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THE EFFECT OF CONTROLLABLE AND UNCONTROLLABLE
SHOCK ON SUBSEQUENT MOOD STATES AND BEHAVIOR

Dissertation

Presented in Partial Fulfillment of the
Requirements for the Degree Doctor of
Philosophy in the Graduate School of
The Ohio State University

By
Kevin John Hartigan, B. A., M.A.

* * * * * * * *

The Ohio State University

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CHAPTER I

INTRODUCTION

In recent years there has been a dramatic surge of empirical evidence and informed speculation that stress is in large part responsible for the majority of the physical and psychological dysfunctions for which people require professional assistance. The increase in medical and psychological publications related to stress has led some commentators to suggest that it is a problem of the highest magnitude in our society. The disorders that are treated by general medical practitioners are said to be up to 80% stress and tension-related, notably such problems as headaches and the various psychosomatic diseases. Beck (1967) found that 81% of inpatients suffering from some form of psychopathology (e.g. depression) reported experiencing severe stress just prior to admission. Since stress appears to be an inescapable part of life, and since it appears to be related to the problems many clients bring to counseling and clinical psychologists, it seems an appropriate topic for psychological investigation. Thus, the remainder
of this section will be devoted to a brief discussion of the conceptual parameters which bear on the empirical questions to be investigated in this study.

Hans Selye (1956) formulated the modern biological concept of stress as "the sum of all nonspecific systemic reactions of the body" (p. 12). It is usually associated with a stimulus which provokes physiological disequilibrium, to which the organic systems of the body strive to neutralize or adapt to. More recently, investigators (e.g. Appley and Trumbull, 1967) have expanded the scope of phenomena subsumed under the term "stress" from the physiological to the psychological, on the premise that the induction of stress in humans is mediated by cognitive factors. Glass and Singer (1972) argue that given the phylogenetic predominance of homo sapiens, the impact of a stressor is less dependent upon its veridical stimulus properties and more contingent on cues which are related to the consequences and meaning of the stress-inducing stimuli. Thus, investigators of human behavior (e.g. Lazarus, 1966) speak of psychological stress, that is, the affective, behavioral and physiological response to perceived threat or harm. This then shall serve as the definition of stress to be considered in this study.

No attempt will be made to posit stress as an unequivocally aversive phenomenon, particularly insofar as it brings physiological and psychological capacities to bear on novel or threatening stimuli.
The evolution of the human species can be viewed in terms of successful adaptation to stress-inducing stimulation. In fact, human learning is said to require a certain amount of stress or tension, which serves to energize the individual's capacities to acquire new knowledge. **Adaptive responses**, according to Glass and Singer (1972), refer to changes in an organism brought about by disturbances (stressors) to an internal or an organism-environment equilibrium. In this study, adaptive responses will refer to stress-related changes in the organism. The term will not imply that such changes are beneficial (which is the usual use of the term) or harmful (e.g. "maladaptive"). Adaptation which enhances the organism's survival value in the environment will be labeled "coping" and that which denigrates survival value will be described accordingly. Adaptive responses can be categorized in two ways: those which pertain to the survival and evolution of the species, and those that enable an individual to function effectively in the environment. It is with the latter category that this study is concerned.

The capacities which enable man to survive and function in the environment are said to be highly cognitive in nature (Lazarus, 1966). Thus it cannot be expected that an individual with severe cortical damage will be capable of actively coping with many stressors. In any event, while adaptation to stress is beneficial in some ways, it does not occur without a cost to the individual. Selye (1950) and
others have suggested that man has a limited amount of "psychic energy," portions of which are depleted in the process of adaptation to stress. When a sufficient amount of psychic energy is depleted as a result of prolonged stress, exhaustion, depression and other deleterious after-effects of stress are experienced.

The usual pattern of adaptation to stress is through a cognitive reappraisal of the aversiveness of the stressor, which often results from repeated exposure to it. Glass and Singer (1972) suggest that continued exposure to a stressor may produce cumulative effects which are only evidenced after the stimulus has terminated. Alternatively, constant vigilance and coping may become stressful in that they severely strain the capacities and energy of the individual.

Both of these effects refer to the potentially aversive consequences of adaptation to stress. These after-effects may become evident either shortly after a stressful experience (e.g. exhaustion or mild depression) or may require several years to surface (e.g. an ulcer). In either case, it appears that the disorders which unsuccessful attempts to control stress eventuate lead many to enlist the aid of psychologists and medical practitioners.

Stress appears to affect individuals differentially. There is some evidence which suggests that the differential impact of a stressor is related to both the properties of the stimulus and the
characteristics of the individual. Several investigators (e.g. Staub, Tursky, and Schwartz, 1971) have suggested that the predictability (periodicity) of a stressor significantly reduces its perceived aversiveness and mollifies the detrimental impact it usually has on task performance. Unpredictability (aperiodicity) of a stressor is said to have the opposite effect. A phenomenon which ensures predictability is the "safety signal" (Seligman, 1975b). The presence of such a signal has two important consequences: 1) it relieves the individual of undue fear that an aversive event will occur in the absence of the signal, and 2) it provides the individual with time to construct coping strategies to be implemented upon the onset of the signal. The latter point suggests another property of stressors, that is, the amount of control (or lack thereof) an individual can exercise over the occurrence and/or impact of a stressor. Controllable stress is said to enhance the individual's ability to cope, while controllable stress is said to have a deleterious impact on the person. A third property of stressors to which people respond differentially is their duration. Stressors which occur infrequently and are of short duration are not likely to take a heavy toll on the individual: Conversely, frequent and high intensity stress will tend to victimize those who lack either the behavioral repertoire or personality characteristics required for effective coping responses.
Behaviorally, most stressors elicit chains of activity which are intended to neutralize or cope with their aversive elements. Thus, if an examination is perceived to be exceptionally difficult, the student prepares himself accordingly. There is an emerging literature which suggests that animals and humans subjected to uncontrollable or unavoidable stressors learn to become "helpless" and passive (Seligman, 1968; 1975b) and generate gastric ulceration (Weiss, Glazer and Pohorecky, 1976). Behavioral referents to this type of stress are: a lack of assertiveness, depression, problem-solving deficits, as well as a profound tendency to "give up" in the face of frustration. Stress which is either avoidable or perceived to be avoidable evokes the opposite responses (e.g. Glass, Reim and Singer, 1971). Much of the evidence for the detrimental effects of stress comes from the animal literature. Several researchers are currently engaged in the extension of the animal findings to human psychopathology. Some of this research is related to particular personality characteristics which are said to render humans differentially vulnerable to stress.

Hiroto and Seligman (1975), working in the "learned helplessness" paradigm (referred to above), suggest that individuals with an external locus of control (i.e., who believe that their reinforcements are contingent upon luck, fate or powerful others) are
significantly more susceptible to performance decrements in the face of stress than are those with an internal locus of control (i.e., who believe that they themselves exert control over reinforcement). Further, Friedman and Rosenman (1974) argue that a cluster of personality constructs is related to susceptibility to cardiovascular disease, which frequently is the product of prolonged stress. The authors posit two personality "types": Type A, characterized by intense drive, competitiveness, aggressiveness, ambition; and Type B, characterized by much lower levels of the above traits, together with a "milder" personal style. Friedman and Rosenman (1974) argue that those who (for the most part) fit the description of a Type A individual are most likely to contract some form of cardiovascular disease, while those who largely resemble the Type B description are least likely to encounter heart trouble. While persons of both types encounter stress, it appears to inflict much less harm in people of the "B" type.

The most frequently cited emotional correlate of the consequences of stress is depression. Seligman (1975b) has proposed a functional relation between the learned inability to control outcomes and human depression. He and his colleagues (e.g., Overmeir and Seligman, 1967) have demonstrated that animals exposed to escapable/controllable shock subsequently escaped painful stimulation. Seligman and associates attribute this phenomenon to
a learning effect. That is, animals who initially were exposed to inescapable shock are said to have learned that no behavior on their part could alter the environment. This is said to account for their passivity in the face of subsequent shocks. Conversely, animals exposed to escapable shock are said to have learned that their instrumental behavior could effectively alter the environment, and thus were capable of escaping subsequent shock. In a similar vein, Seligman suggests that human depression is the result of the belief that aversive stimulation is unavoidable, and that behavior and reinforcement/control over outcomes are independent. This results in pronounced passivity, lack of assertiveness, loss of libido, and other symptoms that are usually associated with depression.

As such, the relationship between the uncontrollability of an aversive stimulus and subsequent affective states and behavior has been posited in very general terms. At present there is no clear evidence (to my knowledge) to suggest that uncontrollable aversive stimulation yields a depressed affective state in humans. Further, there is no empirical evidence that a depressed affective state leads to significant behavioral passivity. Thus, the following questions will provide the main foci of investigation in this study.

1) Does controllability or uncontrollability over an aversive stressor produce alterations in mood states?
2) Are the mood states engendered by the controllability/uncontrollability of an aversive stressor (if any) differentially predictive of passivity in a subsequent stressful situation?

3) Does the controllability or uncontrollability over an aversive stimulus have any impact on learning?

4) Is the physiological adaptation to stress affected by its controllability/uncontrollability, subjects' locus of control, or mood/affective states?
CHAPTER II

REVIEW OF THE LITERATURE

In this chapter, the major theoretic and empirical developments relevant to the major variables in this study will be reviewed. Several theories of stress will be briefly presented, together with supporting evidence. There will be a deliberate attempt to narrow the focus of this review to "psychological" stress, to the exclusion of material pertinent to "social," "military," or other forms of stress. Broadly outlined, this chapter will be concerned with the effects of stress on the following processes: adaptation, the physiology, behavioral after effects, and the affective state. Major psychological variables related to stress will be presented and their relationship to stress will be explored. Finally, a summary of the major findings in this review will be presented.

Stress and the Adaptive Process

There is general agreement among researchers that a stressor in some way provokes the organism to adjust at one or more levels
of functioning in order to achieve a self-protective or self-enhancing state (c.f. Glass and Singer, 1972). Selye (1966) was careful to note that "stress is the common denominator of all adaptive reactions in the body." (p. 54). This assertion, however, is not very clear. Selye attempts to clarify the ambiguity by defining stress as "the state manifested by a specific syndrome which consists of all the nonspecifically induced changes within a biologic system." (p. 54). Thus, stress has its own characteristic form, yet it is not associated with any particular cause. Selye argues that its form is comprised of visible changes due to stress, whatever its cause. They are the "additive indicators which reveal the sum of all adjustments occurring in the body at any one time." Stress reveals itself as a specific syndrome which is nonspecifically induced. A nonspecifically induced change is one that affects many parts of the body without selectivity. Such change can be induced by many agents. Conversely, a specifically induced change is induced by one (or a very few) agent(s) and is focused on a specific part of the body. According to Selye, adaptation occurs as a function of a tripartite phenomenon which he labels the "General Adaptation Syndrome." This encompasses all of the nonspecific changes in the body as they develop through time during continued exposure to a stressor. The first part of
this triphasic model is the "alarm reaction". This phase is described in terms of the bodily equivalent of a call to arms of the defensive forces to protect the organism. The alarm reaction is characterized by the secretion of adrenalin into the blood stream, increases in heart rate, and muscular reactivity, all of which serve to ready the organism to cope with a stressor. However, an organism cannot maintain a constant state of alarm without serious damage accruing to physical functioning. Thus the alarm reaction is necessarily followed by a second stage, which Selye labels the "stage of resistance." This stage is characterized by a set of internal responses that stimulate tissue defense. Thus, while a variety of organs are rapidly mobilized during the alarm reactions, the resistance phase serves to protect the organs from suffering from a depleted reserve of energizing substances. In this phase, the body seeks to adjust or adapt to a stressor. In a sense, the various systems in the body seek to normalize their functioning, given the presence of the stressor. However, after prolonged exposure to a noxious stressor, this acquired adaptation is lost and the body enters the "phase of exhaustion." Predictably, this is induced when the body can no longer muster the adaptive energy to effectively cope with the noxious agent. This is characterized by the temporary or permanent breakdown of the affected bodily tissues and the increased
Vulnerability of the body to the deleterious effects of the stressor. Selye offers the concept of adaptation energy, which clarifies the process of adaptation and exhaustion. "It is as though we had hidden reserves of adaptability in ourselves throughout the body. As soon as local stress consumes the most readily accessible local reserves, local exhaustion sets in and activity in the strained part stops automatically."

This results in exhaustion, which in turn enforces rest, during which stores of energy (behavioral and other) are replenished. However, when the entire store of adaptive energy in the body is consumed, general exhaustion and death ensues.

The above suggest that in certain cases adaptation to stress may be costly. Rene Dubos (1968) comments:

Man is endowed with an extremely high level of adaptability to many different forms of stress, an attribute that enables him to survive, function, and multiply under a very wide range of conditions. Paradoxically, however, man's very adaptability may be his undoing in the long run. Tolerance to stressful conditions is achieved through histological, physiological, and mental responses that are usually homoeostatic and therefore serve a useful purpose at the time they occur; but they may eventually become deleterious, especially if they are called into play early in life... Many types of chronic and degenerative disorders, both physical and mental, are the delayed and indirect effects of responses that first served a useful homoeostatic purpose.

(Dubos, 1968, pp. 143-133)
Dubos continues to argue that many degenerative diseases are in effect the cost that an urbanized civilization exacts from its inhabitants.

Glass and Singer (1972), in contrast to Selye's formulations regarding adaptation, argue that the process of adaptation occurs through a cognitive reappraisal of the aversiveness of a noxious stimulus and active coping responses. However, they, despite their differences with Selye and Dubos, argue that the process of adaptation may render the individual less able to cope with subsequent environmental demands.

Thus far it can be seen that man does adapt to stress in a systematic manner, but not without a potentially hazardous cost to physical and mental functioning. From Selye's biological approach to adaptation, it would appear that noxious stimuli exact the least amount of adaptation energy when the body is able to repair itself and remain protected from prolonged aversive stimulation. A more careful examination of the effects of stress on the physiology is in order.

The Effects of Stress on the Physiology

A large number of studies have demonstrated that stressors produce discrete (and often pathological) alterations in an organism's
internal environment. Scott and Howard (1970) reviewed several studies which demonstrate this effect. The following citations are from their review. Stevenson and Duncan (1950) and Wolf (1948) report that cardiac functioning is susceptible to change due to stress. Wolff (1948) demonstrated that a real or a symbolic stressor can trigger mucous membrane (nasal) secretion. There are other studies which suggest a relationship between stress and the genesis of specific disease syndromes such as cardiovascular disorders (Wolf, 1948), ulcerative colitis (Grace, 1950), dermatitis (Kepecs and Robin, 1950), and galucoma (Ripley, 1950). These studies suggest that stress generated by a pathogenic agent triggers distinct physiological changes and eventuates certain "disorders of adaptation."

Alexander (1950), Dunbar (1947) and Grinker and Spiegel (1945) have generated a psychosomatic model of stress. The model is built on the assumption that tensions occurring in one organ or system of the body often have pathological ramifications for other systems. Thus, chronic anxiety may not only produce an elevated heart rate, but may also constrict respiration and lead to ulcers. In this case, a psychological variable (conflict, worry, etc.) is said to produce specific physiological changes. McQuade and Aikman
(1974) review studies which suggest that psychological variables are implicated in the generics of such disorders as: migraine headaches, peptic ulcers, ulcerative colitis, allergies and rheumatoid arthritis.

In a similar vein, Thomas Holmes and his associates (e.g. Holmes and Mausda, 1968) have reported significant relationships between the presence of significant life stressors (e.g. marital separation) and the onset of illness. Although this study is correlational in nature, the data Holmes has produced seems to lend further support to the widely held connection between stress and pathological changes in physiological functioning.

The animal literature is replete with evidence of the deleterious effects of stress on the physiology. Weiss, Pohorecky, and Glazer (1976) report that differences in the ability to control various stressors (electric shock, the cold-pressor test) lead to changes in the flow of norepinephrine to the brain, which in turn resulted in differences in behavior subsequent to the introduction of the stressor. This effect was found with rats (Weiss, et al., 1976), dogs (Seligman, 1968), and mice (Weiss, 1970). Animals who could not control noxious stimulation evidenced severe gastric lesions, loss of body weight and higher plasma steroid levels (Weiss, 1971a).

In summary, stress, whether environmental or psychological in nature, can potentially alter physiological functioning in an adverse
manner. The psychosomatic model of stress adds an additional dimension to Selye's early biological work. That is, stress not only has physiological ramifications, but psychological ones as well. More recent research has indicated that, similar to the results of the animal studies, stress has a profound impact on behavior.

**Behavioral Aftereffects of Stress**

Several studies have indicated that stress produces behavioral deficits under certain conditions. Glass, Singer, and Friedman (1969) demonstrated that adaptation to high intensity, aperiodic noise results in greater performance decrements on a cognitive task (proofreading) than does adaptation to predictable noise. Glass, Reim and Singer (1971) replicated this finding. Hiroto and Seligman (1975) demonstrated a cross-modal helplessness effect. Subjects who were pretreated with either inescapable noise or insoluble anagrams demonstrated significant deficits in learning on subsequent experimental tasks, as compared to subjects who were pretreated with either escapable noise or soluble anagrams. Gatchel and Proctor (1976) replicated this effect.

Thus, there is some laboratory evidence to suggest that behavioral deficits can result from exposure to an aversive stimulus. It is important to note that the studies reviewed above utilized a
typical cognitive performance task as dependent variables. Whether or not these are representative of the kinds of cognitive skills required to perform well in other situations (e.g. school) remains to be seen. It further should be noted that the studies reviewed above achieved differential learning and/or performance effects by manipulating the degree of control the subject could exercise over the occurrence or duration of the stressor. Control appears to be one of the significant psychological variables which moderates the impact of a stressor.

Psychological Variables Related to Stress

The psychosomatic model of stress (reviewed above), as well as the evidence from which it was derived and subsequently supported lends sufficient reason to believe psychological variables have a measurable impact on the effects of stress. One such variable is control.

Control over a stressor has been shown to reduce the perceived aversiveness of a stressor and lessen postadaptive learning decrements. This effect has been reported when such control was vertical (Glass, Rieim and Singer, 1971), or non-veridical (Geer, Davison, and Gatchel, 1970), when the stressor was electric shock (Hiroto and Seligman, 1975; Geer et. al., 1970) or noise (Glass, Singer and
Friedman, 1969), and whether the stressor was predictably or unpredictably delivered (Staub, Tursky and Schwartz, 1971). The effect caused by control or a lack thereof over a stressor is of sufficient consequence to warrant a detailed presentation of two studies in this area.

Hiroto and Seligman (1975) tested the generality of debilitation produced by uncontrollable events across tasks and motivational systems. Four experiments were conducted simultaneously. In the first, subjects were pretreated with escapable, inescapable or control aversive noise (102db) followed by shuttlebox escape testing; in the second, subjects were pretreated with soluble, insoluble or control discrimination problems followed by anagram solution testing; in the third, subjects were pretreated with escapable, in-escapable or control aversive noise followed by anaogram solution testing; in the fourth, subjects were pretreated with soluble, insoluble or control discrimination problems followed by shuttlebox escape testing. The significance of these experimental conditions is that they represent two distinctly different task modes. The first is an instrumental mode, represented by the aversive tone and shuttlebox escape tasks. The second is a cognitive mode, operationalized by the stimulus discrimination and anagram tasks. In two
of the four conditions, the modes were switched from pretreatment to experimental treatment, and in the remaining conditions they were held constant.

In the instrumental pretreatment, the apparatus was a button on a circular base. In the escapable condition, punching the button four times terminated the noise. In the inescapable condition, button-presses had no effect on the noise. In the cognitive pretreatment, a series of four dimensional stimulus patterns were used, following Levine (1971). Each pattern was comprised of two values. In the soluble condition, one value of one of the dimensions was consistently correct, while in the insoluble condition no value was consistently correct.

The soluble instrumental task (i.e. the experimental task) was operationalized using a shuttlebox. Moving a knob from one side to the other escaped and avoided the aversive noise. The soluble cognitive (experimental) task was a series of 20 five-letter anagrams. Each anagram could be solved by applying a consistent letter in order formula. The results were as follows:

1) Cognitive pretreatment -- Instrumental post test: the group pretreated with insoluble discrimination problems evidenced a significantly lower performance level on the shuttlebox escape task than did the groups pretreated with soluble and control discrimination problems.
2) Cognitive pretreatment -- Cognitive posttest: the group pretreated with the soluble discrimination task performed significantly better on the anagram task than the groups pretreated with insoluble and control discrimination problems.

3) Instrumental pretreatment -- Instrumental posttest: the group pretreated with inescapable noise in the button-pressing task did not escape as well as the other groups in the shuttlebox test.

4) Instrumental pretreatment -- Cognitive posttest: the group pretreated with inescapable noise evidenced a greater decrement in anagram solution testing than the escapable and control groups.

The results suggest that a lack of control over an oversive stimulus can produce behavioral/learning deficits in both instrumental and cognitive tasks. The authors placed a "learned helplessness" interpretation on the results, suggesting that inescapable or insoluble pretreatments with an aversive stimulus in effect result in a loss of control over desired behavioral outcomes. Thus producing marked debilitation on later task performance. The inference to be drawn from this study is that the individual's awareness of his actual control or lack thereof over an aversive stimulus is
differentially predictive of his subsequent task performance. Simply put, if an individual does have control (and is aware of it) over a stressor, he will perform more adequately than the individual who realizes that he has no control over a stressor.

Glass, Reim and Singer (1971) have conceptually and empirically advanced the above inference. What happens to the postadaptive performance of individuals who merely believe they have control over a stressor? The authors conducted an ingenious study in which they manipulated the actual and perceived control subjects could exercise over aversive noise (108db). All subjects listened to the same noise, but under one of four conditions.

1) Perceived control -- in which subjects believed they could terminate the noise by signaling a confederate.

2) No Perceived control -- in which the confederate had a control button to terminate the noise, but no opportunity was given the subject to communicate with him.

3) Together-No button -- in which the subject was exposed to noise with no one else in the room and without the means for terminating the stressor.

The results indicated that those subjects who believed they had control over the noise performed significantly better on a
proof-reading task than subjects who believed or actually had no control over the noise.

The results of the two studies reviewed above are striking. They suggest that the ability to control a stressor nullifies its potentially debilitating effects, at least with respect to learning and some psychomotor behaviors. However, the mere belief in such control (whether it actually exists or not) produces the same effect. This implies that cognitive, information processing variables may have an important effect on the degree of deficit induced by a stressor. Richard Lazarus (1966; 1968) has developed a theory to speak to this issue.

Lazarus' premise is that emotional reactions (i.e., to stress) should be regarded as effects, rather than causes. These effects, in turn, rely heavily on cognitive processes. Lazarus, like Ellis (1962) contends that cognitive processes result in experienced emotion which serves to organize behavior. Schacter and Singer (1962) and Arnold (1960) have presented data which supports this contention. Cognitive processes, notably the process of "appraisal" are used to explain how the individual evaluates the potential aversiveness of an impending or present stressor. Such processes are also implicated in how the individual chooses to cope with a
noxious stimulus. It appears that distinctly different appraisals underlie, for example, the denial or over-evaluation of the noxiousness of a threat to the organism. Appraisals of threat in turn seem to affect the particular coping strategy the individual chooses to content with it.

But we are somehow reasonably sure that it is the combination or interaction of stimulus and dispositional properties that determines much of the reaction. And when we say that an individual appraises a situation in choosing a form of coping process, we are opening the way to seeing the effects as caused by a transaction with a particular environment by an individual with a particular psychological structure. We are implying in this way that if we knew the factors in the stimulus configuration and those within the psychological structure that jointly influence this appraisal, we could then predict the coping process and the observed reaction. (Lazarus, 1966, p. 162)

The author in effect suggests that what an individual knows or believes about a stressor is somehow predictive of his reactions to it.

In a similar vein, Seligman (1975b) suggests that if an individual knows or otherwise believes that he has no control over reinforcement or behavioral outcomes, passivity, loss of motivation, and depression will result. In his view, lack of control over behavioral outcomes reinforcement teaches people to become "helpless." Several studies (e.g. Hiroto, 1974; Hiroto and Seligman,
1975) have attempted to document this effect, with generally positive results.

It has been argued in this section that psychological variables such as the controllability of a stressor and its effect on learning and emotions plays an important role in responsibility to stress. The role of appraisal of threat and its influence on coping processes is also important in this area.

Summary

This review has covered an examination of the effects of stress progressing from physiological to psychological variables. For the purposes of this study, it is important to note that stress can have a pathological impact on the physiology, which can result in widespread or localized physical damage. Uncontrollable stress appears to have a debilitative impact on subsequent behavior, notably learning. The impact of some stressors are moderated to a degree by cognitive and motivational processes, which in turn affect the individual's emotional state. These summarized findings are central to the variables investigated in this study.
CHAPTER THREE

METHOD

In this chapter, the descriptive and procedural details germane to this experiment will be considered. Subject sample, instruments used, apparatus and statistical design will be briefly described, while the experimental procedures and treatments will be considered in some detail. Debriefing procedures will be presented and finally the experimental hypotheses will be offered.

Design

Five groups, four experimental and one control, were used to examine the effects of differential control over shock on mood, learning and subsequent behavior. The groups were differentiated on the basis of the degree of actual and/or perceived control over twenty-four aperiodically delivered shocks. The experimental groups were: actual control, perceived control (vertical), perceived control (false), and no control. Finally, a non-shock group was also included in the design.
Subjects

Seventy-five subjects, all enrolled in an Introductory Psychology course at The Ohio State University during the Winter Quarter, 1976, participated in this investigation. All were male. Subjects received appropriate course credit for their participation in the experiment. In a pre-experimental session, potential volunteers were informed as to the basic nature of the experiment and all eventual subjects signed an informed consent form, as specified by the Human Subjects Committee for the Social and Behavioral Sciences at The Ohio State University (c.f. Appendix A-1). Subjects also completed Rotter's 1-E Scale (Rotter, 1966) during this session. The range of the 1-E scores was divided into seven intervals. Subjects within each interval were randomly assigned to treatments. This was to insure an even distribution of locus of control scores throughout the experimental treatments.

Experimental Settings and Apparatus

The first and third sessions of this investigation (pre-testing and debriefing, respectively) were conducted in a classroom in Arps Hall. The room was chosen because it could accommodate forty-eight people at a time, and was therefore appropriate for the pretest and debriefing group sessions.
The second session of the experiment was conducted in two separate rooms: an "experiment room" and an office approximately seventy-five feet away. The former was a 6' x 18' room in which was located GSR (Galvanic Skin Response) recording equipment, two chairs, and the subject's chamber. The latter, located at the rear of the room, was an 8' x 4' x 4' semi-soundproof enclosure which housed the subject's chair, electrode (GSR and shock) leads, a shock-offset pedal, a screen, and an intercom terminal. In the area outside of the chamber the other equipment used in the shock phase of the study was located. These included: a Galvanic Skin Response (GSR) Recorder (Tektronix, Model 160A) which was used to measure subjects' skin resistance; connected to the GSR machine was a Brush Mark II paper recorder, which provided a constant record of the subjects' skin resistance during the shock phase of the study; the shocks, which reached a maximum intensity of 2.5 mA's were administered by an Applegate Stimulator Model A 250 through two metal electrodes taped to the index and middle fingers of the subject's left hand. Skin resistance recordings were taken via two disc electrodes attached to a rubber strap, which was then wound around the subject's right hand such that either disc was secured against the palm and back of the hand. These electrode discs were filled with Redux Electrode Creme before they were applied to the subject's hand. A stimulus discrimination task was presented
to the subjects while in the chamber via twenty-four slides, which were projected automatically onto a 2' x 2 1/2' screen located inside the chamber. A latency timer was used to measure the interval between the onset of each shock and the pedal press response of the subjects in the actual control group. Subjects and the experimenter communicated via an intercom system. Two disc tape timers (4 revolutions/minute) were employed to automatize the presentations of the shocks and slides.

The second room utilized in the middle phase of the study was located near the "experiment (or GSR) room." It was the office of an equipment technician. In this room were various pieces of equipment unrelated to the study, a telephone and two desks. This room was used for the "phone call" portion of the experiment, which will be described later in the chapter.

Experimental Procedure

Session One

Pretesting - In the first session of this study subjects com-
pleted Rotter's I-E scale (Rotter, 1966) and a brief mood scale de-
signed by the experimenter (c.f. Appendix A-3). The purpose of the mood scale was to exclude subjects who reported experiencing a particularly extreme mood state (i.e., depression or hostility) at
the time the scale was administered. Scale results did not reveal pronounced depression or hostility in any subject. I-E frequencies and range data are available in Appendix A-2.

Session Two - Phase One - Shock Trials. During this phase of the experiment subjects were run individually. The experimenter met each subject and escorted him to the GSR room. He was then reminded of the general nature of the experiment. The experimenter informed the subject that a learning task would be presented to him in this phase of the study, and then provided some details relative to the shocks and the learning task. While all subjects were presented with the same instructions relative to the learning task, differential instructions were provided with regard to the use of the shock offset pedal, depending on what experimental condition the subject was in. Detailed transcripts of the learning task and shock instructions are presented in Appendix B-1.

The subject was then informed that his skin resistance would be constantly monitored during the shock trials. At this point the experimenter responded to the subject's questions, directed him to the chamber, attached the electrodes, and demonstrated the use of the intercom and the shock offset pedal (with subjects in the appropriate
experimental conditions). After a GSR baseline was taken, the experimenter closed the chamber door and activated the disc tape timer, which initiated the trials.

As indicated earlier, the presentation of the shocks and slides was automatized and randomized by the disc timers. Stimulus presentation intervals are detailed in Appendix E-1. The subject was exposed to twenty-four shocks and twenty-four slides.

**Phase Two.** Following the presentation of the last stimulus, the subject was taken from the chamber and seated at a table in the outer room. He was then asked to complete a Mood Adjective Checklist (Nowlis, 1959), a manipulation check, and a cognitive control questionnaire specifically designed for this study. Copies of the above are in Appendices C-1 and C-2. Following the completion of the questionnaire, each subject was presented with five anagrams. The first two anagrams were relatively easy, based on data collected by Brown (1969). The remaining three were insoluble. All five anagrams had been used in previous studies (e.g., Feather and Simon 1971). The subjects were told to work on the anagram task until they either completed it or chose to discontinue their efforts, at which time they were to contact the experimenter, who was sitting in the hall approximately 15 feet from the GSR room. Detailed instructions and a copy of the anagram task are presented in
Appendix C-3. If the subject did not contact the experimenter after ten minutes had elapsed, the experimenter returned to the GSR room and interrupted the subject, saying "we're running short on time and I'd like to get on with the rest of the experiment." The experimenter recorded how long each subject persisted on the anagram task (up to ten minutes).

**Phase Three.** The subjects were then informed that they were to be exposed to another series of shocks, which were to be more intense than the ones just endured. The experimenter told the subjects that before the next series of trials could begin, he needed to adjust the apparatus so it could handle the increased shock load. In order to do this, the experimenter required close access to the equipment, and therefore the subject would have to leave the room for a short period of time. The subject was then escorted to a nearby office. While there, the experimenter instructed the subject to read an article which he argued contained information the subject would need to know in order to perform well in the upcoming trials and to mollify the impact of the increased shock levels. The article given the subject was a recent publication by Barber, Spanos and Lang (1974) entitled "Cognition and Self-Control: The Cognitive Control of Painful Sensory Input." Before leaving the office the experimenter
explained that the room they were in was shared by several people and cautioned the subject not to be bothered by others who entered and left the room. He also requested that the subject answer the phone if it rang and no one else was available to do so. The experimenter then made a phone call and asked for "George," claiming that he had a piece of equipment the former required. The call was placed to a confederate, who duly informed the experimenter that "George" was not available at the moment, but would return the call. The call itself served as a cue to the confederate to return the call in about 2 1/2 minutes, thus giving the experimenter time to return to the GSR room, which he did as soon as the conversation with the confederate was finished. The specific instructions to the subject for this part of the experiment and the text of the experimenter's conversation with the confederate are contained in Appendix B-2.

The above suggests that while the subject was alone in the office (presumably reading the assigned article), the confederate called. When the subject answered, the confederate asked to speak with the experimenter. Since the experimenter was not in the office the confederate then asked the subject (who knew where the experimenter was) to return to the GSR room and call him to the phone. If the subject immediately complied, he would return to the aforementioned room to find the experimenter "fixing the equipment"
and being too busy to take the call. When the subject returned with that message, the confederate made another request of the subject, which again involved his return to the GSR room. If the subject complied, the confederate made a third request, also requiring the subject to "check something out" with the experimenter. When the subject returned to the phone after acquiring the information the confederate desired, the latter politely thanked the subject and terminated the conversation. The text of the confederates' role is contained in Appendix B-3.

During the interaction between subject and confederate, the experimenter feigned preoccupation with the equipment repair. After a sufficient amount of time had elapsed (approximately seven minutes) to allow for the subject-confederate phone interaction, the experimenter returned to the office to escort the subject back to the GSR room. Once in that room, the subject was informed that due to a lack of time there would not be another set of trials. The experimenter then informed the subject of the arrangements to be made regarding debriefing. When the experimenter was satisfied that the subject was not experiencing any ill effects from the experimental manipulations, he was dismissed.

Session Three - Debriefing. The final session of the experiment was devoted to debriefing, which took place after all subjects
had been run. The subjects were informed of the procedural and methodological details of the experiment, the deceptions involved therein, and some of the experimental hypotheses. All questions posed by the subjects were answered. After the final question, the subjects were again thanked for their participation, given the appropriate course credit for their efforts, and released.

Groups

As indicated earlier, the basic distinction between the shock groups was the degree of actual or perceived control over the duration of the shocks. Subjects in the shock conditions received the same amount and mean duration of shocks. The latter was made possible by yoking all other shock groups to the actual control group. That is, mean shock offset latencies for each shock were calculated for all subjects in the actual control group, which was the first group run. In this manner, the experimenter was able to determine the average duration of each shock endured by the subjects in the actual control group. Subjects in the other shock groups were then exposed to the same duration of shock. Mean durations for the 24 shocks are presented in Appendix E-3. Finally, it is important to note that there were an equal number of subjects (15) in each group.
Actual Control Group (Group 1)

Subjects in this group enjoyed vertical control over the duration of the shock, which they exercised by depressing the shock offset pedal when the shocks were presented. They were informed in advance that the pedal was indeed operative and were encouraged by the experimenter to utilize it whenever a shock was introduced.

Perceived Control Group #1 (Group 2)

Subjects in this group had the potential to exercise actual control over the duration of the shocks. They were truthfully informed by the experimenter that they could terminate each shock by depressing the offset pedal. However, the experimenter informed them of his preference that they refrain from utilizing the pedal unless the shocks became too painful. It was expected on the basis of previous research (c.g. Glass and Singer, 1972) that no subject in this group would actually resort to the pedal in order to escape the shocks. None did. However, it was expected that the subjects in this group would perceive that they had some measure of control over the shocks even though they chose not to exercise it.

Perceived Control Grouped #2 (Group 3)

Subjects in this group were falsely informed that they could control shock duration by depressing the offset pedal. They were told
that after a short interval following a pedal press response, the shocks would terminate. Given that all shocks were less than one second in duration, this instruction was considered believable. The offset pedal, while present in the chamber, was surreptitiously disconnected. Subjects in this group were also informed of the experimenter's preference that they refrain from using the pedal. Again, no subject in this condition attempted to escape the shocks via a pedal press.

No Control Group (Group 4)

Subjects in this group were informed that the purpose of the study was to investigate the effects of stress on the Galvanic Skin Response and learning. They were offered no experimental avenue for escape from the shocks. With the offset pedal having been removed from the chamber, subjects in this group simply endured the shock and performed the stimulus discrimination task.

Experimental Control Group (No Shock) (Group 5)

Subjects in this group received no shock. They were reminded of the purpose of the experiment and told that whether or not they would be exposed to shock was determined at random by a computer. They were also informed that they would participate in two series of trials—one, both, or none of which could involve shock. While in the chamber, subjects in this group performed the stimulus
discrimination task. This group served to control for the effects of the shocks themselves on the major dependent variables.

Major Dependent Variables

Physiological Adaptation

It is important to this investigation that subjects across shock groups demonstrate similar trends toward physiological adaptation to the shocks themselves. This was investigated by taking the mean skin resistance value (in ohms) after the first four shocks and subtracting it from the mean resistance value after the last four shocks for each subject. Each subject thus received a mean skin resistance change score. A grand mean skin resistance change score was calculated for each group, and these were then compared using a simple Analysis of Variance.

Manipulation Check

Three questions were included in the questionnaire to acquire information relative to the effectiveness of the experimental manipulations. Subjects were asked to rate on a nine-point scale, their feelings or beliefs about: 1) the aversiveness of the shocks (from "not at all bothersome" to "very irritating"); 2) the degree to which the subject believed he could control the number of shocks received.
(from "definitely could" to "definitely could not"); and the degree to which the subject believed he could control shock duration (from "definitely could not" to "definitely could"). The "control" questions were particularly salient to the subjects in the received control groups in that the experiments deliberately attempted to persuade the subjects in these groups that they could control shock duration, yet requested that they not exercise that control.

Mood Scale

The Mood Adjective Checklist (Nowlis, 1965) was administered to all subjects subsequent to their completion of the shock/discrimination task trials. The checklist required the subject to respond to thirty-three mood adjectives on a four dimensional scale. That is, the subject was to read the mood adjective and record how well it described his mood at the moment. Potential responses (on the four dimensional scale) were indices of feeling 1) very much, 2) slightly, 3) not at all like the mood suggested by the adjective. A fourth dimension, that of "in question," was available to the subject in the event that he was uncertain of whether or not a particular adjective described his mood at the time.

On the basis of previous research (e.g. Nowlis and Green, 1964), the 33 mood adjectives loaded on 12 general mood factors,
nine of which were considered relevant to this study. They were:
aggression, anxiety, surgency, elation, concentration, fatigue,
sadness, skepticism and general activation. Each factor was
comprised of three mood adjectives on the checklist, which was
scored by assigning a numerical value to each of the four possible
subject responses. The values employed were 0, 1, 2, and 3.
These have been used with considerable success in previous studies
(Nowlis, personal communication). Thus, on any given mood factor,
a subject's score could range from 0 to 9.

Several studies have investigated the reliability of the Nowlis
Mood Adjective Checklist. It should be noted that perfect test-retest
or within-test reliability cannot be expected due to the fact that,
moods can change rapidly, sometimes in as brief a time as it
takes to complete the checklist. Borgatta (1961), using a college
male sample, found test-retest coefficients ranging from .40 (Fatigue)
to .71 (Social Affection). With a sample of college women, he found
coefficients ranging from .07 (Fatigue) to .78 (Social Affection). In
a study by Green (1964), a sample of college men reported their
momentary mood at a predetermined time every day for periods of
twenty-five to sixty days. Mood score correlations within that period
of time yielded coefficients ranging from .50 (Aggression) to
.75 (Depression).
Nowles (1965) argued that the validity of the Mood Adjective Checklist (MACL) could be approached by examining the social desirability of the mood factors. That is, moods are differentially attractive; some are welcomed and others are despised. Green (1964) asked subjects to rate the desirability of the mood factors, both in terms of their own preferences and what they believed to be the preferences of others. He found that 6 of the 39 mood adjectives were correlated with social desireability ratings, with a maximum r of .35. Green concluded that the social desireability status of a word has little effect on how it is checked when a subject is asked to report how he feels at the moment he reads each word.

Stimulus Discrimination Task

The subjects performed the Levine Stimulus Discrimination Task (Levine, 1971) while in the channel. The task was presented on 24 slides, which were randomly interspersed among the shocks. The task consisted of four 6-trial multidimensional problems. Each trial was initiated by the display on the screen in front of the subject of two stimulus patterns (see Appendix F-1). One pattern consisted of a set of values from each of eight two-valued dimensions. The other pattern consisted of the complementary values of the dimensions. The eight dimensions and their associated values are
presented in Appendix F-2. From trial to trial the dimension values shifted from one pattern to the other. The shifting of values from trial to trial followed these rules: 1) on each pair of adjacent trials, values from four dimensions remained paired together (i.e. were on the same side for both trials); 2) no two dimensions values remained paired for more than three trials; 3) for any dimension value there was one and only one other value paired for the three trials.

The four problems consisted of six interrelated trials apiece.

The six component slides (trials) of the problem were interrelated in that one value of one dimension remained consistent throughout the problem. That is, one and only one of the values of one (out of eight) dimension did not change its position from the first to the last slide, while all other dimensions and values switched slides over the course of the six slides. The subjects task was to determine which value remained consistent. This value was labeled the "correct" one, for lack of a better term. To make the task easier, the subject was informed that the correct value would not switch sides over the course of a problem. Thus, after each slide was displayed (for five seconds) the subject was asked first to determine which side the correct value was on, and second, to determine which was the correct value. The experimenter provided feedback as to correctness of the subjects' responses after each trial via the intercom
system. He also informed the subject when a new problem or series of six slides was about to begin. Performance on this task was on a trials to criterion basis. The criterion was established as two successive correct responses.

Anagram Task

The anagram task was essentially employed to assess the subjects' degree of persistence at a frustrating task following exposure to a stressor. As indicated earlier, the maximum duration of this task was ten minutes, with shorter durations determined by the voluntary termination of his efforts at the task. For the subjects who chose to discontinue performance before the ten minute maximum, their persistence score was the difference (in minutes/seconds) between the time they began the task and the time they opened the door to find the experimenter, who was sitting nearby. All persistence scores were measured and recorded by the experimenter.

The degree of difficulty of the anagrams was determined in a study conducted by Brown (1975), who presented a series of anagrams to college sophomores. Degree of difficulty was determined by the total number of subjects who successfully completed each anagram within a given time period. The first anagram used in this study was successfully completed by 100% of the subjects in Brown's study.
The second anagram was successfully completed by 87.5% of Brown's subjects. The remaining three anagrams used in this experiment were insoluble.

A Behavioral Measure: The Phone Call

The phone call, in which a confederate made three requests of the subject, was designed to measure the impact of the previously induced stress on the subjects' subsequent behavior in a situation calling for either an assertive or a passive/compliant response. The requests made to the subject were assumed to be unreasonable, given the context of the situation. That is, compliance with the requests severely limited the amount of time the subject could devote to reading the article, which was considered to be the most adaptive response the subject could elicit. This would be the case in that all subjects fully expected to encounter another series of trials with increased shock intensities.

Previous empirical and theoretical efforts (c.f. Seligman, 1975b) suggested that individuals who believe themselves to be powerless to control behavioral outcomes learn to become passive or "helpless." It was expected that those subjects who believed they had no control over the shock would be most likely to comply with the confederate's requests. The phone conversations between the subjects and the confederates were tape recorded on a Bell and
Howell Cassette Recorder with a "tap" recording attachment connected to the confederate's phone. Four first year graduate students in Counseling Psychology and one upper division Psychology major (undergraduate) served as confederates.

The five confederates also rated the phone calls for behavioral content. A three category rating scale was devised by the experimenter to assess subjects' behavior during or as a result of the phone call. The categories were: 1) passive compliance. Among the criteria for this category were immediate compliance with the confederates' requests, pleasant tone of voice, compliance with minimum clarification of the confederates' instructions; 2) hesitant compliance. Criteria for this category were subject repeats himself, or gives inappropriate/false responses, subject responds to the confederate in a passive-aggressive manner, subject seeks clarification of instructions for delay or avoidance purposes, subjects' tone of voice characterized as hostile; 3) assertive non-compliance. Subject handles the situation confidently and consistently. Tone of voice reflects firmness and yet is polite. Subject takes a stand and "sticks to it" without evidence of hostility.

The raters listened to and evaluated all seventy-five subjects using this scale. The raters were blind with respect to the identity of the subject, the experimental condition he was in, and his
performance previous to the phone call. Additionally, the raters were blind as to the purposes of the experiment, and were not introduced to the rating scales until after the last subject was run. The experimenter trained the raters in the use of the scale. The criteria for each response category were thoroughly discussed. When the raters indicated a satisfactory degree of understanding (in theirs and the experimenter's judgment) of the response categories and the attendant criteria, six practice tapes (from a pilot study) were played and rated. After each phone conversation was rated, the experimenter checked the ratings to assess the degree of agreement among the raters. Any ambiguities relative to the scale or the response criteria were then clarified by the experimenter. The raters then listened to and evaluated the phone conversation tapes of all seventy-five subjects. Interrater reliability was assessed using Wherry's "Intrat (interrater reliability) for Corrected and Uncorrected Reliability" (Wherry, 1975). The corrected total interrater reliability was .90. The uncorrected total was .88.

Primary Hypotheses

Hypothesis 1

It was expected that there would be no significant differences among the shock groups on the mean skin resistance change scores.
This in effect would suggest that subjects across all shock groups physiologically adapted to the shocks in a similar fashion. Thus, experimental results could not be accounted for by differential adaptation to the stressor.

Hypothesis II

Glass, Reim, and Singer (1971) found a relationship between perceived control over a stressor (noise) and subjects' ratings of its aversiveness. Those subjects who believed they had control over the duration of the noise (even though they chose not to exercise it) rated it as less bothersome than subjects who had no control over the stressor. Similarly, it was expected that subjects who believed that they possessed some control over shock duration would rate the shocks as being less aversive than the subjects who believed they had no control over them (i.e. subjects in the no control group).

Hypothesis III

Given that some of the de facto differences between the groups depends on the degree to which the experimenter was successful in inculcating the subjects' belief in their power to actually or potentially control the duration of shocks, it was expected that subjects in the actual and perceived control groups would report believing that they had some control over shock duration. It was also expected
that their ratings of control over the shock would significantly differ from those of the subjects in the no control group.

Martin Seligman and associates have developed a "learned helplessness" theory of human depression. Several studies (e.g. Overmier and Seligman, 1967; Seligman, 1968) have found that animals exposed to pre-experimental inescapable shocks were unable to perform an escape/avoidance experimental task. Conversely, animals exposed to escapable pre-experimental shock easily performed the same experimental task. These results have been consistent across several studies. Seligman has placed a learning interpretation on this effect, namely that the animals treated with inescapable shocks "learned" that no instrumental activity on their part could effectively alter the environment (i.e. terminate the shocks). Because they learned that they had no control over the stressor the animals passively tolerated experimental shocks. In effect, they learned to be "helpless." Seligman's argument thus is that the learned inability to exercise control over outcomes leads to passivity, failure to persist at cognitive tasks and to depression forms. This is the basis for the following hypotheses.

Hypothesis IV

On the premise that control over stress should lead to a lesser learning decrement than no control, it was expected that subjects
in the actual and perceived control groups would perform significantly better on the stimulus discrimination task than the subjects in the no control group.

Hypothesis V

In a similar vein, it was expected that subjects in the actual and perceived control groups would persist significantly longer on the anagram task than the subjects in the no control group.

Hypothesis VI

It was expected on the basis of Seligman's (1975b) work that subjects in the no control group would report post-experimental mood states of fatigue and sadness more frequently than subjects in the actual control group.

Hypothesis VII

It was expected that subjects in the no control group would display more compliant responses to the confederates' requests than the subjects in the other groups.
CHAPTER IV

RESULTS

In this chapter, the results relative to the five major dependent variables will be presented. Interpretation and discussion of the results will be deferred to the final chapter.

GSR Change Scores

A one way analysis of variance was performed to assess whether there were any differences between the groups in physiological adaptation to the shocks. The results are presented in Table 4.1. Recall that GSR change scores were used in this analysis. The scores reflected the difference (as measured in ohms) between each subject's mean response following the first four and last four shocks. A mean score was obtained for each group by averaging the difference or change scores of the constituent members.
TABLE 4.1

An Analysis of Variance on Group Differences in Physiological Adaptation to Shock.

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>6283.54</td>
<td>4</td>
<td>1570.88</td>
<td>.16</td>
<td>.96</td>
</tr>
<tr>
<td>Within Groups (Error)</td>
<td>682246.50</td>
<td>70</td>
<td>9746.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inspection of the data in Table 4.1 reveals no significant differences between groups relative to adaptation to the shocks.

Learning Task

Another one way Analysis of Variance was performed to assess whether or not there were group differences on learning task performance. The Levine Stimulus Discrimination task was used, and performance was measured on a trials to criterion basis on the last two (of four) learning problems. The results of this analysis are presented in Table 4.2

The data revealed no significant group differences relative to performance on the learning task.
TABLE 4.2

An Analysis of Variance on Group Differences on Performance of a Learning Task

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1.433</td>
<td>4</td>
<td>.358</td>
<td>.494</td>
<td>.739(ns)</td>
</tr>
<tr>
<td>Within Groups (Error)</td>
<td>50.733</td>
<td>70</td>
<td>.724</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Multivariate Analysis**

In order to assess group differences on the 13 major dependent variables, a Multivariate Analysis of Variance was performed. The Analysis revealed a significant Multivariate F ratio \((F = 1.46, 52, 226df, p < .03)\). Univariate F tests were also performed to more clearly isolate the significant components of the Multivariate Analysis. Table 4.3 contains the univariate group means on all variables.

The Univariate Analyses of Variance revealed significant between group differences on Variable 01 (aversiveness, \(F = 5.3, 4, 70 df, p < .001\)). Variable 02 (control-onset, \(F = 2.64, 4, 70 df, p < .04\)), and Variable 03 (control-duration, \(F = 2.99, 4, 70 df, p < .02\)). Analysis of the mood and persistence variables failed to reveal significant between group (univariate) differences.
### TABLE 4.3
Univariate Group Means for the Manipulation Check
Mood Scales and Persistence Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 (aversiveness)</td>
<td>4.73</td>
<td>4.06</td>
<td>4.00</td>
<td>3.86</td>
<td>1.46</td>
</tr>
<tr>
<td>02 (control-onset)</td>
<td>4.66</td>
<td>3.60</td>
<td>3.80</td>
<td>4.06</td>
<td>1.86</td>
</tr>
<tr>
<td>03 (control-duration)</td>
<td>6.40</td>
<td>3.86</td>
<td>4.06</td>
<td>2.80</td>
<td>4.93</td>
</tr>
<tr>
<td>04 (aggression)</td>
<td>1.40</td>
<td>1.40</td>
<td>1.20</td>
<td>1.53</td>
<td>1.86</td>
</tr>
<tr>
<td>05 (anxiety)</td>
<td>3.40</td>
<td>2.00</td>
<td>3.60</td>
<td>2.86</td>
<td>2.93</td>
</tr>
<tr>
<td>06 (surgency)</td>
<td>2.40</td>
<td>3.40</td>
<td>3.93</td>
<td>3.20</td>
<td>2.33</td>
</tr>
<tr>
<td>07 (elation)</td>
<td>2.60</td>
<td>2.60</td>
<td>2.86</td>
<td>2.06</td>
<td>2.73</td>
</tr>
<tr>
<td>08 (concentration)</td>
<td>5.00</td>
<td>5.26</td>
<td>5.33</td>
<td>4.73</td>
<td>5.20</td>
</tr>
<tr>
<td>09 (fatigue)</td>
<td>2.40</td>
<td>1.93</td>
<td>2.60</td>
<td>3.93</td>
<td>2.33</td>
</tr>
<tr>
<td>10 (sadness)</td>
<td>1.13</td>
<td>.93</td>
<td>.66</td>
<td>1.80</td>
<td>1.46</td>
</tr>
<tr>
<td>11 (skepticism)</td>
<td>3.46</td>
<td>3.00</td>
<td>3.00</td>
<td>3.60</td>
<td>2.80</td>
</tr>
<tr>
<td>12 (gen'l activation)</td>
<td>4.06</td>
<td>4.66</td>
<td>4.26</td>
<td>3.93</td>
<td>3.66</td>
</tr>
<tr>
<td>13 (persistence)</td>
<td>9.08</td>
<td>8.78</td>
<td>8.96</td>
<td>8.00</td>
<td>7.95</td>
</tr>
</tbody>
</table>

**Discriminant Analyses**

A discriminant analysis was performed to determine which variable or combination thereof maximally differentiated the groups of subjects. This type of analysis was also employed because it revealed the power of each variable and successive combinations of variables to differentiate between the groups. Further, the discriminant analysis was used to predict a given subject's membership in a particular experimental group.
The first such analysis yielded four discriminant functions, only two of which were significant. These two functions and their component variables are presented in Table 4.4

TABLE 4.4
A Step-wise Discriminant Analysis on the Manipulation Check, Mood and Persistence Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Function 1</th>
<th>Function 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Var 01 (aversiveness rating)</td>
<td>0.66232</td>
<td>-0.24085</td>
</tr>
<tr>
<td>Var 03 (control rating)</td>
<td>-0.17741</td>
<td>-0.51435</td>
</tr>
<tr>
<td>Var 05 (anxiety)</td>
<td>-0.24807</td>
<td>-0.03991</td>
</tr>
<tr>
<td>Var 06 (surgency)</td>
<td>0.41771</td>
<td>0.43045</td>
</tr>
<tr>
<td>Var 07 (elation)</td>
<td>-0.12754</td>
<td>-0.41638</td>
</tr>
<tr>
<td>Var 09 (fatigue)</td>
<td>-0.11887</td>
<td>0.26878</td>
</tr>
<tr>
<td>Var 13 (persistence)</td>
<td>0.29951</td>
<td>-0.27971</td>
</tr>
</tbody>
</table>

With respect to the discriminant analysis, the first function was highly significant (p=.000), and accounted for 54.89 percent of the total variance. The second function was also significant (p<.032) and accounted for 36.04 percent of the total variance. In summary, the following variables maximally distinguished the groups: 1) subjects' ratings of the aversiveness of the shocks; 2) the degree to which subjects believed they could control the duration of the shocks; 3) the degree to which subjects reported feelings of anxiety, surgency (a carefree playfulness), elation and fatigue, and 4) the length of time the subject persisted at the anagram tasks.
A closer examination of the discriminant analysis revealed that much of its power to predict group membership was a function of the shock aversiveness ratings. The analysis yielded various group comparisons on the aversiveness variable. The results of these comparisons indicated significant differences in aversiveness ratings between Group 5 (no shock) and all other groups ($F_c=2.53, 4.70df, p < .05$). The fact that the non-shock group was included in the discriminant analysis suggests that the power of the aversiveness check to predict group membership is an artifact, a matter which will be taken up later in this chapter.

Variable 3 (control) was the next most powerful discriminant. When combined with variable 1, the following pairwise significant group differences were noted: Group 5 vs. Groups 1, 2, 3, and 4 and 1 vs. Group 4 ($F_c=3.15, 2.69df, p < .05$).

Surgency (Variable 6) proved to be the next most effective discriminant. When combined with variables 1 and 2, the analysis yielded more group differences. On this combination of variables Group 5 proved to be significantly different from all other groups. Further, Group 1 (actual control) significantly differed from all other groups ($F_c = 2.76, 3.68df, p < .05$).

The next variable included in the step-wise analysis was persistence. In combination with the other variables, the analysis revealed significant differences between Group 5 and Groups 1, 2, 3,
and 4, as well as differences between Group 1 and Group 4 ($F_c = 2.53, 4.67d, p < .05$). A difference between Groups 1 and 3 approached significance ($p < .06$).

The next variable to be considered is fatigue. When combined with the other variables, there were significant differences between Group 5 and all others, and Groups 1 and 4 on the fatigue variable. ($F_c = 3.34, 5.66df, p < .05$). This same pattern of results were evident when Variables 7 and 5 (elation and anxiety, respectively) were added to the others.

Each group received a mean score on each function, which is called a centroid. Using the centroids, it was possible to depict how the groups were separated on the two discriminant functions.

```
Figure 4.1
Plot of Group Centroid Scores for Functions 1 and 2
```
It is clear from this Figure 4.1 that function one clearly differentiates Group 5 from Groups 2 and 3, with 1 and 4 located roughly midway between the others. Function 2, conversely, clearly differentiated between Groups 1 and 4, while the other groups settled in the middle. The functions were labeled partially on the basis of how they differentiated subjects into groups. Function 1 suggests a description of subjects who rated the shocks as highly aversive, but who reported a positive mood of surgency and evidenced little anxiety and greater persistence. This suggests an identification of the first discriminant function as "task orientation." The second function suggests a group of subjects who experienced little control and elation, positively scored on surgency and fatigue and failed to persist on the anagram task. This led to interpretation and labeling of the second function as a "negative motivational orientation."

It should be noted that the interpretation of a discriminant analysis is very difficult. Therefore, the interpretations offered above must be considered tentative.

As indicated earlier, the presence of the non-shock group in the total analysis led to inflated function coefficients on the oversiveness and control dimension. Thus in order to acquire more accurate information as to the discriminatory power of the variables, another discriminant analysis was performed using all except the
aversiveness and control variables. This analysis uncovered four discriminant functions. However, none were significant. The variables found to be the most powerful were surgency, elation, fatigue, and persistence. To clarify the value of the functions and to assist in the interpretation thereof, the first two functions were rotated via a Varimax Factor Rotation Program. Table 4.5 presents the percent of variance accounted for by new, rotated functions.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.868</td>
<td>58.076</td>
<td>58.076</td>
</tr>
<tr>
<td>2</td>
<td>0.627</td>
<td>41.923</td>
<td>100.000</td>
</tr>
</tbody>
</table>

Table 4.5 reveals that most (if not all) of the variance due to the variables other than aversiveness and control could be accounted for using two variables and two functions. The rotated function matrix is presented in Table 4.6
TABLE 4.6

Rotated Function and Variable Matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>Function 1</th>
<th>Function 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 (surgency)</td>
<td>-0.87868</td>
<td>-0.47742</td>
</tr>
<tr>
<td>07 (elation)</td>
<td>0.47742</td>
<td>0.87868</td>
</tr>
</tbody>
</table>

Function 1 suggests a group of subjects who score low on surgency and high on elation. This suggests function identification as one of the "mood focus or intensity." Function 2 suggests subjects who reported very favorable mood states. Accordingly, the function was identified as "positive mood states."

The degree to which the rotated discriminant analysis predicted group membership on the basis of the above variables and functions is depicted in Figure 4.2

DF = Discriminant Function

Figure 4.2

Plot of Group Centroid Scores for Functions 1 and 2 After a Varimax Function Rotation
As can be seen from the diagram, the rotated functions offer more of a discrimination between Groups 2 and 3 and present a different array of relationships between the groups from the ones resultant from the initial discrimination analysis. This will be discussed in Chapter 5.

As indicated earlier, the discriminant analysis predicts a given subject's group membership on the basis of his scores on the dependent variables. The accuracy with which it did this is detailed in Table 4.7.

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>#SS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Actual Control)</td>
<td>15</td>
<td>73.3%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>13.3%</td>
<td>6.7%</td>
</tr>
<tr>
<td>2 (Perceived Control #1)</td>
<td>15</td>
<td>20.0%</td>
<td>33.3%</td>
<td>13.3%</td>
<td>20.0%</td>
<td>13.3%</td>
</tr>
<tr>
<td>3 (Perceived Control #2)</td>
<td>15</td>
<td>13.3%</td>
<td>26.7%</td>
<td>40.0%</td>
<td>6.7%</td>
<td>13.3%</td>
</tr>
<tr>
<td>4 (No Control)</td>
<td>15</td>
<td>13.3%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>73.3%</td>
<td>6.7%</td>
</tr>
<tr>
<td>5 (Experimental Control)</td>
<td>15</td>
<td>6.7%</td>
<td>6.7%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>80.0%</td>
</tr>
</tbody>
</table>

As indicated in the table, the discriminant analysis was quite successful in predicting the actual group membership of subjects in the actual and no control groups, as well as the no shock group. However, it was not successful in correctly classifying the subjects in both perceived control groups. The analysis inaccurately placed approximately one-half of the subjects from Group 2 (Perceived Control #1) into...
into either Group 1 or Group 4. This suggests that the Perceived Control Groups may not have been operationalized well enough. This matter will be discussed in the final chapter.

**Phone Call**

Most subjects readily complied with the directives of the confederate. Therefore, no formal analysis was undertaken to assess group differences. However, a count of the non-compliant subjects by group yielded some interesting results, which are presented in Table 4.8.

**TABLE 4.8**

Frequency of Non-Compliance on the Telephone Conversation by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Subjects Who did not Comply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (AC)</td>
<td>7</td>
</tr>
<tr>
<td>2 (PC #1)</td>
<td>1</td>
</tr>
<tr>
<td>3 (PC #2)</td>
<td>3</td>
</tr>
<tr>
<td>4 (NC)</td>
<td>5</td>
</tr>
<tr>
<td>5 (EC)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
</tr>
</tbody>
</table>

An inspection of Table 4.6 reveals that approximately one-half of the subjects in the actual control group, as compared to one-third of the subjects in the no control group, declined cooperation with the confederates' requests. Non-compliance relative to the other groups was minimal.
CHAPTER V

DISCUSSION AND IMPLICATIONS

In this chapter the results detailed in Chapter 4 will be discussed. Each hypothesis will be restated and the results relevant to confirmation or disconfirmation will be reported. The limitations of this study will be outlined and finally, areas for future research will be offered.

Hypothesis I

It was expected that there would be no significant differences among groups relative to physiological adaptation to the shocks. The ANOVA performed on the group GSR change scores solidly supports this prediction. In fact, it can be said that all groups adapted to the shock in a very similar way. Therefore, it is unlikely that any significant effects in this study could be accounted for by differential adaptation to the stressor.
Hypothesis II

It was expected that subjects in the actual control group would significantly outperform those in the no control group, with the remaining groups falling in between the two. The second ANOVA failed to support this prediction. All groups received almost identical mean performance scores. One of the reasons for the widespread success of subjects across all conditions on this performance task was that it was relatively easy. In short, this study failed to find the interference in learning effect due to uncontrollable stress. This is contrary to the reported findings of Seligman (c.f. 1975b) and others.

Hypothesis III

It was expected that subjects in the no control group would rate the shocks as more aversive than subjects in the other shock groups. An inspection of the multivariate and initial discriminant analyses did not yield support for this hypothesis. The only significant pairwise group differences were those comparing Group 5 (no shock) to each of the other groups. This, of course, was to be expected. These findings fail to replicate the research reported by Glass, et. al. (1971) and Geer et. al. (1970). Apparently, control (or lack thereof) over shock had little to do with subjects'
aversiveness ratings. Most subjects, then, found the shocks to be relatively aversive. This finding is curious in the light of previous research, in that the shock intensity used in this study was lower than the intensities used in the published literature in the stress area. A possible explanation of this effect is that many other stress studies use high intensity noise as the noxious stimulus. However, college students are typically more familiar with loud noise than with electric shock. Thus, the novelty of the shock stimulus may have added to its perceived aversiveness.

Due to the lack of between group differences and the large number of dependent variables, it was decided that the determination of which variables or combination of variables were the most effective in grouping subjects together would be a more valuable source of information than univariate pairwise group comparisons. Hence data from the univariate tests will not be emphasized.

Hypothesis IV

It was expected that subjects in all control groups would persist longer than those in the no control groups. An inspection of group means for persistence does not indicate support for this hypothesis, although the results are in the predicted direction. However, when persistence is combined with the aversiveness, .
control and surgency variables, Groups 1 and 4 significantly
differ. This suggests that subjects who either had or believed they
had actual control over the shocks, tended to persist longer and be
less likely to report an agitated mood state than those who perceived
their inability to control the stressor. This certainly is in line
with experimental predictions. It may indicate that persistence at
a frustrating task is a function of present mood, control over the
task and its perceived aversiveness. Thus, these variables may
combine to produce task persistence or non-persistence. Addition­
ally, the 10 minute maximum set for the anagram (persistence)
task may not have been long enough to allow for a thorough test of
this hypothesis.

Hypothesis V

Subjects in the no control group will report post experimental
mood states of fatigue and sadness more often than subjects in the
actual control group.

The data only partially support this hypothesis. The mood
factor "sadness" was not potent enough to be included in the dis­
criminant analysis. An inspection of group means on the fatigue
variable indicated that as a whole, subjects in the no control group
reported greater feelings of fatigue than those in the actual control
group. This effect, however, while in the predicted directions, failed to achieve significance. However, when combined with the other variables in the step-wise analysis, significant differences between the actual and no control groups were observed. This gives use to the speculation that inability to control a stressor may partially account for feelings of tiredness, etc.

**Hypothesis VI**

Subjects in the no control group will display more compliant responses to the confederate on the phone than will subjects in any other group.

An inspection of Table 4.8 reveals no support for this hypothesis. The no control group was second only to the actual control group in non-compliance with the confederates' requests. This result stands in contrast to the learned helplessness perspective which predicts that the inability to control outcomes results in increased passivity. One possible explanation of the obtained results is that subjects in the no control condition were sufficiently anxious about the forthcoming shock trials that they refused to act compliantly with the stooge. Instead, they may have chosen to completely focus their attention on the Pain article. The fact that approximately 50% of the subjects in the actual control group chose
not to comply with the confederates' wishes suggests that they were not at all helpless, but rather took active steps to ensure the completion of the priority task (i.e., reading).

Other Results

Concentration - The mood factor "concentration" was frequently reported by subjects across all groups. This may either be an artifact of the experimental situation or may suggest an initial task orientedness, which could be modified by several other factors (e.g., loss of control, fatigue, etc.).

Control - The analysis revealed that Group 1 was significantly different from Group 4 on the aversiveness and control over shock duration variables. This suggests that at least in part, the experimental manipulations were effective. The evidence also suggests that perceptions of control interact with task persistence and positive mood states (e.g., surgency). This finding makes intuitive sense, given the previous result that lack of control appears to be connected with fatigue.

Instructional Set

It is clear that the findings relative to the effects of control over shock are the most important results of this study. However,
it should be noted that contrary to the experimenter's intention, many subjects in the Perceived Control groups did not believe they had any control over the shocks. It is presumably for this reason that the discriminant analysis was not very successful in predicting subjects' membership in these groups. A closer inspection of the data supplied by subjects in the two perceived control groups suggests that these subjects who did believe they had control over the shocks tended to rate them as being less aversive and persisted longer in the anagram task. The mean aversiveness ratings for those who believed they could control shock duration was 3.23, while that of their nonbelieving counterparts was 4.91. Further, subjects who believed they had control on the average persisted slightly longer on the anagram task (9 as compared to 8 1/2 minutes).

Similarly, it is entirely possible that the discriminant analysis classified those subjects in the Perceived Control groups who believed they had control into Group 1 (the actual control group), and those who believed they had no control into Group 4 (the no control group). This underscores the possibility that perceptions of control do make some difference relative to the experienced aversiveness of a noxious stimulus and persistence at a frustrating task.
The Discriminant Functions

The step-wise analysis seems to have identified two significantly different sets of effects the experiment had on the subjects. The first discriminant function in Figure 4.1 appears to differentiate subject groups via a task orientation effect. That is, subjects although they perceived the shocks as aversive maintained high mood and persistence levels. The fact that Group 5 is low and Groups 2 and 3 are high on this function adds credence to this argument. It also suggests that stress can trigger certain mood states (the second set of functions also bear this out), which presumably affect an individual's behavior.

The second function points to another effect the experiment had on the subjects. It suggests that subjects who perceived little control over the stressor tended to adopt a carefree, fatigued mood and failed to persist very long at the anagram task. It may not be unreasonable to argue that the mood states engendered by a lack of control point toward the subjects' "giving up." If this is true, the results of this study lend additional support to Seligman's theoretical connection between lack of control and passivity.
Results in Relation to the Theories And Research Regarding Stress

I believe that it can be defensibly argued that much of the scientific and theoretical work relative to stress falls into two broad categories: the biological and the psychological perspectives. The biological view, best exemplified by Selye's work, seems to characterize the effects of stress in terms of physiological tolerance. Once an individual's tolerance is taxed or broken, undesirable physiological symptoms result. Thus, stress is an intrusion from the environment. The psychological perspective on the other hand, tends to view stress as a property of the entire organism. Its impact is said to be determined at least in part by what the subject believes about the stressor, himself in relation to the stressor, and the consequences of the encounter with stress.

This experiment provided a partial test of both views. From a physiological perspective, between group differences in Galvanic Skin Response would lend some weight to the argument that the subjects demonstrated significant differences in their capacity to tolerate the shocks, which in turn could account for the other reported results. However, no between group differences were found, and therefore, the results of this experiment cannot be solely accounted for in "physiological capacity" terms.
The intent of the experiment was to study some psychological effects of stress. The finding that belief in the controllability or uncontrollability of the shocks was associated with differential mood states, persistence and aversiveness ratings offers support for the psychological perspective on stress. However, this result should not be construed as detrimental to the physiological view. The basic issues remain: are stress reactions more a function of physiological tolerance or a function of the individual's belief and coping systems? Where and how do the two interface? These are intriguing questions and bear further investigation.

Limitations of This Study

A major methodological limitation of this study was that there was not enough distinction made between the two perceived control groups. Due to this lack of differentiation it proved difficult to extract and interpret any data regarding subjects' beliefs about their control (or lack thereof) over the stressor. In effect, the difference between the two groups was the utility of the shock affect pedal. This by itself did not justify the inclusion of second perceived control groups. However, had I encouraged the members of the non-verdical perceived control group to use the offset pedal, the present limitation would be minimized.
Another problem encountered in the study involved the use of the phone call as the behavioral test for the effects of stress on compliance. Most subjects routinely complied with the confederates' requests. However, this effect could reasonably be accounted for by the demand characteristics of the situation. Also, some subjects very clearly perceived the intent of the call.

Another difficulty encountered was that the large array of dependent variables made it difficult to determine which were the most important without performing a discriminant analysis. The E would have preferred to run a series of ANOVA's -- one per variable.

Recommendations for Further Research

In general, research can productively examine the interface between cognitions, stressors and mood states.

Further validation is required for the major finding of this study: the connection between aversiveness/control and fatigue, surgency and task persistence.

The speculation that control over stress leads to positive mood states and persistence could be tested using employees in a variety of work and experimental settings.
It would be interesting to test the hypothesis that mood fluctuations can be associated with changes in perceptions of control over a stressor.

The usefulness of the locus of control construct as a predictor of an individual's predisposition toward either control or passivity in the face of stress also requires careful research.

An analysis of the motivational impact of mood seems appropriate, particularly as it bears on learned helplessness.

**Summary**

The major finding of this study is that belief in one's ability to control shock led to mood states which facilitated persistence on a frustrating task. Conversely, belief in the uncontrollability of the shocks led to a negative motivational mood state which tended to undermine persistence. These results suggest support for the "learned helplessness" explanation of depression. The results connecting beliefs about control and mood states and persistence are suggestive of significant cognitive and learning components in stress reactions and the genesis of emotional states. One surprising result was the lack of major group differences per se relative to persistence on the anagram task. This clearly fails to replicate
previous research. Possible reasons for this effect were presented. Finally, the limitations of the study and recommendation for future research were offered.
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APPENDIX A
APPENDIX A-1

Experiment CD-1

DESCRIPTION

TITLE: The physiological and psychological effects of stressful stimuli.

EXPERIMENTER: Kevin J. Hartigan

In our society, stress appears to be an inescapable part of life. There is a need for research to investigate the effects of stress that occurs for a brief period of time. By being able to determine and recognize these effects, we will be better able to teach people ways of coping with stress.

The experimental procedure you will be asked to follow is this: First, tonight you will be asked to complete two fairly brief questionnaires. One will be the "internal-external" scale (the Personal Reaction Inventory), and the other a mood inventory (these will be explained in a few minutes). The results of these inventories will be kept confidential and the results will be shared with you on an individual basis, if you wish. Secondly, subjects in some of the experimental conditions in this study will be exposed to very brief electric shocks. In previous experiments, shocks such as the ones to be delivered in this study have been found to be slightly painful, but not at all damaging and having no side or after effects. Those of you who are unwilling to be exposed to this stimulus or are otherwise uncertain about your participation in this experiment are free to withdraw now or at any other time during the course of this study.

The hypotheses and hopefully some of the results of the experiment will be shared with you as a group at the end of this experiment. At that time I will be happy to answer all of your questions about the experimental procedures and other issues related to this study. Again, if you want feedback on the inventories you are about to take, that will also be arranged.
Appendix A-1 (continued)

If you are willing to participate in this experiment, I would ask you to sign your name on the line below. Your signature means that a) you are willing to participate; and, b) recognize that you may be exposed to electric shock in the course of the experiment. Thank you for your interest and participation.

__________________________
(signature)
### I-E FREQUENCIES

<table>
<thead>
<tr>
<th>I-E Score</th>
<th>Frequency</th>
<th>Range</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>I-E</td>
<td>f</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>3-5</td>
<td>6</td>
</tr>
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<td>18-20</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
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</tr>
</tbody>
</table>
APPENDIX A-3

MOOD INVENTORY

Please rate on the scales below how you feel right at this moment. Make your rating by placing a check (✓) above the number on the scale which most accurately represents your feelings at this minute.

<table>
<thead>
<tr>
<th>Mood</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Sad</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Anxious</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Relaxed</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Elated</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Discouraged</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Peaceful</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Hostile</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Down</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Up</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Pleasant</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Alert</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>Sleepy</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
</tbody>
</table>
This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you're concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief: obviously there are no right or wrong answers.

Your answers to the items on this inventory are to be recorded by circling the letter (a or b) which is next to the statement you more strongly believe to be true.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you're concerned. Also, try to respond to each item independently when making your choice; do not be influenced by your previous choices.

REMEMBER

Select the alternative which you personally believe to be more true.
I more strongly believe that:

1. a. Children get into trouble because their parents punish them too much.

   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.

   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.

   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.

   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.

   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.

   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try, some people just don't like you.

   b. People who can't get others to like them, don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.

   b. It is one's experiences in life which determine what they're like.
9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

I more strongly believe that:

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
   b. Many times exam questions tend to be so unrelated to course work, that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
   b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
   b. This world is run by the few in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.
   b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyway.

14. a. There are certain people who are just no good.
   b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
   b. Many times we might just as well decide what to do by flipping a coin.
16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand nor control.

b. By taking an active part in political and social affairs the people can control world events.

I more strongly believe that:

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.

b. There really is no such thing as "luck".

19. a. One should always be willing to admit his mistakes.

b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.

b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.

b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort, we can wipe out political corruption.

b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.

b. There is a direct connection between how hard I study and the grades I get.
24. a. A good leader expects people to decide for themselves what they should do.

   b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.

   b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.

   b. There's not much use in trying too hard to please people, if they like you, they like you.

I more strongly believe that:

27. a. There is too much emphasis on athletics in high school.

   b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.

   b. Sometimes I feel that I don't have enough control over the direction of my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.

   b. In the long run the people are responsible for bad government on a national as well as on a local level.
APPENDIX B
APPENDIX B-1

TRANSCRIPT OF THE LEARNING TASK INSTRUCTIONS

As I mentioned earlier, you will be asked to perform a learning task during the shock trials. (Shows 2 stimulus discrimination cards). The task will go something like this: while you are in the chamber, you will see some slides. On each slide there will be a pair of figures, which will look something like the ones on this card. Each pair of figures will contain 8 separate components or dimensions. (E labels 4 of the dimensions using the card). Can you pick out the other four?

As I said before, the figures will be presented on slides. A series of six slides will comprise one "problem." Each of the six slides within a series will be interrelated in that they share in common one and only one dimension which I have labeled "correct." Your job is to determine which of the eight dimensions it is. The correct dimension will always be on the same side of the slide, while other dimensions will switch from one side to the other. When each slide comes on, take a good look at it. When it goes off, I will ask you two questions. The first will be "Which side is the correct dimension on?" Your response will either be "left" or "right." Then I will ask "Which dimension do you think is correct?" Then you will tell me the name of one of the eight dimensions. After each trial, I will tell you whether you are correct or incorrect, so to help you arrive at the correct dimension. Here is an example: (E demonstrates an example using the stimulus discrimination cards). Any questions?

You should know that how well you do on this task has no effect on the shocks you will receive. You will get the same amount of shocks, regardless of whether you get them all right or all wrong.
Transcript of Shock Instructions (Shock Group)

Let me remind you that the purpose of this experiment is to investigate the physiological and psychological effects of stress. One of the psychological variables I'm concerned with is learning. So, in this phase of the experiment, you will be exposed to a stressor, electric shock, and a learning task. Let me first tell you some things about the shock. I will gradually increase its intensity to an upper limit, so that you can become accustomed to it. At its upper limit, the shocks may be slightly painful, but not at all harmful or damaging. However, if you find the shocks too painful, let me know and I will stop the experiment and you will be free to go. The shocks will be delivered randomly. I do not control when they will be delivered— that is done by a machine. I do control the intensity of the shocks.

ACTUAL CONTROL GROUP
In the chamber, you will find a fast pedal. You will be able to terminate each shock by pushing the pedal. So as soon as the shock comes on, push the pedal and it will immediately go off. Since I am not interested in how much shock you can tolerate, I would ask you to push the pedal each time a shock comes on. If you fail to press the pedal, the shocks will go off by themselves after a short period of time, but I'd prefer that you use the pedal. Any questions?

PERCEIVED CONTROL GROUP #1
In the chamber you will find a foot pedal. You will be able to terminate each shock by pushing the pedal. As soon as each shock comes on, a pedal-press will stop it. However, I prefer that you do not use the pedal at all, unless the shocks become too painful. If they do, go ahead and use it. Otherwise I'd rather you not use it. Any questions?

PERCEIVED CONTROL GROUP #2
In the chamber you will find a foot pedal. You will be able to terminate each shock by pushing the pedal. As soon as each shock comes on, a pedal press will stop it, after about one quarter of a second. However, I prefer that you do not use the pedal at all unless the shocks become too painful. If they do, go ahead and use it. Otherwise, I'd rather you not use it. Any questions?
Transcript of Shock Instructions (Shock Group)

NO CONTROL GROUP
No additional instructions

NO SHOCK GROUP

You will be in the chamber for two sets of trials. Insofar as a machine determines who gets shocked and when, some subjects receive shock both times they are in the chamber, some get shocked in neither set of trials, and some get shocked in one set of trials and not the other.
Phone Call situation: Instructions to the Subject
And conversation with the Confederate

For the next phase of this experiment, I'm going to increase
the intensity of the shock. (To subjects in Actual and Perceived
Control groups: I'm also going to deactivate the shock offset
pedal). In order to do this, I'll need to adjust these machines to
handle the increased shock load, and that will take 5-6 minutes.
I'll also need some room to move around in here, so I'm going to take
you to our equipment office. There, I'll give you an article to read
which will help you in the next series of trials. It's about how you
can mentally reduce the painfulness of stimuli like shock. The article
is very long, and you'll not be expected to get through all of it.
However, there is some information in it that you'll need to know in
order to do well on the next series of shock trials. So the more you
read, the better off you'll be.

IN THE EQUIPMENT OFFICE:
As you can see, this is our equipment room. Several of us who
are conducting experiments use this room, so you need not be con-
cerned about people who walk in and out of the office. Here is the
article. Remember, the more you read, the better off you'll be, so
read as quickly as you can. I'll be back when I'm ready to start
the next phase of the experiment, which will probably be in about
six minutes.

(E calls confederate)

E: Can I speak to George please?
C: He's not here.
E: All right. This is Kevin. I've been calling him all day because
he has a piece of equipment I need. I left a message earlier.
Please have him call me when he gets in.
C: Will do.
E: Thank you. Goodbye.

Oh, (subjects name). I have one more thing to tell you. If the
phone rings and no one else comes in to answer it, we'd appreciate
it if you would. I'll be back to get you in about six minutes.
APPENDIX B-3

Text of the Confederate's Role in Phone Call to the Subject.

(Call 9)

1. "Is Kevin Hartigan around?"

   (Possible Responses)

   A. "He's not here."
   B. "Who? I don't know who he is."

   If (A), "Do you know where he is?"

   (Possible Responses)

   1. "He's in the experiment room."
   2. "I don't know."

2. "O.K., would you do me a favor?"

   (Possible Responses)

   A. "No, I can't." (hangs up)
   B. "Yes, What do you want?"
   C. "I don't know; I've got something to do."
   D. "Look, I'm busy; Can you leave a message?"
   E. "Shove it!"

   If (A), Call again.
   (C/D), Press for favor.
   (E), Call again.

3. "I think he may be running an experiment tonight. Will you go down to the experiment room and tell him I want to talk to him?"
(Possible Responses)

A. "No, I can't." (hangs up)
B. "O.K." (complaint)
C. "O.K." (hostile)
D. "Shove it!"
E. "Look, I'm really busy right now. I have something important to do. I really wish you would call back in ____ minutes."

If (A), Call back (press)
(B/C), O.K.
(D), Call back (press)
(E), If same response, hang up

(S Comes back from room)
He's not there (factual)
He's not there (hostile)

4. "Oh no!" "I have to use the equipment in that room tomorrow morning and I need it checked." "Could you do me one more favor?"

(Possible Responses)

A. "No!" (hostile)
B. "O.K." (compliant)
C. "Look, I really need to get something done here. Please call back in ____ minutes.

5. "Could you check the ohmmeter on the GSR machine?" "You know the one - it's the big machine on the right as you go into the experiment room. The meter is the dial on the right."

(Possible Responses)

A. "No!" (hostile)
B. "No, that will take too much time. I'll tell him you called." (whiney)
C. "O.K." (complaint)
D. "O.K." (hostile)
E. "No, I can't do that now." "Can it wait a few minutes?" "Call back and I'll try to help you then."

If (A), "Thanks anyway."
(B), (give name)
(C/D), "Thanks."
(E), "O.K., I'll call back."
APPENDIX C
APPENDIX C-1

QUESTIONNAIRE

I. On the questions below, place a check (√) above the number which best describes your feelings regarding the shocks in this phase of the experiment.

1. The electric shock I felt in this phase of the experiment was:

   not at all ___________________________ Very
   bothersome 1 2 3 4 5 6 7 8 9 irritating

2. While working on the discrimination tasks, the shocks

   did not interfere ___________________________ made it very
t   with my concentration 1 2 3 4 5 6 7 8 9 difficult to  concentrate

3. During this phase of the experiment, did you think you could have stopped the shocks from coming on?

   definitely ___________________________ I definitely could not
   could not stop them 1 2 3 4 5 6 7 8 9 could stop them

4. During this phase of the experiment, did you think you could control the number of shocks you received?

   definitely ___________________________ definitely could not
   could 1 2 3 4 5 6 7 8 9 could not

5. During this phase of the experiment, did you think you could control the duration of the shocks?

   definitely ___________________________ definitely could
   could not 1 2 3 4 5 6 7 8 9 could
Appendix C-3

II. On the questions below, place a check (✓) above the number which best describes your feelings and/or behavior with respect to your participation in this phase of the experiment.

1. How important was it to you to solve the discrimination problems?

   not too                       very
   important 1 2 6 4 5 6 7 8 9 important

2. On the problem you solved correctly, was it primarily due to

   skill                         luck
   1 2 3 4 5 6 7 8 9

3. As this phase of the experiment progressed, did you feel like trying harder on the discrimination tasks?

   yes, very                      no, not
   much so 1 2 3 4 5 6 7 8 9 at all

4. As the experiment progressed, did you actually try harder to solve the problems?

   yes                             no
   1 2 3 4 5 6 7 8 9

5. As the experiment (this phase) progressed, did you feel like putting less effort into solving the problems?

   Yes, I felt like giving up 1 2 3 4 5 6 7 8 9

   No, I put as much or more effort into it.

6. As this phase of the experiment progressed, did you actually put less effort into solving the problems?

   Yes                             No
   1 2 3 4 5 6 7 8 9
Appendix C-3

7. To what degree (if any) did you feel discouraged during this phase of the experiment?

very much ______________________ not at all
so 1 2 3 4 5 6 7 8 9

8. If you did feel discouraged, when were you most aware of it?

____ early in the shock trials
____ halfway through the trials
____ toward the end of the trials
____ I did not feel discouraged at all

9. To what degree (if any) did you feel anxious during this phase of the experiment?

not at very much all
all 1 2 3 4 5 6 7 8 9

10. If you did feel anxious, when were you most aware of it?

____ early ___ halfway ___ toward the end ___ did not feel anxious
A Short Form of the Mood ACL

Each of the following words describes feelings or mood. Please use the list to describe your feelings at the moment you read each word. If the word definitely describes how you feel at the moment you read it, circle the double check (vv) to the right of the word. For example, if the word is relaxed and you are definitely feeling relaxed at that moment, circle the vv as follows:

relaxed       vv   v   ?   no (This means you definitely feel relaxed at the moment.)

If the word only slightly applies to your feelings at the moment, circle the single check v as follows:

relaxed       vv   v   ?   no (This means you feel slightly relaxed at the moment.)

If the word is not clear to you or you cannot decide whether or not it applies to your feelings at the moment, circle the question as follows:

relaxed       vv   v   ?   no (This means you cannot decide whether you are relaxed or not.)

If you definitely decide the word does not apply to your feelings at the moment circle the no as follows:

relaxed       vv   v   ?   no (This means you are definitely not relaxed at the moment.)

Work rapidly. Your first reaction is best. Work down the first column, then go to the next. Please mark all words. This should take only a few minutes. Please begin.
APPENDIX  C-2 (continued)

A Short Form of the Mood ACL (continued)

<table>
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<tr>
<th>Mood</th>
<th>vV</th>
<th>v</th>
<th>?</th>
<th>no</th>
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<tbody>
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<td>Angry</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Clutched up</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Carefree</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Elated</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Concentrating</td>
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<td>v</td>
<td>?</td>
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</tr>
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<td>Drowsy</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
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<td>Affectionate</td>
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<td>v</td>
<td>?</td>
<td>no</td>
</tr>
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<td>Regretful</td>
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<td>v</td>
<td>?</td>
<td>no</td>
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<td>vV</td>
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<td>?</td>
<td>no</td>
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<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<td>Playful</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<td>Overjoyed</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<td>vV</td>
<td>v</td>
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<td>Sluggish</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<tr>
<td>Kindly</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
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<td>Sad</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Skeptical</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<tr>
<td>Egotistic</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<td>v</td>
<td>?</td>
<td>no</td>
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<tr>
<td>Rebellious</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Jittery</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
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<td>Witty</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Pleased</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Intent</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Tired</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Warmhearted</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Sorry</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Suspicious</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Self-centered</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>Vigorous</td>
<td>vV</td>
<td>v</td>
<td>?</td>
<td>no</td>
</tr>
</tbody>
</table>
The task you are about to perform is an anagram task. Below you will see several words whose letters have been scrambled. Your task is to unscramble the letters such that they make a meaningful English word. Try to be as accurate as possible in your solutions. It is important that you note the exact time you start this task. You may record it in the appropriate spaces below. At the point when you think you have successfully completed as many anagrams as you can, or do not care to do any more, let me know and we will continue with the rest of the experiment.

NKGHTI _______ _______
(translation)

TYWENT ________ _______

OPGUSN _______ _______

EMAGLE _______ _______

ALSEGT _______ _______
APPENDIX  D
APPENDIX D-1

```
0  34  1
1  15  2
2  30  3

0  31  1
1  42  2
2  20  3

3  38  4
4  57  5
5  34  6

3  32  4
4  29  5
5  20  6

6  04  7
7  34  8
8  58  9

6  54  7
7  40  8
8  54  9

9  07  10
10  20  11
11  98  12

9  31  10
10  22  11
11  14  12
```
Mean Shock Durations for the Actual Control Group

<table>
<thead>
<tr>
<th>Shock #</th>
<th>Duration (in millsecs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-13</td>
<td>670</td>
</tr>
<tr>
<td>2-14</td>
<td>520</td>
</tr>
<tr>
<td>3-15</td>
<td>480</td>
</tr>
<tr>
<td>4-16</td>
<td>550</td>
</tr>
<tr>
<td>5-17</td>
<td>650</td>
</tr>
<tr>
<td>6-18</td>
<td>460</td>
</tr>
<tr>
<td>7-19</td>
<td>600</td>
</tr>
<tr>
<td>8-20</td>
<td>570</td>
</tr>
<tr>
<td>9-21</td>
<td>650</td>
</tr>
<tr>
<td>10-22</td>
<td>390</td>
</tr>
<tr>
<td>11-23</td>
<td>480</td>
</tr>
<tr>
<td>12-24</td>
<td>410</td>
</tr>
</tbody>
</table>
An Example of a Pair of Patterns in the Levine Stimulus Discrimination Task.

![Diagram of two patterns]
Dimensions and Values in the Levine Stimulus Discrimination Task.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Associated Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Letter</td>
<td>&quot;A&quot; or &quot;T&quot;</td>
</tr>
<tr>
<td>2. Letter Size</td>
<td>large/small</td>
</tr>
<tr>
<td>3. Letter Color</td>
<td>blue/red</td>
</tr>
<tr>
<td>4. Border Shape</td>
<td>circle/square</td>
</tr>
<tr>
<td>5. Border Number</td>
<td>one/two</td>
</tr>
<tr>
<td>6. Border Texture</td>
<td>solid/dashed</td>
</tr>
<tr>
<td>7. Underline</td>
<td>solid/dashed</td>
</tr>
<tr>
<td>8. Dots</td>
<td>one/two</td>
</tr>
</tbody>
</table>