive stimuli of the experiment were presented to the subject by a Kodak ektographic projector. Electronic timers were used to control the duration of the photograph. The warning signal was a 1,000 Hertz, 60-decibel tone whose duration was controlled by an electronic timer. A tape timer was utilized to control interstimulus intervals. Psychophysiological data were collected on a Beckman Model RB polygraph using that machine's recording couplers. Beckman biopotential electrodes and electrode past were used for collection of psychophysiological data. Data reduction was accomploshed through an analog-to-digital conversion system utilizing an AR Vetter FM recording adapter and a Hewlett-Packard digital voltmeter with a Hewlett-Packard digital recorder printout unit. All recording from the subject was performed in a sound- and electrically shielded isolation chamber. The slide projector and polygraph were located in an adjacent room where their operation was neither visible nor audible to the subject.

Subjects were met and seated in a reclining arm chair in the sound shielded room, and galvanic skin response (GSR) and heart rate electrodes were attached. Heart rate electrodes were attached in Standard Lead I position; GSR was measured between the palm and the forearm of the subject's nonpreferred hand. A Grason-Stadler headset was placed over the subject's ears for delivery of the tones. Following headset placement, the subjects were instructed to relax while the experimenter went into the adjacent equipment room and calibrated the physiological equipment. All further instructions to the subjects were delivered via an intercom. Following a calibration and rest period of 5 minutes, background data were collected for 2 minutes on all subjects. After the collection of the background data, the experimenter read the instructions to the subject over the intercom. A 1-minute rest period preceded the actual beginning of the delivery of experimental stimuli.

Subjects were randomly assigned to one of three groups. Subjects in the "actual control" group were given the following instructions:

> You will be shown a series of 10 photographs of dead bodies at 60-second intervals. Each photograph will be preceded by a tone of 10 second's duration. By pressing the button you are holding, you can terminate the photograph whenever you wish. This is neither a speed nor endurance test. Just be certain to look at each picture, and when you have seen enough, push the button and the photograph will disappear.

Actually, a viewing time limit of 35 seconds was imposed so that if any subject in the actual control group had not terminated any photograph following 35 seconds of viewing, the photograph was terminated. Subjects in the actual control group were not told of the viewing time limit of 35 seconds.

Subjects in the "predictability" and "no-control" groups were not given a button during the introduction period. Instead, the subjects in those two groups were yoked to the subjects in the actual control condition. Subjects in the predictability group received the following instructions:

> You will be shown a series of 10 photographs of dead bodies at 60-second intervals. Each photograph will be shown for ____ seconds, and each one will be preceded by a tone of 10 second's duration. Be certain to look at each photograph.

Yoking of the group was accomplished by taking mean duration of photographs for a given subject in the actual control group and using that time for the duration of the photographs for a given subject in the actual control group for a yoked subject. Thus, the subject in the predictability group were informed as to the relationship between photographs and tones, for how long the tones and photos would be presented, and the number of tones and photos; however, they were unable to terminate or control the presentation in any manner.

Subjects in the no-control group could neither control nor predict the occurrence of the tones or photographs. Their instructions were: "From time to time you will be shown photographs of dead bodies, and from time to time you will hear tones. Be certain to look at each picture." Stimuli were presented so that the total interstimulus interval between tones and photos was equal to the same period for the yoked subject in the actual control group. Stimuli in the no-control group were randomly presented. For this study, this means that the occurrence of a stimulus did not predict the time or the nature of the next stimulus. To review the yoking procedure, a subject in the actual control group was yoked to a subject in the prediction and no-control group; picture duration was yoked to the mean duration of subjects in the actual control group. Further, the total interstimulus interval duration was equal for all yoked subjects.

Effects of Gaining Control over Aversive Stimuli After Differing Amounts of No Control

Ss were 60 male undergraduates from the State University of New York at Stony Brook.

Electric shock was delivered by a Grass Model S4 stimulator with an isolation unit. Shock frequency was 10 cps and pulse duration was 50 msec. A Carousel projector delivered the warning signal. One channel of a Beckman Type B Dynograph recorded basal skin resistance while a second channel recorded GSRs. Beckman biopotential electrodes and electrode paste were used and placed on S's non-dominant palm and wrist. A black box 3 in. x 8 in. x 4 in. that had 3 push buttons and one green "correct" light was the task apparatus. Reaction time (RT) was recorded on a separate polygraph channel.

Ss were told that the experiment concerned physiological reactions to problem solving under conditions of stress (shock). Following this introduction E attached a Tursky shock electrode (Tursky, Watson, & O'Connell, 1965) to S's dominant wrist and measured S's sensation and pain threshold to shock. The level of shock used in the experiment was one-half the distance, in volts, between pain threshold and pain tolerance level. A detailed description of this procedure is to be found in Geer, Davison, and Gatchel (1970).

E instructed all Ss that they had 4 sec. in which to guess the correct combination of three button presses. A light flashed on a screen as a signal for S to try and solve the problem. Ss were shocked if they did not select the correct sequence of button presses within the 4 sec. Solutions were randomly selected with the first trial of each "problem" incorrect so S would always be shocked on the first trial. When S was in a control block (a sequence of three soluble problems), problems became soluble on the second trial. If S tried all solutions systematically he would hit the right one by at least the sixth trial as each button was to be pressed only once. In a no-control problem all attempted solutions were followed by shock, thus a systematic S would perceive lack of control by no later than the sixth trial. Each S received 96 trials with 15-sec. intertrial intervals.

Predictable and Unpredictable Aversive Events: Evidence for the Safety-Signal Hypothesis.

Twenty male undergraduates enrolled in Introductory Psychology served as Ss. They were seated in a reclining chair inside a slightly darkened sound-attenuating chamber and told only that their physiological reactions to pictures of dead bodies were to be measured. While each S was informed that he could terminate the experiment if it proved too aversive, the E emphasized that it was highly unlikely that anyone would feel unable to remain throughout the entire experiment. Both groups of Ss put on earphones with the simple instructions: "I'd like you to wear these please." The earphones were functional only for the predictable group (PG). In order to ensure that Ss looked at the slides, all Ss were instructed to keep their eyes open during the experimental session. They were further told that occasionally a light or a letter or word might be flashed on the screen superimposed on the slide and that it was important that they remember what it was in order to answer questions at the end of the session. (Of course, nothing was every superimposed on the slides, although several Ss reported noticing flashes of light on some slides.) Ss were also requested to sit as still as possible during the experiment, but that if they moved, they were to tell the E immediately.

Ten minutes after electrodes were in place, the recording of GSR began. After a 2-min. baseline period, the first stimulus was presented. For the PG, the CS was an 8-sec. 50-dB 1,000-Hz tone. The UCS was a 5-sec exposure of a color slide photo of a dead body, the onset of which was simultaneous with the offset of the CS. Slides were projected onto a screen in front of the S. The size of the projected image was 81 cm^2. The unpredictable group (UPG) received only the UCS. A random presentation of "CSs" was not employed because this has been shown to be more arousing than UCSs presented alone (Geer, 1968). For both groups, 15 UCSs were presented according to a VI 2 schedule (Fleshler & Hoffman, 1962), the order of ITIs determined randomly. For the PG, the ITI was calculated from the offset of the UCS to the onset of the next CS. For the UPG, the ITI was calculated from the offset of the UCS to the onset of the next UCS. Each ITI was of exactly the same duration for each group.

Spontaneous fluctuation of skin resistance was defined as a decrease of at least 400 ahms that occurred during an ITI and was not associated with movements. Skin resistance had not only to decrease, but had to begin increasing after reaching asymptote. Square root of conductance change was used as the measure of GSR amplitude.

Effects of Different Degrees of Control

Ss were 14 female and 16 male students. After having been tested for sex and on the level at which they perceived shock as painful they were randomly assigned to one of the following three treatment sequences:

Group	(1)	(2)	(3)	(4)
I	determination of shock levels	0% control	100% control	preference
II		50% control	50% control	-
III		100% control	50% control	preference

The 0% control condition was yoked to the 100% control condition. In the 50% control condition "no control" trials were yoked to "control" trials.

At first, the levels were determined at which each individual S indicated to experience shock as a sensation, as uncomfortable and as painful. For this purpose shock was increased by 0.5 mAmp. at each trial starting with 0.5 mAmp. This procedure was repeated during each one of the two following conditions of control.

After Ss had experienced two conditions of control they were asked to indicate their preference for any one of the two. This was done under the pretense that they would receive the conditions of their choice for a fictitious third series of trials.

Effects of Control and Prediction on Reactions to Aversive Stimuli

The aversive stimuli which will be employed in this study are photos of victims of violent and sudden death. A study by Geer & Klein (1967) established that autonomic responses elicited by these photos were quantitatively and qualitatively different from simple orienting responses. These photos have been successfully employed as aversive stimuli in subsequent studies in this laboratory. Ss generally report that they find the pictures aversive.

Control will be defined as the ability to terminate exposure to the aversive photo by flipping a switch. A S in the control condition will be instructed to flip the switch and terminate exposure when he wishes to do so. Care will be taken to communicate to the S that this is neither a reaction time task (to see how quickly he can flip the switch) nor an endurance task (to see how long he can "take it"). Termination of exposure is to be a simple expression of his preference to terminate the viewing for whatever reason. If S does not flip the switch within thirty seconds, the picture will be automatically removed.

The thirty-second maximal viewing time was chosen on the basis of data from a previous experiment which indicated that the mean viewing time for Ss in the control condition was twenty-one seconds. A S in the no control condition will also be told to flip the switch when he no longer wishes to look at the picture (when he would "like it to go away"). He will also be informed, however, that the picture will not disappear when he flips the switch; exposure may be terminated before or after his indicated preference.

Each S will receive twenty-four trials. He will be randomly assigned to one of three control treatment groups: 12 trials of control followed by 12 trials of no control (C/NC); 12 trials of no control followed by 12 trials of control (NC/C); 12 trials of no control following by another 12 trials of no control (NC/NC). A S's first 12 trials will be called phase I of the experiment and his second run of 12 trials, phase II. Thus for a S in the C/NC treatment condition, his phase I experience would consist of 12 trials of control and his phase II treatment of 12 trials of no control.

One half of the Ss will receive a quarter-second tone four seconds before a photo is presented. These Ss will, then, be able to predict (P group) when the aversive stimulus is coming. The remaining Ss will be assigned to a no prediction (NP) treatment group; the quarter-second tone will be presented four seconds after the picture is shown. Ss in the NP condition will, therefore, have no information about onset of the aversive stimulus. Inter-trial intervals will vary randomly from ten to thirty seconds so that Ss cannot predict UCS onset and do not develop a conditioned response to the onset of the photo.

In order to ensure that differences among groups are due to the experimental manipulations rather than just to duration of aversive experience, one must equate exposure to the photos across treatment conditions. It is not possible for the E to fix duration of exposure for Ss who have control, since they control their viewing time. It is possible, however, to yoke NC Ss to CSs so that exposure times are equated. This procedure will be carried out in the following manner: Ss will be yoked in groups of six, each group including a S in the PC/NC, PNC/NC, PNC/C, NPC/NC, NPNC/NC, NPNC/NC treatment conditions. The mean durations of viewing time to which the PC/NC S allows himself to be exposed during his first 12 trials (i.e., when he has control) will be calculated. This mean duration will then be the viewing time for all Ss in the yoked group during their NC phases. This yoking procedure will allow comparison of the control and prediction manipulations across all NC conditions since stimulus variables (duration of exposure to photos) will be equated across these conditions.

Psychophysiological data will be recorded on a Beckman Type B dynograph. Skin resistance will be recorded on two channels, one recording GSRs and the second, basal skin resistance. The S will be seated in a sound and electrically-shielded chamber. He will be told that the experiment involves recording of his reactions to two types of stimulus: Tones and photos of dead bodies. If he agrees to continue with the experiment, electrodes will be affixed, and basal data will be collected for two minutes. This basal data will serve as a check that random assignment to treatment conditions has indeed resulted in physiologically comparable groups. Ss will then receive the control (no control) and Prediction (no prediction) instructions in accordance with the treatment condition to which they have been assigned. Psychophysiological data will be collected for two minutes before delivery of the first stimulus to see whether the expectation of control/no control produces differential psychophysiological effects.

Two easily discriminable tones (high and low frequency) will be employed. Each photo will be paired with a high or low tone. (The sequence of high-low tones will, of course, be randomly generated.) At the conclusion of the 24 trials, S will be shown each picture again and asked to indicate whether a high or low tone was associated with it.

Following this "test", a proof-reading task requiring care and attention will be administered. S will be told to correct errors in a passage. Each S will be allowed ten minutes to work on this task. Quality of performance will be measured by percentage of errors not found of the total number of errors that could have been detected (See Glass, Singer, & Friedman, 1969 for a more detailed description of this task).

The switch which S flips to indicate when he would like exposure to the photo to terminate will be connected to a reaction timer. A record will thus be available of the preferred viewing times for Ss in the various treatment conditions. For Ss in the control condition, this preferred viewing time will be, of course, identical with actual viewing time.

Effects of Veridical and Nonveridical Perceptions of Control Over Aversive Events on Reaction Time and Galvanic Skin Response

Subjects were one hundred undergraduate females from the State University of New York at Stony Brook. All subjects were paid two dollars for their participation in the experiment. Five additional subjects were actually recruited, but their data were discarded due to equipment failure.

The 500 CPS warning tone was delivered by a Hewlett-Packard square wave generator model 211A through a speaker in the subject room. Slides of the dead bodies were shown on a screen by means of a Kodak Ectagraphic projector located outside the subject room. Reaction time was measured by a Hunter Klockounter model 120A. Electronic times were used to control stimulus durations and inter-trials intervals. An intercom system was used to keep in constant contact with the subject.

GSRs were recorded on a Beckman Type B dynograph. One channel was used to measure reactive GSR and another was used for basal skin resistance. Beckman biopotential electrodes placed on the palm and wrist with Beckman electrode paste were used to measure GSR.

The physiological responses of interest in this study were amplitude of galvanic skin responses (GSRs) to the warning tones and to the pictures and spontaneous fluctuations of skin resistance. A GSR was defined as a decrease in skin resistance which occurred between one half and six seconds after the onset of a stimulus. The square root of the change in conductance was used to determine GSR amplitude on a given trial for each stimulus. The formula for change in conductance was $(1/R_2 - 1/R_1) \times 10^6$, where R_1 is the skin resistance in ohms at the start of the inflection and R_2 is the skin resistance in ohms at the point of maximum deflection. The use of change in conductance as the appropriate unit of measurement of the GSR has been substantiated by a number of authors including Lacey and Siegel (1949) who maintained it was independent of basal level and Lader (1970) who claimed that it yielded biologically as well as statistically meaningful results.

A sponteneous fluctuation (SF) was defined as a decrease in skin resistance of at least 200 ohms, which occurred when there were no stimuli presented. Any responses which were believed to have been due to movement, coughing, or any other subject activity were of course not counted as spontaneous fluctuations. Subjects were asked not to make any movements other than those required for the reaction time task. The intercom system was able to pick up any sounds such as coughing or sighing.

Reaction time (RT), as stated before, was measured by a Hunter Klockounter which began to run simultaneously with tone onset. The flipping of the reaction time switch in the subject room served to interrupt the timer. RT, which was measured in milliseconds, was recorded on each trial by the experimenter who remained in another room.

All subjects were met by a female experimenter and conducted to a sound-proof and electrically shielded chamber. Subjects were seated in a comfortable chair in front of the screen upon which the slides would be projected. Subjects were told that the experiment was concerned with physiological responding and RT under conditions of stress. It was explained that in order to simulate the stress of the real world in the laboratory, slides of dead bodies would be shown. Subjects were advised that the physiological response used in the experiment would be the GSR which was considered a measure of sweat gland activity. All subjects were informed that the intercom system would be functioning at all times so that if they felt that they wished to leave the experiment at any point, they could do so by simply informing the experimenter. After these preliminary explanations, GSR electrodes were placed on the palm and wrist of the subject's non-dominant hand. A ground electrode was attached to the subject's forearm. The reaction time switch was also placed in a position which could be easily reached by the subject's preferred hand. The following instructions were given to all subjects in Phase I of the experiment.

> Let me describe to you what your task will be in the experiment. On each trial a tone will come on through the speaker in here. Your task will be to simply flip the switch as soon as you can when you hear the tone come one. After the tone goes off there will be a slight gap in time and then one of the slides I told you about may or may not flash on the screen. Whether it does or not depends solely on a random sequence determined before the experiment. If a slide comes on it will last six seconds. Please look at the slide while it is on the screen. Before we begin the main part of the

experiment, I would like to give you twenty practice trials without the slides in order to familiarize you with the task. First we will have a rest period of ten minutes while I take base level physiological readings. Then I will tell you over the intercom when we will begin the practice trials. After the practice trials are over, a two minute rest will follow, and then we will begin the first of two sets of twenty trials with slides. So in all, there will be three sets of trials, one set of practice trials and two sets of "real" trials. Any questions?

After the instructions and questions were dealt with, a ten minute rest period began during which the experimenter told the subjects that the practice trials were about to begin and to prepare for the first tone. After twenty two second tones there was a two minute rest period. During this time, the experimenter calculated the median RT during the practice trials. After the rest period, the experimenter informed the subject via the intercom that the first phase was to begin and to prepare for the first tone. On each trial a two-second tone occurred followed by a two-second gap in time and then a six-second slide appeared eight per cent of the time for all subjects. Intertrial intervals were fifteen seconds throughout the experiment. During the first phase, the experimenter recorded RTs for all trials. After Phase I was over, subjects were given different instructions for Phase II. For the three perceived control groups, the instructions were as follows:

Phase II of the experiment will be essentially similar to Phase I. The only difference is that if your speed of responding is faster than your average speed in Phase I, you will not receive a slide. In other words, on each trial that you flip the switch faster than your average speed of Phase I, you can avoid seeing a slide on that trial. Any questions? Now I will re-calibrate some of the equipment and check over your reaction times in Phase I. Then I will let you know when Phase II will begin.

In one of these groups, PC/AC, these instructions were actually true, so the experimenter calculated the median RTs for Phase I. The reason for the gap in time after the tone was simply that the experimenter needed time to manually flip a switch either allowing or not allowing a slide to come on depending on the subject's RT. For the other two perceived control groups (PC/NC_1 and PC/NC_2), the instructions were non-veridical since RT actually had no effect on slide presentation. Slide presentation was actually determined by a yoking procedure based on median response speeds during practice trials. Subjects in the PC/NC_1 group received slides in Phase II on those trials when their yoked partners in the PC/AC group received them. Subjects in the PC/NC_2 group received slides in Phase II on those trials when their yoked partners in the NPC/AC group received them.

The instructions for the two no-perceived control groups were as follows:

> Phase II of the experiment will be the same as Phase I. Again you will receive slides on the basis of a prearranged random sequence. Now I will check the electrodes and re-calibrate some of the equipment. O.K.?

In one of these groups, NPC/AC, these instructions were nonveridical, i.e., slide presentation was not determined at random but was affected by the subject's reaction time. Therefore, the same procedure was followed as for the PC/AC group. For the other no perceived control group, NPC/NC, the instructions were veridical since the slide presentation again was determined by a yoking precedure. Subjects in the NPC/NC group received slides when their yoked partners in the NPC/AC group received them. The yoking again was done on the basis of median reaction times during the twenty practice trials. In summary, the PC/AC and PC/NC_1 groups received the same number of stimuli, being yoked to each other, and the NPC/NC and PC/NC_2 groups were exposed to the same number of stimuli as the NPC/AC group. During the practice trials, and in Phase I and Phase II, GSR was recorded continuously with the experimenter monitoring the dynograph.

After Phase II was over, the experimenter entered the subject room and removed the GSR and ground electrodes. The subject was then brought to another section of the laboratory where the two questionnaires were administered. The first of these was the Rotter Locus of Control scale which was prefaced by the same instructions prescribed by Rotter (1966). When the subject had finished that scale, the second questionnaire was given. This one was designed by the experimenter and had several purposes. It was given to check to see whether the manipulation worked, i.e., whether the instructions induced the perceptions they were supposed to. Preferences for the two phases were also assessed. Subjects were questioned concerning their anxiety during Phase I and Phase II. The unpleasantness of the slides in both Phase I and Phase II was also assessed.

After both questionnaires were completed, the subject was then debriefed. All subjects were told about the hypotheses of the experiment and the particular group they were in. The purpose of the questionnaires was also discussed. The subjects were then paid and asked not to disclose the hypotheses or the manipulation to anyone else

The Effect of Differing Percentage of Control on Selection of Potential for Control

Forty human Ss were used in this experiment. Twenty-two Ss were male with a mean age of 20. Eighteen Ss were female with a mean age of 19½. The mean age for all subjects was 19.8.

All Ss were college students. Experimenters did not base any part of this experiment on marital status, race, or religion.

All Ss were informed that the experiment involved the use of mild shock, the level of which was determined by each S. Ss were informed that they could withdraw from the experiment if they so wished. All Ss acknowledged that they had not participated in an experiment of this nature before. All Ss signed separate and individual consent forms (in lieu of the fact that this was an experiment involving the use of shock stimuli). All Ss were provided with an information sheet prior to actual participation in the experiment. In addition, Ss were aked by the Es if they had any additional questions.

An experimental laboratory was used for this experiment. It consisted of a sound-proof chamber and an apparatus/observation room. All Ss were submitted to the experimental conditions separately and exclusively. Prior to the experiment, each S was given an information sheet which stated purpose, S's part, and risks.

In addition, Ss were informed that they would experience 20 trials in the experiment, each trial consisting of 20 seconds. Ss were reminded that they "might" have "control" in 1 of the 2 switches at their disposal. Ss were also reminded how "control" was defined for this experiment: (Control--the ability to administer shock to self, not to abort it.) At this point electrodes were attached to the wrist of the S, GSR electrodes were attached, dynagraph calibrated to each S, and shock levels determined.

Ss were told that shortly after the door to the sound-proof room was shut, the experiment would begin. They would see a white light from a projector shine on the screen in front of them for 20 seconds. During the time the light was on, they should elect to depress only 1 of the 2 switches in their command. In doing so they might be able to avoid a shock to themselves. In the event nothing happened when they depressed the switch, they would be shocked automatically when the light went off, also signifying the end of one trial. In the event they selected and depressed a switch which yielded control to them (giving themselves shock), the light would still remain on for the allotted 20 seconds, but there would be automatic shock when the light went out. Ss were instructed not to move during the experiment as it would interfere with the recording of the dynograph.

Two measures were recorded in the experiment, spontaneous GSR and reactive GSR. Amplifiers for both measures and all 40 Ss were calibrated and the sensitivity on both channels (amplifiers) was set to x1. The spontaneous GSR pre-amp was set to 0.2 v/cm for all Ss, while the reactive GSR channel pre-amp sensitivity was set to 2 mv/cm for all Ss. The polygraph speed setting was 0.5 sec/mm. The Es, after calibrating the dynograph to a S, and sealing the door to the sound proof chamber then waited three minutes to establish somewhat of a resting state in each S. Immediately following the resting state, the actual experiment began. Total time involved per S was approximately fifteen minutes. Complete silence was enforced during the running of each S and absolutely no interruptions were permitted until the experiment was completed. After each S completed the experiment, they were debriefed.

<u>The Effect of Being Responsible for Reducing Another's Pain on Subjects' Response and Arousal</u>

There were 67 male undergraduates enrolled in introductory psychology who participated as subjects in the present experiment. Seven subjects were discarded, as recording or procedural errors made their data unusable. The remaining 60 subjects were randomly assigned to one of the four experimental conditions with the restriction that each group contain 15.

A Beckman Model R polygraph was used to record skin conductance responses using that machine's GSR coupler for recording basal resistance and a second channel, with a 6-second tim constant, for recording skin responses. Beckman Biopotential Electrodes and electrode paste were used. A Tursky shock electrode (Tursky, Watson, & O'Connell, 1965) was attached to the model for apparent delivery of shock.

A Hunter Clockcounter recorded the subject's reaction time, a slide projector provided the warning signal, and a Hewlett-Packard signal generator delivered the tone used to signal apparent shock delivery. The tone was a 1,000 hertz, 70 decibel pure tone played through a speaker located 2 feet behind the subject. Solid state circuits were employed for precise timing of all event.

The subject was seated in a classroom desk chair in an IAC sound and electronically shielded room. The model was seated in an armchair that faced 90 degrees from the subject's chair. The model's chair was placed approximately 2 feet in front of the subject with the model's left side toward the subject. The model's "problem box" was a small black box with three buttons and a green "correct" light. The subject's reaction time switch was a single toggle switch in a metal box that was placed on the writing portion of the desk chair.

Subjects arrived at the laboratory knowing nothing about the experiment other than the fact that they and another individual would be involved in an experiment was was called "Interpersonal problem solving under stress." When they arrived for the experiment, they found a confederate of the experimenter already waiting. The confederate (model) was one of four undergraduate females who were hired and trained for this experiment. Shortly after the subject's arrival, the experimenter came out of the control room and began to explain the study to both the subject and the model. The explanation indicated that the experiment was concerned with the physiological responses of individuals while they were involved in an interpersonal problem-solving situation. In order to study the problem, each of the subjects would have a different task to perform. It was further explained that one subject would be involved in a problem-solving task that would involve the use of shock, while the other person would have a completely different sort of task without the use of any shock. In order to assure complete random assignment of subjects to both roles, two cards were shown with the work SHOCK on one and NO SHOCK on the other. The cards were shuffled and placed in front of the subject who was instructed to point to one. A "magician's force" was used so that the model always received the shock card. A magician's force is a procedure by which the subject chooses between two alternatives, yet, in fact, the experimenter determines which alternative is selected. In this experiment, the subject was asked to point to one of two cards. If he pointed to the no-shock card (which should have occurred half the time by chance) he was given that card. If the subject pointed to the shock card the experimenter said, "We'll discard that and the other one is yours," indicating the no-shock card. In either case, the subject received the no-shock card. The fact that the subject made the "choice" made the cover story more plausible.

The confederate was then conducted to the experimental chamber; the experimenter explained that the subject would act as an observer during the experiment, watching the responses and behavior of the model while the model was solving the problem. It was further explained that if she (model) gave an incorrect response on the task, a tone would come on in the room and that the model would simultaneously be receiving a shock. Subjects were told that on trials when the confederate was incorrect and received a shock, they they, the subject, could terminate the shock by throwing a switch. Subject reaction time consisted of the interval between the onset of the tone and the moment he threw the switch.

Subjects in the control condition were given the same explanation of the experiment and also told of their role as observers. On incorrect trials when the tone came on in the experimental room, they were also instructed to throw the switch, but were told that they could not terminate the shock. Although they were performing the same task as the experimental subjects, they were given different reasons for their actions. Control subjects were told that they were being studied for their reaction time in the presence of another who was under stress.

After the completion of these instructions, the experimenter led the subject into the experimental room where the model had previously been seated. The seats were arranged as described so that the subject could easily observe all responses made by the confederate on the problem-solving task and also her reactions to the shocks she was apparently receiving. Beckman electrodes were attached to the palm and wrist of the nondominant arm of both the subject and model, and it was explained that the electrodes would be used to record the physiological responses. A shock electrode was attached to the model's preferred wrist. The experimenter then proceeded to explain the model's role in the experiment. It was explained that the model's task was to find the correct sequence of presses of three buttons. The problem procedure was explained as following:

> A light will flash onto the screen to indicate the onset of the problem solution period. When the light comes on you will have six seconds to give a response. An incorrect response will be followed by a tone and an accompanying shock. A correct response will not be followed by these stimuli.

The experimenter then proceeded to describe the various intensities of shock that the model would receive. In the high-shock condition, subjects were led to believe that the shock would be of an extreme intensity and that the model would find them rather painful. In this condition the model would jerk his arm quickly each time the tone came on [illegible]. In the low-shock condition, the experimenter stated that the shocks would be of only [illegible] as [illegible] the model. In order to keep the overt response of the model [illegible] in all conditions, the experimenter instructed the model to [illegible] each time he heard the tone come on [illegible] was of interest in observing "[illegible] behavioral responses" of people. The model then helped the experimenter set the level of reference shock that was supposedly to be used in the experiment. In the high-shock condition, it [illegible] well above pain threshold, and in the low-shock condition, it was apparently set at detection threshold [illegible] reported it [illegible] not uncomfortable. The models were uninformed as to the responsibility condition under which they were performing. Unfortunately, the setting of shock levels made it impossible to keep the models uninformed concerning that variable. Considerable practice and monitoring of the models' behavior were used in an attempt to keep models' behavior as consistent as possible.

Upon the completion of all instructions, the experimenter returned to the control room which contained all the recording apparatus. After a 5-minute basal recording period, the trials began. There were 20 reaction time trials and 5 trials with no reaction time. The interval between the onset of the light and the delivery of apparent shock with incorrect problem solution was 6 seconds. On reaction time trials, a tone of 2 seconds' maximum duration followed the termination of the light with a 1 second delay. Intertrial intervals were 15 seconds. The sequence of trials was randomly assigned for each subject.

<u>The Effect of Prior Knowledge of Delivery of Aversive Stimuli to a Model upon the Observer's Response</u>

Sixty-three male undergraduates enrolled in Introductory Psychology took part as subjects in this experiment. Three subjects were discarded due to recording errors that made their data unusable. The remaining 60 subjects were randomly assigned to one of four experimental conditions with the requirement that each group contain 15.

A Beckman Model R Polygraph was used to record SCRs using a [illegible] coupler for recording basal resistance and a second channel, with a [illegible] second time constant, for recording [illegible] responses. Beckman Biopotential Electrodes, and electrode paste were used. A Tursky shock electrode (Tursky, B., Watson, P. D., and O'Connell, D. N. (1965) was attached to the model for apparent shock delivery. A Hunter clock counter recorded the subject's RT, a slide projector provided the slides for each of the model's learning trials, and a Hewlett-Packard signal generator delivered the tone used to signal shock delivery. The tone was a 1000 hertz, 70 db pure tone played through a speaker located 2 ft. behind the subject. Solid state circuits were employed for precise timing of all events.

The subject was seated in a classroom "desk chair" in an IAC sound and electronically shielded room. The model was seated in an armchair that faced 90 degrees from the subject's chair. The model's chair was placed approximately 2 feet in front of the subject with the model's left side toward the subject. The subject's RT switch was a single toggle switch located on a metal box that was placed on the writing portion of the desk chair.

Subjects arrived at the laboratory knowing nothing about the experiment other than the fact that they and another person would be involved in an experiment that was called "Interpersonal learning under stress." When they arrived for the experiment they found a confederate of the experimenter already waiting. The confederate (model) was one of three undergraduate females who were hired and trained for this experiment. Shortly after the subject's arrival, the experimenter came out of the control room and began to explain the study to both the subject and the model. The explanation indicated that the experiment was concerned with the physiological responses of individuals while they are involved in an interpersonal learning situation. In order to study the problem, each of the subjects would have a different task to perform. It was further explained that one subject would be involved in a learning task which would involve the use of shock, while the other person would have a completely different sort of task without the use of any shock. In order to "assure" complete random assignment of subjects to both roles, two cards were shown with the word "SHOCK" on one and "NO SHOCK" on the other. The model chose between the two cards. It was decided beforehand that the "SHOCK" card would be in the experimenter's right hand so that the model would always "unluckily" choose the "SHOCK" card.

The confederate was then conducted into the experimental chamber and told that her instructions would be given in a few minutes. She was told to relax, and the door was shut. The subject was told that he was not to be actively involved in the learning task; his task was to flip a switch each time the model answered the task incorrectly. He was told that a tone would sound to indicate an incorrect response and that the tone would stay on for two seconds. In the responsibility group the experimenter explained that flipping the switch would trigger the onset of the shock. The subject was told that he could flip the switch at any time during the tone, and that his reaction time would be taken. RT was the time interval from the onset of the tone to the response (maximum time was two seconds). It was further explained that the rationale behind this procedure was our interest in bodily reactions to stress; for the model the stress was physical, while for the subject the stress was more "psychological." The subject was asked to cooperate and flip the switch when the tone was sounded. The subjects were also informed that when the tone did not sound they were not to flip the switch; if, however, they accidentally did, not to be alarmed because the shock apparatus was disconnected by the experimenter when the model answered correctly.

Subjects in the no responsibility condition were told that the tone would indicate the onset of shock; but that they were in no way involved with it. They were asked to perform their task (switch flip) because the effects of being in a stressful situation upon RT was being studied. These subjects were told not to flip the switch when the tone was absent.

In addition to the above one-half of the subjects had prior knowledge of shock delivery. Subjects in the prior knowledge condition had the model's task fully explained to them. The task went as follows. Lists of words were flashed on a screen. Within each lid there was one word which was related to one word in each of the set of six lists. In the first set of six lists the concept was that of <u>animals</u>; thus in each group of five words, one was an animal. At the end of each list presentation (off the screen) the model was to say the one word which she felt belonged to the group we were looking for. When she answered incorrectly the tone would sound. The informed subject was told that there would be three different concepts in the learning trials: <u>animal</u>, <u>mineral</u> (words such as copper or silver appeared in each of the six lists) and <u>vegetable</u> (carrot, potatoe, etc.). The experimenter explained that the subject was being told the correct answer in order that he would be aware of whether or not the model answered right or wrong before the tone sounded. He was asked not to tell the answers to the subject. While the task was the same for all subjects (flipping the switch) the group they were placed in determined how they viewed their actions' effect.

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Those subjects in the no knowledge condition were told what the learning task was, but were not told the correct answers. In both groups, the subjects were asked not to prompt models and to wait until the tone before flipping the switch.

After the completion of these situations, the subject was led into the experimental chamber where the model was already seated. The subject's seat allowed him to easily observe the model's reaction to the apparent shock. Beckman electrodes were then applied to the palm and forearm of the nondominant arm on both the subject and the model. During this time the learning task was "explained" to the model, who was told that the tone would indicate the incorrect response and would be accompanied by shock. The shock electrode was then placed on the wrist of the model's dominant arm. She (the model) was told that when she answered correctly no tone would sound, and she would not receive any shock. She was also told that the group concept would change after each six slides.

A procedure to determine the apparent shock level was then conducted. The model ran through a procedure designed to look like different intensities of shock were being used to establish the model's shock level. The apparent levels were "just noticeable," "pain," and "tolerance." The experimenter instructed the model to indicate verbally when first she felt the shock, when it first was painful, and when it was as intense as could be tolerated. The experimenter "ran" this determination three times for each model to, it was explained, get stable levels. Following the "setting of levels", the model was told that shock would be somewhere between the "pain" and "tolerance" level.

All three models acted in the same manner during apparent shock delivery. The model would flex her arm when the apparent shock was delivered and would emit an appropriate verbal response.

There were 18 trials which consisted of slides shown for five seconds each. It was predetermined that the model would answer five correctly. Thus, there were 13 apparent shock trials in which RT speed was obtained. The interval between the model's verbal response to the slide and the onset of the "incorrect" tone was eight seconds. The tone was set for two seconds. The tone was set for two seconds. At the onset of the tone the Hunter Clock counter started, it, along with the tone, stopped when the subject flipped the switch. Intertrial intervals (tone-slide intervals) were 15 seconds. Upon completion of all the instructions, the experimenter closed the door of the experimental chamber and returned to the control room. Following a brief delay, the experimental procedures began.

Effectiveness of Placebos and Non-Veridical Perceived Control in the Reduction of Emotional Arousal

The subjects were 48 male students (46 undergraduates and 2 graduate students) at the State University of New York at Stony Brook. All Ss volunteered for the experiment. There were 4 groups of randomly assigned Ss, and for each S there were 3 parts in the experiment; in each part, each S received 10 presentations of electrical stimulation. The groups were as follows:

Group 1; placebo, no instructions; (PNI) - Ss received a placebo pill before Part 2, but had no instructions concerning "anticipated effects" of the pill. Ss had "perceived control" over the aversive stimulation.

Group 2; placebo, instructions, no disabuse; (PIND) - Ss received a placebo pill before Part 2, were given instructions that it was a mild stimulant, and were not disabused of this knowledge until the end of the experiment. Ss had "perceived control".

Group 3; placebo, instructions, disabuse; (PID) - Ss received a placebo pill before Part 2, were given instructions that it was a mild stimulant, and were disabused of this knowledge (told it was a placebo) after Part 2. Ss had "perceived control".

Group 4; no placebo control; (NPC) - Ss received no placebo. This was a control group, all Ss of which also had "perceived control".

At the time of volunteering, all Ss were informed that the experiment would involve electrical stimulation. When each S arrived at the lab, he was taken to the experimental room, a chamber that was sound proof, electrically shielded, and in which there was a comfortable reclining chair. Each S was told, "This experiment involves your reactions to mild electrical stimulation. We will measure both your physiological responses and your reaction time."

Ss in Groups 1, 2, and 3 were then told, "This experiment is also investigating the effects of a pill on your reactions. The pill will not affect you beyond the diration of this experiment. This experiment is being closely supervised by a psychiatrist, and neither the pill nor the electrical stimulation can possibly harm you." For S in Group 4, the above explanation was changed to the following: "Some of the other people in this experiment will receive a pill. But you are in a control group and we want to measure your reactions without a pill. This experiment is being closely supervised by a psychiatrust, and the electrical stimulation cannot possible harm you." All Ss were then asked again for their explicit consent to continue.

At this point, E explained the following: "I am going to place some electrodes on your skin to measure the physiological changes of your skin. I am also going to place this band around your ankle, and the mild electrical stimulation will be delivered through this band." E then attached skin contuctance (SC) and shock electrodes.

There next followed the determination of threshold for sensation, annoyance, and "mild pain" for each S. The E increased shock slowly from 0 and recorded the levels at which S reported that he first perceived the stimulation, felt that the stimulation was at all annoying, and finally the first point at which S considered the stimulation "mildly painful". This procedure was repeated 3 times. The level of electrical stimulation used was the mean of the averages for annoyance and pain for each S. After the threshold data collection, E informed S that the shock level would be "somewhat below that which you indicated as painful." The apparatus was such that a buzzer always accompanied the shock; its onset and offset were identical with shock onset and offset.

The experiment consisted of 3 parts, and in each part S received 10 presentations of shock. Before Part 1, all Ss were told the following:

> "You will be experiencing 10 6 sec. presentations of electrical stimulation. You will at the same time hear a buzzer. Your task will be to flip this switch from the #1 to the #2 position as fast as you can when the electrical stimulation and buzzer come on. The electrical stimulation and buzzer will last for 6 sec. I urge you to react as quickly as possible because we are interested in the speed of your reaction while experiencing electrical stimulation. But your speed of reaction won't affect the duration of the electrical stimulation. It will always be 6 sec. long. There will be a total of 10 of these presentations."

When the instructions were completed, each S was given a sample shock at the appropriate level (mean of the average annoyance and pain levels). There followed a 5 min. rest period, and 20 sec. prior to the first shock, E warned S that the first shock would soon occur. There then followed

10 6 sec. presentations of shock, with a 30 sec. intertrial interval. After Part 1, the E reentered the experimental chamber and told all Ss:

"Part 2 of the experiment will be similar to Part 1. But now, if your speed in reacting is as fast or faster than the average of your reaction times in Part 1, the duration of the electrical stimulation will be decreased from 6 sec. to 3 sec. So if you can react quickly enough, you can decrease the duration of stimulation on each trial. I am timing your reaction on a timer that is sensitive to .001 sec., so even a slight decrease in reaction time will decrease the duration of the buzzer and electrical stimulation."

Group 1 was then given a placebo pill, but they were not given any instructions as to the "expected effects" of the pill. They were told:

"I mentioned before that we would be asking you to take a pill. I would like you to take this pill now. We are investigating whether it will have an effect on reaction time. There will be positively no ill effects. This pill has been very widely used and is perfectly safe for anyone to take. Its effects will wear off by the end of the experiment."

Group 2 and Group 3 were given a placebo pill and were given the following instructions:

"I mentioned before that we would be asking you to take a pill. I would like you to take this pill now. It is a mild stimulant that will help you in responding faster. It works quickly and should enhance your ability to respond quickly. There will be positively no ill effects. This pill has been very widely used and it is perfectly safe for anyone to take. Its effects will wear off by the end of the experiment."

Group 4, the control group, did not receive a placebo pill.

After administering the placebo, E said, "I'm going to allow some time to allow the pill to begin working. I will warn you before Part 2 begins. Part 2 will involve 10 presentations of stimulation." All Ss then had a 4 min. rest period. About 20 sec. before the beginning of Part 2, E warned the Ss that Part 2 would be beginning. There then followed 10 presentations of shock, with a duration of 3 sec.

per presentation for all Ss, and an intertrial interval of 30 sec. It must be emphasized that although Ss were told that they could shorten the shocks to 3 sec. by responding faster, they really had no control over shock duration, and all Ss received 3 sec. shocks for each of the 10 presentations.

After the presentation of the 10 shocks, each S was told, "As you probably could tell, the duration of the electrical stimulation and the buzzer were shortened, so you were being successful in responding faster and shortening the stimulation."

Group 3 (placebo + instructions + disabuse) was then disabused of the previous information concerning the pill. They were told the following:

> "I'd like to tell you now that I purposely fooled you before concerning the pill. The pill I gave you before was a placebo. That means that it had no chemical content whatsoever that could affect you. The shortening of the shock duration was due entirely to your faster responding. There was no help from the pill. You were responding faster on your own."

None of the other groups was told anything about the pill at this time.

All Ss were then told:

> "Part 3 of the experiment is exactly like Part 2. If your speed in reacting is as fast or faster than the average of your reaction times so far, the duration of the electrical stimulation and buzzer will continue to be reduced to 3 sec. Remember that I am recording your reaction time on device sensitive to .001 sec., so even a slight decrease in reaction time sill continue to reduce the stimulation to 3 sec. There will be a short rest period now, and then there will be 10 more presentations of stimulation. As before, I will warn you before Part 3 begins."

There was a rest period of 1 min. for all Ss, and 20 sec. prior to the first shock, all Ss were warned. There then followed 10 presentations of shock and buzzer, always 3 sec. in duration, regardless of how fast S responded. The intertrial interval was 30 sec. After Part 3, threshold data were again collected for sensation, annoyance, and pain. After the experiment, all Ss were thoroughly debriefed concerning the purpose of the experiment and were explicitly told that the pill was a placebo.

Physiological data were recorded on a Beckman Type R Dynograph. Skin conductance was recorded on 2 channels; on one channel was recorded GSRs to shock and spontaneous GSR fluctuations, while the other channel recorded basal skin resistance. To record physiological data, Beckman biopotential electrodes and electrode paste were used.

The shock apparatus was a simple device manufactured at the State Hospital, Carstairs Junction, Lanark, Scotland. It attached simply to a 6 volt battery; it utilized an elastic band with 2 metal snap electrodes, the band being placed around the ankle so that the metal electrodes rested firmly on the skin. On each electrode was rubbed electrode paste for better conductance.

Findings and Analysis

This section of the report is presented in terms of each individual study. Each study is summarized and presented in the order discussed in the Introduction.

Evaluating the Effects of the Prediction-Control Confound

Sixty subjects were randomly divided into three groups in an experiment designed to test if the effects of being able to control aversive stimuli are principally due to being able to predict the occurrence of those stimuli. Subjects in an actual control group could terminate aversive photographs, while the subjects in the prediction and no-control groups could not terminate the photographs. Subjects in the prediction groups were completely informed concerning the time relationships in the study, while the no-control groups were not informed of any such relationships. Subjects in the prediction and no control groups were yoked to subjects in the actual control group. Skin conductance was used as the measure of autonomic responsiveness, and it was found that predicting subjects responded to warning stimulus more than controlling subjects. When considering the response to the aversive stimulus, controlling subjects responded less than subjects in the other two groups. They results are interpreted as indicating that the effects of control are not simply determined by prediction but include other factors.

Effects of Gaining Control over Aversive Stimuli After Differing Amounts of No Control

Sixty male undergraduates were give 4 levels of experience with insoluble problems. Solutions of problems avoided shock while non-solution resulted in shock. Increasing amounts of prior non-solution were associated with retardation of solving problems once solution became possible. The results were case in a "learned helplessness" framework. S's speed of reaction increased as problems became soluble. There were no detectable changes in S's skin responses.

Predictable and Unpredictable Aversive Events: Evidence for the Safety-Signal Hypothesis

GSR was compared in two groups exposed to either predictable or unpredictable aversive stimuli. Spontaneous flucuation (SF) of skin resistance was the primary variable measured because it is unconfounded by attentional responses elicited by experimental stimuli. The unpredictable group showed nearly twice as many SFs as the predictable group. Amplitude of GSR occurring within o-4 sec after onset of the aversive stimulus differentiated between groups, but amplitude of GSR occurring within 4-8 sec after onset did not. The results discussed in terms of Seligman's safety-signal hypothesis, indicated that arousal is greatest for the unpredictable group during intertrial intervals rather than during the presentation of the UCS.

The Effects of Different Degrees of Control

The purpose of this study was to parametrically evaluate the effects which different degrees or percentages of control have on the Ss's preferences, on their perception of the aversiveness of stimuli and on their physiological responding. Also the effects of loss or gain in percentages of control were to be investigated. Control was defined as the S's ability to determine the onset of shock by pressing a button after the offset of a tone. Go control meant the lack of this ability: Shock was set on by the programmed timer independently of when the button was pressed.

The results show that there is no difference between Ss in the 0%, 50%, or 100% control condition as to which levels of shock they experienced as uncomfortable or as painful. Neither loss nor gain of 50% control had any effect on the ratings of either the uncomfortable or painful level. Similarly, an analysis of the GSR amplitudes to chock did not reveal any differences between conditions. The only significant results ($x^2=5.94$; df=1) were the Ss" preferences for one of the two percentages of control they had experienced. Significantly more Ss preferred the higher percentages of control.

Effects of Control and Prediction on Reactions to Aversive Stimuli

It was found that subjects preferred control to no-control conditions and felt less discomfit under control than no control treatment (questionnaire data). Subjects in the control conditions were willing to endure longer exposure to the stimuli than subjects in the no control conditions. Under the circumstances of this experiment, loss of control resulted in greater disruption under subsequent stress (C/NC) than continuation of a previous no control experience (NC/NC) as measured by physiological arousal and reports of discomfit. Subjects who had prediction showed less autonomic arousal, tended to report less discomfit, and tended to prefer longer exposure to stimulation then no prediction subjects. The expectation of prediction as opposed to no prediction treatment had the same inhibiting effect on autonomic reactivity as the actual experience of prediction conditions. There was a trend for the expectation of control to operate in a similar manner, however, these results did not attain statistical reliability. It was also found that matching subjects on level of autonomic reactivity prior to the experiment reduced a significant portion of the error variance in the psychophysiological analyses and that more reactive subjects were more strongly affected by experimental manipulations than less reactive subjects.

The data were interpreted within a framework of the impact reducing (or calming) effects of control and prediction upon subjects' reactions to aversive stimulation. The safety-signal hypothesis was as a possible mechanism through which these variables operated.

Effects of Veridical and Nonveridical Perceptions of Control over Aversive Events on Reaction Time and Galvanic Skin Response.

The experiment investigated reactions to aversive stimuli in subjects exposed to veridical and nonveridical perceptions of control. In a reaction time (RT) task, one hundred subjects were instructed to react to the onset of a two-second warning tone by flipping a switch. Simultaneous with tone offset, a slide of a person killed in a violent accident would flash on the screen eighty percent of the time in Phase I of the experiment, which lasted twenty trials. In Phase II, the five groups of twenty subjects received different instructions. For three of these groups, the perceived control groups, subjects were told that each time they responded faster than their average reaction time for the first twenty trials, they could avoid seeing a slide on that trial. The two no perceived control groups were simply told that Phase II would be similar to Phase I. In the veridical groups, the instructions actually matched the environmental contingencies. If subjects were told that they had control, response speed actually affected slide presentation, whereas if they were not told they had control, response speed did not affect slide presentation. In the nonveridical groups, the instructions did not match environmental contingencies. If subjects were told they had control, response speed had no effect on slide presentation, whereas if subjects were not told they had control, fast responding avoided a slide. The veridical groups were the perceived control-actual control (PC/AC) group, and the no perceived control-no actual control (NPC/NC) group. The nonveridical groups were the no perceived control-actual control (NPC/AC) group and the two perceived control-no actual control groups (PC/NC_1 and PC/NC_2). For the groups that had actual control, PC/AC and NPC/AC, their responses determined the trials on which they received

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slides. For the groups that had no actual control (NPC/NC, PC/NC_1, and PC/NC_2), slide presentation was determined by a yoking procedure. Subjects in the NPC/NC group were yoked to the NPC/AC group. Subjects in the PC/NC_1 group were yoked to the PC/AC group. The PC/NC_2 group was similar to the PC/AC group but was yoked to NPC/AC since it was expected that NPC/AC would receive more slides than the PC/AC group. This would allow assessment of the effect of number of slides on subjects' reactions.

All subjects were given the Rotter Locus of Control Scale and a questionnaire assessing self-reports of anxiety and unpleasantness of the stimuli.

Results showed that for RT difference scores, perceived control groups showed a greater increase in speed in Phase II than the no perceived control groups. In addition, actual control groups showed a greater increase in speed than no actual control groups. There were no significant differences between the five groups in overall RT in Phase II. Results for autonomic measures showed that for spontaneous fluctuations of skin resistance (SFs), perceived control groups were showing more arousal with PC/NC_2 being more aroused than all the others. There were no differences between groups with respect to GSR amplitude during warning tones and dead body slides in Phase II. There was evidence for daptation effects for GSR amplitude during tones and for SFs.

The results for the Rotter scale did not support the notion that subjects perform better in situations where the contingencies matched their generalized expectancies for control. There were no differences between groups for anxiety and unpleasantness ratings.

The Effect of Varying Percentage of Control on Choosing to Control

Forty subjects were divided into 5 groups. All subjects were given 20 trials in which shock was to be delivered. At the beginning of each trial subjects were to select one of two levers and were told that they "might" have control since on certain trials the lever press would result in immediate shock delivery. On the remaining trials the lever press did not result in a shock at the press but rather occurred at the end of the 20 second trial signal.

The 5 groups of subjects differed in the percentage of time in which the control switch resulted in immediate delivery of shock. For example, the 100% group always received shock when they pressed the "control" switch, the 75% group received immediate shock 75% of the times they press the "control" switch, and so on for the 50%, 25%, and 0% or no control group. Subjects were not told that there was a "control" switch and were left to discover that fact for themselves. It was predicted that as the percentage of control increased, selection of the control switch would increase.

Analyses of the results disclosed that (1) subjects preferred control as assessed by a post-questionnaire; (2) spontaneous GSR was greater in least predictability (50% group); and (3) as the percentage of control increased, subjects selected to control with a greater probability. The results confirmed the prediction that the ability to control is perceived as a positive state. However, in this study GSR activity was more responsive to the predictability variable than to control.

The Effect of Being Responsible for Reducing Another's Pain on Subjects' Response and Arousal

Sixty subjects were equally divided in a 2 x 2 experimental design into high-versus low-apparent-shock delivery and responsible versus not responsible for another. The subjects' task in the responsible condition was to make a response that shortened the duration of a shock delivered to a model. High shock versus low shock referred to the level of apparent shock delivered to the model. Subjects' reaction time was faster when they had responsibility and was faster when apparent shock was greater. Skin conductance data indicated that subjects were vicariously aroused by high levels of apparent shock. There was no evidence of vicarious conditioning.

The Effect of Prior Knowledge of Delivery of Aversive Stimuli to a Model Upon the Observer's Response

Sixty male subjects were randomly assigned to four conditions in a 2 x 2 experimental design. One factor was prior knowledge versus no-prior knowledge of delivery of apparent shock to a model. The second factor was the subject being responsible for versus not-responsible for delivery of the aversive stimulus. The experimental procedure involved subjects observing a model in a learning task for which apparent shock was administered if the model made an error. All subject's activated a switch which, in the responsible condition, was to deliver shock. Subject's reaction time was much slower when the subject was "responsible" for apparent shock delivery. In contrast, subject's arousal, as measured by skin conductance activity, was greater during a warning tone that preceeded the apparent shock for non-responsible subjects.

Effectiveness of Placebos and Non-Veridical Perceived Control in the Reduction of Emotional Arousal.

The study presented in this paper was intended to combine two areas of research that involve the investigation of human emotions. One area is that developed initially by Schachter concerning the role of cognition in emotion. The second area is that investigated by Geer concerning the actual physiological responses of the organism to aversive stimuli, and the effects of physiological responding of control over aversive stimulation (emotional responding is here defined in terms of physiological variables).

Because of this success in manipulating cognitions about emotional states in general, and because of the powerful effects of the easy-to-administer placebo in particular, it seems reasonable to extend this research to investigate the possibility of manipulating cognitions in the control over emotion-generating aversive stimuli. Clinical psychologists often have clients or patients who claim that they feel completely out of control concerning situations that confront them, and this perceived lack of control often leads to emotional responding. Geer has begun a series of studies to investigate the effects of prior experience with control, perceived control, or no control over aversive stimuli that elicit emotional responses. This line of research is intended to extend animal research concerning the avoidance and control of aversive stimuli to humans, and in order to do this, one must necessarily look at cognitive variables and at the alteration of physiological arousal that humans label with some "emotional" label. In this area of research, psychophysiological data provide the major dependent variables.

Conclusions and Recommendations

The conclusions to be drawn from the studies reported in this document have been stated in previous sections. It may be useful, however, to summarize them once again and to draw from them the implications that they hold for further research and theorizing.

There are four main findings that can be abstracted from the numerous studies reported. These are:

1. The basic phenomena of prediction and control of aversive stimuli are replicable and robust. Subjects prefer to be able to predict and control aversive events and autonomic arousal typically is lower under increased prediction and control. Further, the perception of control is the important variable not its simple occurrence.

2. The most potent variables that affect prediction and control appear to be previous experience with control. If a subject has experienced no-control he is relatively reduced in the positive effects of control. The condition of control preceding no control produces a disruption when compared to subject always experiencing no control.

3. Control of the delivery of aversive events to another produces arousal, but it appears that the results are much less powerful than direct effects upon the subject.

4. Experimental manipulations of a less direct nature e.g., placebo or misdirection, do not produce clear findings.

What implications can be drawn from these findings. First from a theoretical perspective, the results appear to be compatable with a safety-signal interpetation. That theoretical position suggests that the effect of control or prediction is that those situations allow the subject a safe time when aversive stimuli are reduced or absent. During the safety periods, the subject is less aroused and less arousable. The reasons for this reduction in arousal and its attendant positive state are not clear. It may be that subjects have learned that they can relax more since the likehood of aversive events is less or if one occurs it can be terminated or reduced. It may also be that some positive state occurs in the presence of a safety signal and that this state interferes with the negative effects of the aversive stimuli. The experiments conducted under support from NIA were notable to determine the nature of the cause of the safety signal effect. They did, however, lend support to the theoretical notion that the occurrence of a safety period leads to less arousal and to its selection over a less safe period. Future theoretical speculations would be well advised to carefully consider the safety signal hypothesis and its implications in further research in the area of prediction and control.

A second major implication has to do with the nature of the variables that affect the prediction-control phenomenon. First, the most potent variables effecting the phenomenon are the nature of the subject's prior experience with prediction and control. If subjects were switched from a no-control to a controlling situation the subject's control response was inhibited. Further if subjects were switched to no-control they experienced a disruption of autonomic activity. These findings, in the human, resemble animal research (Seligman, 1968) that has been described under the rubric of learned helplessness. The principal difference being the fact that the phenomenon are more pronounced in the animal research. This should not be unexpected since the strength of the variables and the degree of experimental control is more pronounced in animal research. It might be noted that Seligman (1968) has proposed that the learned helplessness conception has utility in helping clarify phenomena in behavioral pathology. He suggests that loss of control is a factor in the development of psychosomatic disorders and in depression. While the data from the present research do not speak directly to that issue, the fact that autonomic nervous system activity is increased under conditions of lowered control is consistent with suggestions of Seligman.

A third important implication is dorectly based upon experimental findings. It does not matter whether or not individuals actually have control, what matters is whether or not they perceive that they have control. The results are consistent with those reported by Glass and Singer in which they found that subjects who could, uet did not exercise the option to control, were less affected by aversive stimuli. The point that needs to be made is that, at least in the human, actual control is not necessary only the perception of control. Lefcourt (1973) has summarized this finding and its implications thusly:

> It is possible to conclude, then, that with respect to the response to aversive stimulation, perceived control makes a great difference. Pain- or anxiety-arousing stimuli are not simply to be found in the stimuli impinging on our senses. Our responses are evidently shaped and molded by our perceptions of those stimuli and by our perception

of ourselves vis a vis those stimuli. These conclusions are far from unique. What is remarkable, however, is the fact that the findings appear similar across species with different devices and different aversive stimuli. Where behaviorists have often attempted to reduce differences between species through invoking universal principles such as reinforcement, it is possible to conclude thus far that there are remarkable similarities among diverse species without reducing complex cognitive-perceptual systems to simple reinforcement assimilators. The perception of control would seem to be a common predictor of the response to aversive stimulation, it was not due to a lack of data implicating the perception of freedom and control as major determinants of other sorts of behavior. The point is already clear from this narrow review, however, that the sense of control, the illusion that one can exericse personal choice, has a definite and a positive role in sustaining life. The illusion of freedom is not to be easily dismissed without anticipating undesirable consequences. To submit to however wise a master planner is to surrender an illusion that may be the bedrock on which life flourishes.

Finally, having completed three years of concentrated research on the problem of prediction and control, it would be useful to pass along certain suggestions to other researchers. First, we are just beginning to appreciate the extent and nature of the phenomena. There is a great deal to be done and there is a need for precise theorizing to help extend our knowledge. Secondly, researchers should be wary of using experimental variables of limited impact. The effects of control are robust and studies that do not (1) use clear manipulations to produce the pheonomena and (2) use powerful independent variables will not yield clear results. While it would be presumptuous to tell others what research should be followed, it is the intention of this laboratory to move more and more towards the study of the nature of the tasks. We need more definitive definitions as to what situations produce control. Well-designed research on that topic will have considerable payoff.

SUPPLEMENTARY AND APPENDIX MATERIAL

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Appendix

Articles published thus far under support from NIE are listed below:

1. Geer, J. H. and Maisel, E. Evaluation of the effects of the prediction-control confound. *Journal of Personality and Social Psychology*, 1972, *23*, 314-319.

2. Fosco, E. and Geer, J. H. Effects of gaining control over aversive stimuli after differing amounts of no control. *Psychological Reports*, 1971, *29*, 1153-1154.

3. Price, K. P. and Geer, J. H. Predictable and unpredictable aversive events: Evidence for the safety-signal hypothesis. *Psychonomic Science*, 1972, *26*, 215-216.

4. Geer, J. H. and Jarmecky, L. The effects of being responsible for reducing another's pain on subjects' response and arousal. *Journal of Personality and Social Psychology*, 1973, *26*, 232-237.