THE EFFECTS OF ANXIETY AND STIMULUS INTENSITY ON PERFORMANCE IN SEMANTIC GSR CONDITIONING: A TEST OF THE CHRONIC-ACUTE HYPOTHESIS

by

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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENT ii

LIST OF TABLES v

LIST OF ILLUSTRATIONS vii

Chapter

I. ORIENTATION AND BACKGROUND 1

Introduction 1
Theoretical Considerations 7
Theory of Emotionally-Based Drive 8
Hypothetical Emotional Response (r_e) 10
Chronic-Acute Hypothesis 10
Pertinent Research 13
Anxiety and the GSR 13
Stimulus Intensity and the GSR 17
Anxiety, Stimulus Intensity, and Conditioning 19
Methodological Improvements 26
Experimental Task 26
Stress Method 28
Performance Measures 28
Anxiety Criterion 29

II. STATEMENT OF PROBLEM 31

III. METHOD 34
Subjects 34
Apparatus 35
Verbal Stimuli 39
Procedure 41

TABLE OF CONTENTS--Continued

Chapter		Page
IV.	RESULTS	48
	Response Measures and Statistical Analyses	48
	Pseudoconditioning	49
	Anxiety Criterion	50
	Stress Method	53
	Generalization	56
	Extinction	58
V.	DISCUSSION	65
VI.	SUMMARY	73
APPENDICES		75
I.	Kent-Rosanoff Word Association Test	76
II.	Preliminary Word Lists; Conditioning Word Lists; Generalization-Extinction Word Lists	81
III.	A. Means and Standard Deviations of Total Unconditioned GSR Amplitudes during Preliminary Phase	85
	B. Analysis of Variance of Total Unconditioned GSR Amplitudes during Preliminary Phase	86
	C. Per Cent of Subjects Answering "Yes" to Questions 1, 2, 4, and 5 during Inquiry	87
	D. G. Summaries of Individual Scores for Each Experimental Group	88
BIBLIOGRAPHY		91

LIST OF TABLES

TABLE Page

1. Studies Testing the Chronic vs. Acute Hypothesis..... 24

2. Description of the Experimental Groups..... 36

3. Verbal Stimuli: CS, Five Generalization Words, Fourteen Neutral Words..... 40

4. Per Cent of Subjects Associating "Light" to Generalization Words..... 42

5. Per Cent of Tracings Identified Correctly by Six Judges..... 51

6. Comparisons of Mean Anxiety Scores..... 52

7. Per Cent of Subjects Rating the Unconditioned Stimulus as "Pleasant, Neutral," or "Unpleasant"..... 55

8. Mean GSR Amplitudes in Micromhos for Each Word during the Generalization (First Extinction) Series..... 57

9. Means and Standard Deviations of Total GSR Amplitudes in Micromhos during Generalization to "Lamp, Dark, Heavy," and "Soft"..... 59

10. Analysis of Variance of Total GSR Amplitudes during Generalization to "Lamp, Dark, Heavy," and "Soft"..... 60

11. Mean GSR Amplitudes to "Light" (CS) for Full Extinction Series..... 61

12. Means and Standard Deviations of Total GSR Amplitudes in Micromhos during Extinction..... 63

LIST OF TABLES--Continued

TABLE Page

13. Analysis of Variance of Total GSR Amplitudes during Extinction..... 64

LIST OF ILLUSTRATIONS

Figure Page

1. Adaptation of Diagram Representing Portion of Theoretical Schema Relevant to Data for Classical Conditioning. After Spence (1958, 1960) 9

CHAPTER I

ORIENTATION AND BACKGROUND

Introduction

Anxiety or fear[1] has long enjoyed a central role in psychological theory and research. It has also received attention in a variety of fields ranging from sociology (Lynd & Lynd, 1937; Kardiner, 1939; Mannheim, 1941; Stein, Vidich, & White, 1960) to philosophy (Kierkegaard, 1844; Niebuhr, 1941) and literature (Auden, 1947; Kafka, 1937; Wolfe, 1934). Blake and Mouton (1959) suggest that current psychological concern with the topic of anxiety reflects not only the pressures and strains of modern living but also a growing interest in improving mental health. Consistent with such an interpretation, research on anxiety can provide basic and applied data leading to the understanding and control of this important aspect of human behavior.

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[1]There exists little support for the belief that the presence of anxiety should differ essentially from that of fear except in a reported object or focus of emotion. Freud (1936, p.351) stated that "...there are no means by which sensations of neurotic anxiety can be distinguished from those of real anxiety..." Similarly others (Arnold, 1960; Basowitz, Persky, Korchin, & Grinker, 1959; Dollard & Miller, 1950; Kimble, 1961; Mowrer, 1939) have taken the position that differences between anxiety and fear are less important than their similarities, and that they can be studied as one. For these reasons the terms anxiety or fear will be used synonymously throughout this study to refer to an "uncomfortable state of apprehension and uneasiness" (Laughlin, 1956, p.713).

Earlier psychologists conceptualized anxiety primarily as an instinctive reaction to pain and dealt with it largely through the development of taxonomies of innate responses (James, 1890; Hall, 1897; Mosso, 1896; Preyer, 1882; Ribot, 1911). Influenced by Watson's early work on emotion in children (1924), Cannon's concept of homeostasis (1927), and Freud's treatment of the role of anxiety in symptom formation (1936), modern psychology has come to view anxiety as a learned drive which constitutes an important motivating force in human and animal behavior.

Formulations providing experimental tests of anxiety as an acquired drive go back to the work of Mowrer (1939) and Miller (1948). According to Mowrer, anxiety or fear "...is a learned response occurring to signals (conditioned stimuli) that are premonitory of (i.e., have in the past been followed by) situations of injury or pain (unconditioned stimuli) (1939, p. 565)." Anxiety is regarded as the conditioned form of the pain reaction which is acquired according to the principles of classical conditioning and has "great biological utility" (Mowrer, 1939). This use of the concept closely parallels that of psychoanalysis.

Miller (1948, 1959) views anxiety in much the same way as Mowrer, but attempts an integration of the concept

with Hullian theory. He emphasizes that anxiety "...is a drive like hunger or thirst, which may motivate either adaptive or maladaptive behavior...(1959, p.267)." However, in contrast to Mowrer, drive- or fear-reduction continues to play a central role in Miller's experimental and theoretical work (1954, 1959).

Most studies dealing with the dynamogenic properties of anxiety have been conducted in the animal laboratory upon the assumption of phylogenetic continuity (Darwin, 1872; Hull, 1943). Considering the problem of anxiety, the utility of this position is limited (Brown, 1961; Kimble, 1961). Physical pain, which has been employed as a noxious stimulus in most animal studies, seems to play but a minor role in the origin of human fears (Kimble, 1961; Kessen & Mandler, 1960; Krause, 1961). Further, the very nature of animal experimentation leads to an underestimation of the importance of verbal and symbolic factors which play such a powerful role in human anxieties (Brown, 1961; Cleckley, 1950; Dollard & Miller, 1950; Fenichel, 1948; Osgood, Suci, & Tannenbaum, 1957).

Recently Spence and his associates have concentrated on the energizing function of anxiety in human learning (Farber & Spence, 1953; Runquist & Ross, 1959; Spence, 1956, 1958; Spence, Farber, & Taylor, 1954; Taylor, 1951, 1953,

1956). In their work, anxiety or emotionality[2] was conceptualized as part of a hypothetical emotional response which raises a subject's total motivational state (Brown, 1961). In accord with Hull's (1943, 1952) drive-habit interaction theory, the prediction was made, and for the most part supported, (but see: Bindra, Paterson, & Strzelecki, 1955; Hilgard, Jones, & Kaplan, 1951) that anxious subjects demonstrate stronger performance in simple learning situations such as classical eyelid conditioning and reaction time (Spence & Taylor, 1951; Taylor, 1951; Wenar, 1954).

Research at Iowa can be classified according to the method employed to represent different levels of anxiety. In the majority of experiments, differences were established by the selection of individuals with extreme scores on a self-report inventory (Taylor, 1951, 1953, 1956) -- the Manifest Anxiety Scale (hereafter referred to as MAS). The MAS asks individuals to indicate whether statements expressing well-established symptoms of anxiety (viz., reports of anxiety feeling and physiological concomitants of anxiety)

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[2]Although Spence prefers to speak of emotionality rather than anxiety, the interchangeable use of the two terms seems justified in the present study. Anxiety and emotionality not only share drive properties (Duffy, 1957; Malmo, 1957, 1958), but the two concepts have been frequently used synonymously by Spence and his closest collaborators (Brown, 1953; Farber, 1955; Farber & Spence, 1956; Spence, 1956; Spence & Taylor, 1951; Taylor, 1956).

are characteristic of them. The measure of anxiety level consists of the number of such symptoms which the individual admits. In typical experiments, subjects with very high anxiety scores were compared in their performance on diverse learning tasks with those scoring low on the MAS.

A somewhat smaller number of studies is reported in which the anxiety level was manipulated experimentally through the introduction of stress in the actual learning situation. Anxiety-arousing instructions to the subjects (Taylor, 1951), noxious stimulation (Spence & Taylor, 1951), and a combination of these two variables (Spence et al., 1954) proved successful.

To date, comprehensive research summaries of the work at Iowa (Brown, 1961; Franks, 1961; Kimble, 1961; Spence, 1958; Taylor, 1956) show that both high MAS scores and noxious conditions are significantly related to performance in human learning situations involving no obvious competing responses.

In a third series of experiments, anxiety scores and UCS intensities were varied concomitantly. These investigations were carried out with the aim of determining the relative importance of response-defined (MAS scores) and stimulus-defined (UCS intensities) antecedents of the anxiety drive in basic learning. Two alternative hypotheses (chronic vs. acute) concerning the nature of anxiety measured by the MAS

and its relation to environmental stimulation were proposed. Taylor (1951, 1953, 1956) conveyed the impression that subjects with high MAS scores might be considered chronically anxious. Alternatively, it was considered that high MAS scores are but an index of a predisposition to become anxious or emotional only in noxious or threatening situations (a kind of threshold hypothesis). Experimental evidence bearing on the chronic-acute controversy, however, is meager and equivocal as recent reviewers point out (Brown, 1961; Franks, 1961; Spence, 1956; Spence, 1958; Taylor, 1956).

It was the objective of the present investigation to increase the understanding of the energizing properties of anxiety in a human learning situation other than classical eyelid conditioning. Further, the two alternative hypotheses (chronic vs. acute) concerning the nature of anxiety measured by the MAS and its relation to environmental stimulation were tested, employing the paradigm of semantic conditioning. An analysis was made of the generalization and extinction of galvanic skin responses made by high and low anxious subjects under strong and mild stimulus conditions. To avoid the major shortcomings of previous studies, a number of methodological changes were introduced with respect to the experimental task, the criterion of anxiety, the definition of aversive stimulation, and the performance measures.

The results of this experiment are seen as having implications for a number of theoretical and practical issues of importance to modern psychology:

1. The demonstration that anxiety functions as an energizer in semantic conditioning would considerably broaden the scope of the Spence-Taylor theory of behavior (Brown, 1961; Kimble, 1961).

2. This experiment might reveal whether the relation between intensity of the UCS and strength of learning, found in classical eyelid conditioning (Spence, 1958) can be generalized to another response area (GSR).

3. The use here of semantic conditioning as the experimental task could increase our knowledge of a learning phenomenon which plays a substantial role in Soviet Russia but has been largely neglected in this country (Razran, 1961).

Theoretical Considerations

The empirical findings and selected theoretical treatments of the relations among drive, anxiety, and performance in human learning have been summarized at length (Brown, 1953; Hilgard, 1956; Eysenck, 1957; Farber & Spence, 1956; Spence, 1956; Taylor, 1956). The basic underlying theoretical framework has only recently been presented in a systematic way by Spence (1958) and his "theory of

emotionally-based drive" will be developed in the following section.

Theory of emotionally-based drive

Spence (1958) has presented the essential concepts of his theory and their interrelations within a nomological network (Cronbach & Meehl, 1955). An adaptation of this schema is presented in Figure 1. Above the rectangle are shown the independent variables; the dependent variables can be found at the right hand corner; the rectangle itself contains the major intervening variables or constructs known from the writings of Hull (1943, 1952) and Spence (1956, 1958). Arrows indicate functional relations among these three classes of variables.

The theory of emotionally-based drive takes its departure from Hull's basic assumption that the learning factor (H) and the generalized drive factor (D) combine in a multiplicative manner to yield excitatory potential (E) which, in turn, determines performance (Rp). The implications of varying drive level in simple learning situations are clear: the higher the drive level in simple learning situations, the greater becomes the value of E, and in turn, response strength or performance. More specifically, Spence states that Rp is some positive monotonic function of excitatory potential, E.

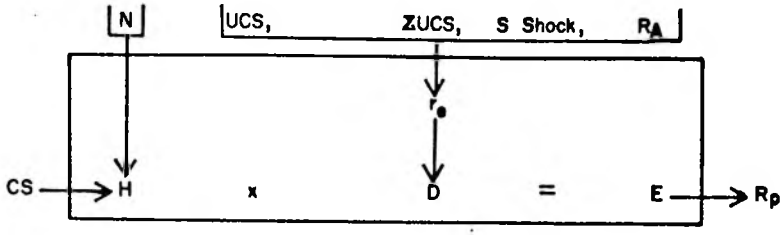

Fig. 1.--Adaptation of diagram representing portion of theoretical schema relevant to data for classical conditioning. After Spence (1958).

Where:

N = number of paired conditioning trials

UCS = unconditioned stimulus

ΣUCS = number of previous presentations of the unconditioned stimulus

S shock = intensity of extra stressful stimulation

R_A = score on anxiety or emotionality scale

CS = conditioned stimulus

H = learning or associative factor

D = generalized drive factor or drive level

r_e = anxiety or emotionality

E = excitatory strength

Rp = empirical response measure (performance)

Hypothetical emotional response (r_e)

Spence assumes further that drive level (D) is a direct function of an internal emotional or anxiety response (r_e) mediated by the autonomic nervous system.

By analogy with overt responding to stressful stimulation (e.g., galvanic skin response to shock, eyeblink to light or sound, etc.), Spence assigned three properties to this hypothetical response mechanism. Two are directly relevant to this study. First, he proposed individual differences in the magnitude of r_e to the same intensity of stimulation. To assess these individual response patterns, Taylor (1951, 1953) developed the Manifest Anxiety Scale. From the remaining portion of the theory of emotionally-based drive, it can then be predicted that subjects with high scores on the MAS should exhibit a high level of performance in simple learning situations. Again, in analogy with overt responding to noxious stimulation, Spence proposed that r_e varies directly with the intensity of noxious stimulation. Consequently, he must predict that subjects conditioned with an intense unconditioned stimulus should manifest stronger conditioning than subjects trained with a mild unconditioned stimulus.

Chronic-acute hypothesis

To account for the joint effects of anxiety and noxious environmental stimulation on performance in simple

learning situations, Spence (1956, 1958) offered two alternative hypotheses. The first, which he termed the "chronic" hypothesis, assumes "...that high anxious subjects react emotionally in a chronic manner to all situations, whether stressful or not..." (Spence, 1960, p.139). The alternative conception, commonly designated as the "acute" (emotional-reactivity) hypothesis, states "...that High A subjects have a lower threshold of emotional responsiveness and react with a stronger emotional response than Low A subjects to situations containing some degree of stress." (Spence, 1960, p.139). According to the chronic conception, differences among high and low anxious groups, provided other conditions imposed by the theory are met, should be found whether or not there is high threat in the form of noxious stimulation, fear of failure, or the like, in the learning situation. For example, anxious subjects should show not only superior performance in classical defense conditioning but also in appetitional conditioning, which is presumably nonstressful. The acute hypothesis, on the other hand, would expect differences in the performance of groups differing in anxiety only in stressful or threatening situations.

The writings of Spence and Taylor provide two ways in which a test of the two alternative conceptions of anxiety could be made. The first method assumes, as implied by Spence

(1956, 1958) and Taylor (1956), that variations in UCS intensity produce variations in stress. A test of the chronic vs. acute theory could then be made by varying, at the same time, the two independent variables, intensity of the UCS and scores on an anxiety or emotionality scale (see Fig. 1). Using a factorial design with two levels of UCS (weak and strong) and two levels of R_A (high and low), the acute hypothesis would predict a significant interaction effect between anxiety and UCS intensity; the chronic, none.

In the 1958 statement of his theory, Spence suggested that a second method for varying conditioning performance might introduce a special stress variable "S shock" (see Fig. 1). He states that it should be possible to obtain a higher level of conditioning by applying "...a strong extra stimulus, such as an electric shock..." (Spence, 1958, p.134). He also envisaged the possibility of inducing stress experimentally in the form of "threat of further shocks" (Spence, 1958, p. 134).

The present investigation attempted to examine the chronic vs. acute problem by manipulating the anxiety scale and UCS intensity. This procedure was selected because it has been most consistently advocated by Spence (1956, 1958) and his collaborators (Brown, 1961; Taylor, 1951, 1956) and because of the interest of the author in the effect of UCS intensity upon strength of conditioning.

Pertinent Research

Anxiety and the GSR

Traditionally, the galvanic skin response has been regarded as one of the most reliable physiological concomitants of emotionality or anxiety in both normal and abnormal populations (Lacey, 1959; McCurdy, 1950; Martin, 1961; Peterson, 1907; Woodworth & Schlosberg, 1954). Likewise, a strong positive relation has been demonstrated between strength of GSR conditioning and anxiety ratings derived from interview behavior (Bitterman & Holtzman, 1952), as well as psychiatric diagnoses indicative of anxiety (Schiff, Dougan, & Welch, 1949; Welch & Kubis, 1947a, 1947b).

Experimental evidence for a relation between MAS scores and performance in GSR conditioning is less compelling. In the same experiment, Bitterman and Holtzman (1952) failed to support the expectations of drive theory with respect to GSR conditioning when they re-analyzed their data using MAS scores as an anxiety criterion. After dividing a group of randomly selected students into upper and lower 50 per cent groups on the basis of MAS scores, they found a slight but statistically non-reliable difference in learning. As Taylor (1956) has pointed out, the criterion of anxiety employed by Bitterman and Holtzman was far less stringent (less extreme cutting scores) than recommended (Taylor, 1951, 1953).

Franks (1956), in a study of the introversion-extraversion dimension in normal and neurotic subjects, found a significant relation between the Extraversion (E) scale of the Maudsley Personality Inventory (MPI) and level of eyeblink and GSR conditioning. The Neuroticism (N) scale of the MPI was not found to be significantly related to conditioning. Since N is highly correlated with the Manifest Anxiety Scale, Franks argued that his findings question a drive interpretation of anxiety. Such reasoning scarcely constitutes an experimental refutation of the Spence-Taylor theory. Further, Franks' results should be viewed with caution because he may have produced pseudo-conditioning rather than true conditioning of the GSR (Stewart, Stern, Winokur, & Fredman, 1961).

Negative results were obtained in a recent experiment by Makres (1961) in which GSR conditioning, complex verbal learning, and discrimination learning were examined in relation to drive (anxiety) level. Anxious and non-anxious subjects were selected for this experiment utilizing scores on the Forced-Choice Manifest Anxiety Scale (HFC-MAS, Heinemann, 1953) and by clinical diagnosis of stuttering. They were given a total of 40 conditioning trials in which a tone served as a conditioned stimulus followed on 25 randomly selected trials by an electric shock (UCS). Immediately after acquisition, tests of stimulus generalization were made.

Makres found that neither HFC-MAS scores nor diagnosis of stuttering related significantly to either acquisition or stimulus generalization. This study, too, must be viewed with caution because of the procedure followed in the selection of anxious and nonanxious individuals. Like Bitterman and Holtzman (1952), he used less extreme cutting scores than recommended by Heinemann (1953). Thus, he may have included moderately anxious subjects in both the high and low anxiety groups thus producing a "dilution" of the effect.

Support for the Spence-Taylor theory of emotionally-based drive is found in only two GSR experiments (Becker & Matteson, 1961; Mednick, 1957). Mednick, in a study of semantic generalization and the incubation effect, selected two groups of subjects on the basis of extreme scores on the HFC-MAS. She then established a conditioned GSR by repeated pairings of a critical word (CS) with a very loud and unpleasant sounding buzzer (UCS). Tests of semantic generalization were made following training, using as generalization stimuli, words meaningfully related to the conditioned stimulus. Results indicated a positive and significant relation between HFC-MAS score levels and performance during semantic conditioning, generalization, and extinction.

Becker and Matteson (1961) also employed the paradigm of semantic conditioning in a study of GSR conditioning, anxiety, and extraversion. They chose four groups of students with extreme anxiety and extraversion scores on Cattel's Anxiety Scale and Guilford's R Scale and conditioned the GSR using a verbal CS and electric shock as UCS. In contrast to Franks' results (1956), anxious subjects demonstrated superior GSR conditioning in terms of both amplitude and trials-to-criterion. No relation was found between extraversion and conditioning. Becker and Matteson concluded that their findings support Spence and Taylor, since Cattel's Anxiety Scale correlates highly with the Taylor Manifest Anxiety Scale. Their conclusion, however, seems limited in validity because, like Franks (1956), they overlooked the contamination of social desirability bias in anxiety questionnaires (Edwards, 1957).

In summary, most studies dealing with the relation between MAS scores and performance in classical GSR conditioning constitute weak tests of the Spence-Taylor hypothesis. Two negative studies (Bitterman & Holtzman, 1952; Makres, 1961) may have failed to obtain an effect because the extreme groups recommended by the author of the MAS (Taylor, 1953, 1956) or its forced-choice derivative (Heinemann, 1953) were not examined. Two further experiments, one critical (Franks, 1956) and one supportive (Becker & Matteson, 1961), yield little information either for or against the

theory because they neglected the social desirability variable. Since only the study by Mednick (1957) withstands major criticism, further study of the relation between MAS and GSR conditioning seemed invited.

Stimulus intensity and the GSR

Stimulus intensity, the second important antecedent variable relating directly to the strength of eyelid conditioning (Passey, 1948; Spence, 1956, 1958) has also been related to the GSR.

The observation that a stronger stimulus is capable of eliciting a galvanic skin response of greater magnitude is not new. Veraguth (1907) observed that the same sound source, when moved closer to the subject, produced a stronger GSR. Bijtel and Van Iterson (1925) demonstrated the same phenomenon using different strengths of olfactory stimuli. Qualitative evidence for a stimulus intensity effect on the GSR has been obtained by Davis (1930) using response amplitude as the dependent variable (see also Misbach, 1932).

Hovland and Riesen (1940) first investigated the problem quantitatively using both electric shock and auditory stimuli of varying intensities. They found that the GSR varied in an approximately linear fashion with strength of shock. Similarly, except at extremely high intensities,

the logarithm of the GSR varied linearly with the intensity of a tone. A related finding has been reported by Davis, Buchwald and Frankman (1955), who showed that both the latency and amplitude of the GSR are a linear function of acoustic pressure.

A conditioned stimulus intensity effect was obtained also in a series of conditioning experiments (Champion, 1962; Hovland, 1937a, 1937b). Hovland, in both experiments, conditioned subjects to respond to a weak CS (1000 cps at 40 db) and another group of subjects to respond to a strong CS (1000 cps at 86 db). Later he tested for intensity as well as frequency generalization. His results indicated stronger performance in groups trained with the strong conditioned stimulus both during acquisition and during the stimulus generalization phase of the experiment. Nearly identical results were reported in a recent study by Champion (1962) who established a GSR to the offset of a weak and strong CS with electric shock functioning as UCS.

No study was found in which variation of the intensity of unconditioned stimulation was examined in relation to level of GSR conditioning. It appears likely that this problem has been either overlooked or neglected because of "lack of consistency" (Spence, 1960). Further exploration of unconditioned stimulus intensity on the learning of the GSR seems indicated. In the past, UCS sound intensities

ranging from 50 db (Melville & Zax, 1959) to more than 120 db (Mednick, 1963) have been used successfully to condition the GSR.

Anxiety, stimulus intensity, and conditioning

Since no study was found in which the joint effects of anxiety and stimulus intensity on GSR conditioning have been examined, the following section is devoted to a review of eyelid conditioning studies dealing with these parameters in relation to the chronic-acute controversy. Generalization of results from eyelid studies to GSR data seems justified because both types of conditioning are of relatively similar complexity, and are probably controlled by the same independent variables as Spence (1956, 1958, 1960) and Taylor (1956) have pointed out.

Psychological interest in the nature of anxiety as measured by the MAS and its relation to environmental stimulation began with Taylor's experiment in 1951. In this study, which has served as a model for most later investigations, drive level was manipulated primarily through the selection of subjects with either extremely high or extremely low scores on the MAS. Individuals falling within the upper twelfth percentile of the standardization population (raw scores of 24 or above) comprised the anxious group; those receiving scores within the lower ninth percentile (raw scores of 7 or below) comprised the nonanxious

group. All subjects were run in an eyelid conditioning situation with light serving as CS and a moderately strong air puff directed at the right eye as UCS. After twenty conditioning trials, Taylor tried to modify anxiety level (D) experimentally by informing half of each group that the intensity of the UCS would be increased on subsequent trials. The remaining half was told that the intensity of the UCS would be decreased from that point on. The actual magnitude of the air puff was held constant for all. Results indicated stronger conditioning in anxious subjects, even after the administration of anxiety-relieving instructions. These findings might be interpreted as confirming the chronic hypothesis since anxious subjects displayed stronger performance in both threatening and, presumably, nonthreatening situations.

In a second experiment, concerned with the joint effect of anxiety and UCS intensity on eyelid conditioning, Spence and Taylor (1951) not only threatened to increase the intensity of the air puff but actually utilized weak and strong UCSs to vary stress level experimentally. They chose two groups of subjects within the upper and lower 20 per cent of the MAS standardization population. Half of each group received a relatively strong puff of air as UCS; the other half, a relatively weak puff. The anxious subjects showed superior conditioning under both stressful

and nonstressful conditions, results which seem in accord with the chronic view.

Highly reliable differences between groups with extreme scores on the Taylor scale were also found in a recent experiment (Spence, 1956) in which weak and strong air puffs were used to induce different levels of stress experimentally. In this experiment, the difference in performance between anxious and nonanxious subjects was even greater when the weak UCS was employed, an outcome that contradicts the implications of the chronic hypothesis.

Three investigations have yielded results which agree with an acute interpretation of the meaning of high MAS scores. In the first experiment (Spence & Farber, 1953), groups of male and female college students with extreme MAS scores were trained to give eyelid responses to a combined visual and auditory CS followed by an air puff of moderate strength. Immediately afterward, all subjects were given 40 extinction trials. In accord with Spence-Taylor predictions, anxious students gave significantly more conditioned responses than those with very low MAS scores during both acquisition and extinction. In this experiment, female students showed significantly more conditioning with the moderately noxious stimulus than other female students who had been trained with a much weaker UCS in a previous study (Spence & Taylor, 1951).

In line with the acute hypothesis, Spence & Farber suggested that the novelty and strangeness of the experimental setup aroused greater fear or anxiety in women than in men. Thus, the women possessed the higher drive level during the course of the experiment.

A further investigation was conducted by Spence, Farber, and Elaine Taylor (1954) to determine the effects of electric shock and shock-threat on performance in classical eyelid conditioning. Three groups of women who were given a total of 80 conditioning trials comprised the experimental subjects. One group sometimes received shock in conjunction with a ready signal preceding the CS; another group was told it might receive such shocks but actually received them only during a preliminary try-out; the control group received neither shock nor shock-threat. When each group was divided after the experiment in terms of high and low anxiety scores, it was found that only those who had been actually punished with electric shock during training yielded significantly more conditioned responses.

In the last study, which supports the acute hypothesis (Spence, 1956), a very mild air puff was used as the unconditioned stimulus and drive level was manipulated by changing the intensity of the conditioned stimulus. Half of the anxious and half of the nonanxious subjects were trained to

give an eyelid response to a very weak auditory CS (8 db). The remaining half was conditioned with the same UCS but, in this case, the CS was a much stronger tone (45 db). No significant difference was found between anxiety groups in the case of the weak CS. To the louder CS, on the other hand, anxious subjects yielded significantly more conditioned responses.

Summarizing (See also Table 1), it appears that experimental evidence bearing on the chronic-acute issue is equivocal. Disregarding the study by Spence and Farber (1953) which indirectly provides support for the acute hypothesis, available experimental results favor slightly the chronic understanding of anxiety.

Four possible reasons can be offered for this equivocality. First, conflicting results could be a function of differences in the experimental tasks and procedures employed. Several writers have suggested that the standard eyelid conditioning procedure may be noxious and anxiety-arousing in independence of the intensity of the air puff employed as an unconditioned stimulus (Bindra, Paterson, & Strzelecki, 1955; Hilgard, Jones, & Kaplan, 1951; Kimble, 1961; Sarason, 1960, Spence, 1956). If this is granted, none of the six reviewed studies qualifies as a fair test of the experimental question, because the effect of anxiety level on performance was not examined

TABLE 1

STUDIES TESTING THE CHRONIC VS. ACUTE HYPOTHESIS

Experimenter	Method	Anxiety Criterion	Response Measure	Hypothesis Supported
Taylor, (1951)	Eyelid conditioning, fear arousing and reducing instructions	MAS	Acquisition	Chronic
Spence & Taylor (1951)	Eyelid conditioning, weak and strong UCS (air puff)	MAS	Acquisition, extinction	Chronic
Spence (1956)	Eyelid conditioning, weak and strong UCS (air puff)	MAS	Acquisition	Chronic
Spence, Farber, & Taylor (1954)	Eyelid conditioning, shock and shock threat	MAS	Acquisition	Acute
Spence & Farber, (1953)	Eyelid conditioning, moderate UCS (air puff) compared with Spence & Taylor (1951)	MAS	Acquisition, extinction	Acute
Spence (1956)	Eyelid conditioning, weak and strong UCS (sound)	MAS	Acquisition	Acute

under distinctly different stress conditions.

Secondly, previous investigators have not been consistent in their use of performance and learning measures. Recently, generalization and extinction have been found to be quite sensitive measures of the performance of anxious subjects under stress (Bitterman & Holtzman, 1952; Lacey, Smith, & Green, 1955; Mednick, 1957).

Thirdly, the methods employed for producing experimental variation in anxiety or drive level (e.g., physical pain, intense sensory stimulation, threatening, and ego-involving instructions alone, or in various combinations) have reflected such a lack of standardization that results resist cross-comparison. Recently, a number of authors (Kimble, 1961; Lazarus, Deese, & Osler, 1952; Taylor, 1956) have pointed out that various stress techniques often produce conflicting effects on performance. Moreover, in no study was an attempt made to determine whether the noxious and non-noxious stimuli were actually experienced as "painful" by the experimental population.

Finally, no investigator has tried to control for the tendency of college students to respond to personality tests, like the MAS, in a socially desirable direction (Edwards, 1957; Fordyce, 1956; McGrath, 1958; Sarason, 1960; Taylor, 1956; Warm, 1962).

Methodological Improvements

The present study sought to avoid the weaknesses of previous tests of the chronic-acute hypothesis by incorporating several methodological changes with respect to the experimental task, the procedure for manipulating stress, the response measures, and the criteria for anxiety or emotionality.

Experimental Task

Semantic conditioning, the establishment of an involuntary response to the meaning of a written or spoken word or sentence, served as the experimental task (Kimble, 1961; Osgood, 1953; Razran, 1939, 1961). This method appears particularly appropriate because it is only slightly more complex than classical eyelid conditioning, can also present an aversive situation, and thus it "fits" the Spence-Taylor formulations (Spence, 1956, 1958, 1960; Taylor, 1951, 1956). The fact that semantic conditioning studies have made use of a variety of unconditioned stimuli (e.g., food, cold, heat, shock, sounds, lights, etc.) and responses (e.g., salivation, GSR, finger flexion, vasoconstriction and dilation, heart rate, etc.) presents another advantage. Semantic condition has been related also to the performance of anxious subjects under stress (Lacey & Smith, 1954; Mednick, 1957).

Changes in electrical skin resistance were selected as the response to be conditioned for a number of theoretical and practical reasons. The employment of the GSR seemed especially recommended since it is apparently influenced by most, if not all, of the same variables as the eyelid response (Passey, 1948; Spence, 1956, 1958; Spence & Taylor, 1951; Taylor, 1951). Practical considerations, which suggested the adoption of the GSR for the present study included its sensitivity to noxious and non-noxious stimulation (Davis, et al., 1955; Woodworth & Schlosberg, 1954), its retest reliability (Davis, et al., 1955; McCurdy, 1950), and its relatively uncomplicated instrumentation with an attendant minimum inconvenience for the subject (Martin, 1961; Woodworth & Schlosberg, 1954).

Sounds, varying from weak to strong in intensity, constituted the unconditioned stimuli and served to induce experimental anxiety.

All verbal stimuli were adapted from those used in earlier studies of semantic conditioning to make comparisons possible (Diven, 1937; Lacey, et al., 1954, 1955; Mednick, 1957; Razran, 1939; Riess, 1940, 1946). They were also pretested to avoid confounding skin potential changes due to emotionally-toned words with those due to pairing with the UCS (Menzies, 1937; Woodworth & Schlosberg, 1954).

Stress Method

Weak and intense unconditioned sound stimuli were also viewed as inducing various levels of situational stress. The use of loud sounds to produce fear or anxiety dates back to Watson's (1924) early work on emotion in children and has continued to be popular (Davis, 1948; Mednick, 1957; Mitchell & Zax, 1959; Paul, 1954; Spence, 1956; Sullivan, 1951). Since even the most intense sound could fail to produce fear (Krause, 1961), and since much less intense stimuli might be perceived as threatening, all unconditioned stimuli were pretested in a pilot study using a special standardizing group. The verbal reports of these subjects as to the noxious quality of the stimuli were then utilized in the selection of the intensities defining the two experimental levels of situational stress. While the stimuli productive of stress might be idiosyncratic for any single subject, one can reasonably view a stimulus as stressful or nonstressful in a statistical sense if it is perceived as such by a large number of subjects. This procedure represents an improvement over past studies in which neutral and fear-arousing situations were defined intuitively.

Performance Measures

The performance measure recorded during generalization and extinction was response amplitude. Both American (Hilgard,

Jones, & Kaplan, 1951; Mednick, 1957; Mitchell & Zax, 1959) and Russian studies (Luria & Vinogradova, 1959) have concentrated recently on generalization measures of learning and performance. Stimulus generalization has also been related in theory and practice to psychopathology and psychotherapy. Bender and Schilder (1930) noted extreme overgeneralization by schizophrenics in a study involving conditioned withdrawal from shock. Cameron (1947) has discussed "overinclusion" in schizophrenic patients citing clinical and experimental observations. Dollard and Miller (1950) have treated at length the role of stimulus generalization in the learning and extinction of neurotic symptoms. The energizing effect of anxiety on stimulus generalization has been demonstrated by Hilgard, Jones, and Kaplan (1951) in a differential eyelid generalization experiment, by Mednick (1957) in the previously discussed experiment on semantic conditioning and generalization, and by Wenar (1954) in a study of temporal conditioning.

Anxiety Criterion

An attempt was made by the experimenter to control for the social desirability bias of the Taylor scale by using a forced-choice form of the MAS (Heinemann, 1953). This scale has helped to decrease the correlation between anxiety scores and various test-taking attitudes (Sarason,

1960) and has, to date, nearly replaced previous editions of the Taylor scale. While no specific validity information is available for this test, the low but significant correlation between scores on the Heinemann Scale (HFC-MAS) and skin conductance readings reported in two studies (Bergs, L. P. & Martin, P., 1961; Silverman, 1957) can be regarded as strengthening the validity claim of the HFC-MAS.

CHAPTER II

STATEMENT OF PROBLEM

Two hypotheses have been offered by Spence (1956, 1958, 1960) and Taylor (1951, 1956) to account for the nature of anxiety at the human level, its relation to environmental stimulation, and its energizing effect in simple learning situations. According to the first of these views (chronic hypothesis), anxiety is regarded as a trait which is chronically present in certain individuals. The other position (acute hypothesis) conceives of anxiety as situational, as an acute reaction to stressful stimulation. As we have seen, the experimental evidence bearing on these rival interpretations is meager and inconclusive (Brown, 1961; Franks, 1961; Spence, 1956; Taylor, 1956). The main purpose of the present experiment was that of critically examining the validity of the two theories.

To overcome limitations of previous tests of the chronic-acute issue, methodological innovations were introduced with respect to the experimental task, the procedures for varying stress experimentally, the performance measures, and the criterion of anxiety. The two independent variables manipulated were anxiety scores and the intensity of a tonal UCS. The dependent variable consisted of measures of semantic GSR conditioning.

A factorial design with two levels of anxiety (high and low) and two levels of UCS stimulus intensity (weak and loud) was utilized. The four experimental groups received the following treatments:

Group HAWT (high anxiety, weak tone) consisted of subjects with high anxiety scores who were trained to give a conditioned GSR to a verbal signal while a weak tone served as UCS. Immediately following acquisition, tests of semantic generalization and extinction were conducted.

Group HAST (high anxiety, strong tone) consisted of subjects with high anxiety scores who were trained to give a conditioned GSR to a verbal signal while a loud (strong) tone served as UCS. Immediately following acquisition, tests of semantic generalization and extinction were conducted.

Group LAWT (low anxiety, weak tone) consisted of subjects with low anxiety scores who were trained to give a conditioned GSR to a verbal signal while a weak tone served as UCS. Tests of semantic generalization and extinction followed.

Group LAST (low anxiety, strong tone) consisted of subjects with low anxiety scores who were trained to give a conditioned GSR to a verbal signal while a loud (strong) tone served as UCS. Tests of semantic generalization and extinction followed.

The absence of a significant interaction effect between anxiety scores and intensity of tonal stimulation would tend to support the chronic interpretation. The acute hypothesis would predict a reliable interaction, i.e., the high anxious group should separate more strongly from the low anxious group under high stress (strong tonal UCS) than under weak stress (weak tonal UCS).

CHAPTER III

METHOD

Subjects

All experimental subjects were selected on the basis of extreme scores on the Forced-Choice Manifest Anxiety Scale (HFC-MAS, Heinemann, 1953) from more than 200 students enrolled in six introductory psychology classes at the University of Alabama Extension Center in Birmingham during the Winter Quarter, 1963. This anxiety index was selected because it has been used successfully to reduce the social desirability response set of the original Taylor scale (Heinemann, 1953; Sarason, 1960).

Seventy-four student nurses of the University of Alabama Hospital School of Nursing and the Baptist Hospital School of Nursing in Birmingham and an additional 10 female students enrolled in the evening program at the Birmingham Center constituted the experimental sample. The 42 individuals scoring within the upper 20 per cent on the anxiety test (scores of 64 or above) constituted the high anxious groups (HAWT & HAST). An equal number of students scoring within the lower 20 per cent (scores of 45 or below) were designated as low groups (LAWT & LAST).

Anxious and nonanxious subjects were assigned by an assistant to two subgroups of 21 subjects each according to the unconditioned stimulus to be employed. The experimenter remained ignorant of the subject's anxiety classification until after the experiment.

An attempt was also made to match the four experimental groups as closely as possible on the following dimensions supplied by the two schools of nursing: age and performance on standard tests of intelligence (California Capacity Questionnaire, Form A, 1951; Henmon-Nelson Test of Mental Ability, 1950) and scholastic achievement (grades). The ten evening students who took part in the study were administered the Henmon-Nelson in group form and information concerning their academic work was obtained through the Center registrar. An attempt was made to insure adequate motivation by giving extra credit in class work for participation. Illness, withdrawal from school, or failure to show up for appointment reduced slightly the size of the experimental sample (final N was 75).

A description of the sample is presented in Table 2 where it may be seen that the four subgroups were well matched with respect to the three nonexperimental variables.

Apparatus

The galvanic skin response was measured by a Grason-

Table 2

DESCRIPTION OF THE EXPERIMENTAL GROUPS

Group	N	Mean Age	Mean Intelligence	Mean Grade Average	Mean Anxiety Score
HAWT[a]	18	18.94	114.05	1.61	68.30
HAST[b]	20	19.00	115.80	1.55	69.30
LAWT[c]	20	19.30	117.60	1.65	39.95
LAST[d]	17	19.76	114.24	1.52	40.24

[a]High Anxiety, Weak Tone (UCS)

[b]High Anxiety, Strong Tone (UCS)

[c]Low Anxiety, Weak Tone (UCS)

[d]Low Anxiety, Strong Tone (UCS)

Stadler psychogalvanometer (Model E-664) which records changes in skin resistance utilizing hot stylus recording on continuously moving heat sensitive paper. This instrument possesses an amplifier with selective response to signals useful in GSR work, can register skin resistances up to 200,000 ohms, and is self-balancing (Grason-Stadler, 1961). Basal readings were taken directly before the preliminary phase, before and after conditioning, and before and after the generalization-extinction period. Following Mednick (1957) and Grason (1962), the instrument was calibrated by throwing in a standard resistance of 1,000 ohms while shorting out the subject. The deflection (pen excursion) to this known resistance provided a calibration unit of 1,000 ohms.

Commercial stainless steel electrodes (Stoelting, 1962) measuring approximately one by one-half inch served as GSR pickups. They were attached to the fourth and index fingers of the right hand with Velcro straps, causing no inconvenience for the subject and, of course, producing no circulation blockage. To maximize conduction and to reduce polarization, the skin surface was cleaned with ethyl alcohol prior to the attachment of the electrodes and rubbed with Redux electrode paste as suggested by the manufacturer (Grason-Stadler, 1961).

A 500 cycle, 5 per cent warble tone, 70 db above individual loudness thresholds, which had been judged by more than 80 per cent of the individuals in a pilot study as either "pleasant" or "neutral," was selected as a non-noxious or non-stressful unconditioned stimulus. The same tone, presented at an intensity level of 90 db, which had been rated as "frightening" and "unpleasant" by over 90 per cent of the individuals, constituted the noxious or threatening UCS. Both tones were produced by an Allison Audiometer (Model 218) and were broadcast through a loud-speaker to the subject. The UCSs had a duration of three seconds and followed the CS according to a random 50 per cent schedule of partial reinforcement. The same audio-meter was used to establish loudness thresholds for each subject.

All verbal stimuli were presented by a Kodak Carousel Projector (Model 550). The words appeared in white block letters about two inches high on a black ground. Each word remained on the screen for five seconds and was separated from the next by a dark interval of 10 seconds to allow recovery of the GSR following stimulation and to permit time for changing the slide magazine. The five and ten second intervals were governed by a cam-operated interval timer. A second timer was utilized to activate the marker mechanism of the psychogalvanometer whenever a new word appeared on the screen.

The unconditioned stimuli were controlled manually by momentarily depressing the "operate switch" of the psychogalvanometer. The duration of the UCSs was regulated by automatic timer.

The experiment was conducted in a two-room, sound-treated, auditory testing unit located in the Speech and Hearing Clinic of the University of Alabama Medical Center. The experimental room was furnished with a comfortable chair equipped with armrests and Velcro armstraps; a second padded chair served as a footrest. Before the subject was a projection screen. A loudspeaker was located behind the subject's chair. The control room, where the experimenter remained throughout, contained the recording and projection equipment. A loudspeaker system provided intercommunication.

Verbal Stimuli

The verbal stimuli for semantic conditioning and generalization were chosen empirically using a method developed by Martha Mednick (1957) in a study of mediated generalization and the "incubation effect." The 25 words comprising the word lists for the preliminary phase, for conditioning, generalization, and extinction phases of the experiment, are shown in Table 3. The conditioned stimulus was the word "light" which was obtained as an association to a number of words on the Kent-Rosanoff word list in a

TABLE 3

VERBAL STIMULI: CS, FIVE GENERALIZATION WORDS, FOURTEEN NEUTRAL WORDS

Carpet	Hand	Light*	River
Dark**	Heavy**	Moth	Soft**
Earth	High	Needle	Square***
Fruit	House	Order	State
Girl	Lamp**	Rest	Window

*Conditioned stimulus
**Generalization words
***Neutral test word

recent study at the University of Minnesota (Russel & Jenkins, 1954). The words "dark, heavy, soft," and "lamp" which, in association, elicited the CS"light" most frequently, served as generalization stimuli. Neutral filler words (a neutral word being one to which "light" was not associated by the Minnesota group) were also selected from the Kent-Rosanoff word list. To insure that high and low anxious subjects did not differ significantly in their word associations prior to the experiment, the Kent-Rosanoff word list was administered to all subjects and their association frequencies compared with those reported by Martha Mednick (1957) for Minnesota and Northwestern students (see Table 4). While the association frequencies of "light" were somewhat higher than found at the other two universities, no important differences were found between high and low anxious subjects. The complete word lists utilized for the preliminary phase, and for conditioning, generalization, and extinction are reproduced in Appendix II.

Procedure

Each subject was met by the experimenter's assistant and conducted to the experimental chamber. After being seated in the lighted room with back toward the control window, initial instructions were read by the experimenter through the loudspeaker:

TABLE 4

PER CENT OF SUBJECTS ASSOCIATING "LIGHT" TO GENERALIZATION WORDS

Sample	N	Generalization Words Dark	Heavy	Lamp	Soft
Minnesota					
HA	28	86	54	50	0
LA	28	82	57	61	0
Northwestern					
HA	25	60	32	60	4
LA	25	64	60	60	0
Alabama					
HA	38	77	61	86	6
LA	37	73	57	80	3

> You have been asked to take part in an experiment which is concerned with the way in which people learn certain types of material. The experiment will last approximately one hour and will consist of three parts. During part one, you will be asked to listen to some sounds through the loudspeaker. During part two, you are to read aloud some words projected on the movie screen in front of you and to listen to more sounds. During part three, you will be asked to answer some questions.

The assistant then attached the subject to the apparatus while the experimenter gave the following running commentary:

> This is just rubbing alcohol to clean off your fingers before the experiment. We also have to connect your right arm to the armrest. Now please put your feet on this padded chair so you will be more comfortable.

While the assistant applied the electrode paste, the experimenter said:

> This paste is needed to get a reading on our instrument. Please do not remove any connections until the very end of the experiment. Keep as relaxed as possible and try to think of nothing in particular. You will be most cooperative if you remain very quiet, keeping movements at a minimum. Speak only in response to questions. We shall now turn off the light and close the door but you remain, of course, in contact with me through the loudspeaker system.

After the lights were dimmed, the subject was instructed to listen and to say "yes" when she heard the tone (500 cps). Each trial was introduced with the word "ready" by the experimenter. Absolute thresholds for loudness were established by the method of limits, defined as the lowest

intensity at which the subject responded to three or more of six presentations. The tone to be used as UCS was then set on the audiometer and the output of the audiometer connected to the stimulus control mechanism.

The preliminary phase of the experiment followed immediately and was introduced with the following instructions:

> After this first part of the experiment, a series of words will be shown on the screen directly in front of you, and you will again hear some tones through the loudspeaker. As soon as each word appears, I want you to read it aloud in your normal speaking voice. You do not have to tell me when you hear the tones. In fact, no talking is involved apart from the reading. You will be most cooperative if you remain very quiet during this part of the experiment, keeping movements of the body at a minimum. Are there any questions? Then we shall proceed. If necessary, I shall contact you through the intercom system.

The preliminary phase consisted of three steps: First, the CS "light and the 14 neutral words were projected on the screen before each subject once in a random order but without reinforcement. Next, the tone selected as UCS was delivered three times while the screen remained dark, and no word presented. The preliminary phase was concluded with a second random presentation of the 15 verbal stimuli again without accompanying UCS. This procedure was employed to ascertain whether the subjects had understood the experi-

mental directions before actual conditioning was begun. It was also introduced to make possible an assessment of pseudoconditioning which has presented problems in classical eyelid as well as GSR conditioning (Hilgard & Marquis, 1940).

During the conditioning phase of the experiment, which followed immediately, a series of words consisting of 14 neutral words and 6 presentations of the CS "light" was projected four times. Both the neutral words and the conditioned stimuli were arranged differently for each of the four word lists to control for position effects. The lists are contained in Appendix II. The CS remained on the screen for five seconds and was followed two seconds later on reinforced trials by the UCS which lasted three seconds. Reinforcement was delivered randomly 50 per cent of the time to obtain stronger conditioning (Kimble, 1961) and to utilize the trials on which the UCS was omitted as tests for conditioning. A detailed definition of the response measures used as well as of the rationale for using them will be found in a later section.

The generalization-extinction phase of the experiment followed without interruption. During this stage, the subject remained attached to the apparatus but experienced no UCS. The word list for stimulus generalization

and extinction consisted of the CS, the four generalization stimuli and the neutral word "square." Six repetitions of this word list constituted the extinction series. The first repetition was considered a test of semantic conditioning. To combat position effects, the six lists were constructed individually for each of the 75 subjects by shuffling the slides in a box, drawing them randomly, and presenting them in the order drawn.

After the last of the six repetitions, over the loudspeaker, each individual was asked the following questions adapted from Welch and Kubis (1947a):

> Did any of the words suggest anything to you?
> Did the tone disturb you?
> Would you characterize the tone as pleasant, neutral, or unpleasant?
> Did you find yourself anticipating the tone?
> When was the tone given?

The subjects were also assured at that time that their scores on the learning task as well as their answers to the questionnaire would be held confidential. They were urged, upon threat of losing the extra credit, not to discuss the experiment with any of their participating classmates.

CHAPTER IV

RESULTS

Response Measures and Statistical Analyses

The measures and criteria for conditioning were patterned after those used in previous investigations (Becker & Matteson, 1961; Boone, 1960; Mitchell & Zax, 1959; Welch & Kubis, 1947a, 1947b; Wishner, 1962). In consideration of the reported range of GSR latencies (Davis, et al., 1955; Stewart, et al., 1960), a conditioned GSR was defined as the greatest deflection from the baseline yielded during the eight second period following the CS onset on nonreinforced trials.

Several steps were followed in treating the raw data. First, the basal resistance (R 1) for each subject was translated into basal conductance (C 1). Next, the new resistance level (R 2) following the presentation of the CS was obtained by subtracting the resistance change[1] (Δ R) from the basal resistance (R 1). This value was then converted into conductance (C 2). Finally, conductance

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[1]The resistance change (Δ R) was taken directly from resistance tracings following a suggestion of Grason (1962) and Mednick (1957, 1962) by measuring with a caliper the height of galvanometric deflections using the 1000 ohm deflection as the unit. Thus a deflection from the baseline of 1 millimeter was equal to a resistance change of 1000 ohms; a deflection of three millimeters, 3000 ohms, etc.

change (Δ C), the response measure analyzed in this experiment, was obtained by subtracting C 1 from C 2. For example, if a subject had a basal level of 100,000 ohms, which dropped 20,000 ohms upon stimulation, the new resistance level would be 80,000 ohms. Converting into conductance units (micromhos), basal conductance would then be (1/100,000) x (10^6) or 10 micromhos, conductance following stimulation would be (1/80,000) x(10^6) or 12.5 micromhos, and the conductance change, in turn, would be found to be 2.5 micromhos.

Three scores were computed for each subject:

To evaluate the effectiveness of the stress method, a Preliminary Score was obtained by summing the conductance changes in micromhos (Δ C) to the three UCS presentations during the preliminary phase of the experiment.

To measure semantic generalization, a Generalization Score was obtained by summing the conductance changes in micromhos (Δ C) to the words "lamp, dark, heavy," and "soft" (generalization stimuli) during the generalization phase of the experiment (first extinction series).

As a measure of extinction, an Extinction Score was obtained by summing the conductance changes in micromhos (Δ C) to the word "light" (CS) during the six extinction series.

Preliminary scores were computed for all 75 subjects, generalization and extinction scores only for the 68 individuals meeting the following criterion of conditioning: An individual was considered conditioned when two of three consecutive presentations of the CS alone elicited a galvanic skin response greater than that accompanying the last neutral word immediately preceding the CS.

The present experiment relied on parametric tests for the evaluation of performance differences among the four experimental groups. The use of variance analysis as well as *t* tests seemed justified since it has been demonstrated that conductance change does not violate the usual criteria for the use of parametric statistics (Lacey, 1947; Lacey & Siegel, 1949). Further, Boneau (1960) has shown that the *t* test is not greatly affected by non-normality, provided the samples are approximately equal in size.

Pseudoconditioning

As indicated earlier, to assess the possible confounding effects of pseudoconditioning (Hilgard & Marquis, 1940), the CS and the 14 neutral words were shown to each of the subjects once before and once after presenting independently the UCS three times. If pseudoconditioning had taken place, the subjects should show a stronger response to the second presentation of the preliminary word

series. The GSR recordings made during the presentation of each of the two preliminary word lists were cut out of the seventy-five records, and six independent judges were asked to sort the polygraph tracings into two groups. They were instructed that the paper strips represented physiological recordings made under two different experimental conditions, that the "pile" need not be divided equally, and that they could use as much time as they needed in putting together the records which looked alike or belonged together. This sorting procedure rested on the assumption that the psychogalvanometer used in the study was sensitive enough to reflect pseudoconditioning which could be distinguished by the judges. Table 5 shows how many per cent of the judges were able to identify correctly whether the record belonged to the first or second of the two preliminary word series. It was concluded that pseudoconditioning had not entered into the experimental situation, since the judges were so close to chance in their discrimination.

Anxiety Criterion

To demonstrate that the respective anxious and non-anxious subgroups were comparable in anxiety level, the scores for the four experimental groups on the Forced-Choice Manifest Anxiety Scale, (Table 2, p.36) were examined by *t* test. Table 6 presents relevant *t* values. The very significant

Table 5

PER CENT OF TRACINGS IDENTIFIED
CORRECTLY BY SIX JUDGES*

Judges	Tracings 1 (N 75)	Tracing 2 (N 75)
1	51	53
2	52	48
3	49	50
4	53	52
5	47	50
6	51	48

50% represents a chance sorting

Table 6

COMPARISONS OF MEAN ANXIETY SCORES

Groups	*t*	D.F.
HAWT vs. HAST	0.61	36
HAWT vs. LAWT	15.62**	36
HAWT vs. LAST	14.03**	33
HAST vs. LAWT	16.14**	35
HAST vs. LAST	16.29**	35
LAWT vs. LAST	0.20	35
(HAWT + HAST) vs. (LAWT + LAST)	9.55**	73
(HAWT + LAWT) vs. (HAST + LAST)	1.01	73

**P < .01

difference between high and low anxious groups confirm the efficiency of the procedure for selecting subjects. No significant differences were found between the means of the two anxious groups. Similarly, no differences were found between the two nonanxious groups.

Stress Method

To determine whether the use of strong and weak tones as unconditioned stimuli had successfully produced two different degrees of stress, unconditioned response amplitudes (ΔC) recorded during the preliminary phase of the experiment and answers to the inquiry were analyzed. Appendix III (Tables A, B, and C) presents the means and standard deviations of total UCR amplitudes yielded during the preliminary phase (Preliminary Score), a summary of an analysis of variance of these scores, and a tabulation of answers to the four unanalyzed inquiry questions.

The analysis of variance of the total of the three unconditioned GSR conductance changes recorded during the preliminary phase (Preliminary Scores) yielded a significant F value ($P < .05$) for intensity differences. This indicates that the experimental groups receiving a strong tone as UCS (HAST plus LAST) responded more strongly than did groups administered a weak tone (HAWT plus LAWT). The significant ($P < .05$) F for anxiety indicates that high anxious groups (HAST plus HAWT) responded more strongly than did low anxious groups (LAST plus LAWT).

Answers to question three of the inquiry ("Would you characterize the tone as pleasant, neutral, or unpleasant?"), constituting a subjective estimate of the success of the stress method, are summarized in Table 7.[1] Groups HAWT and LAWT, conditioned with the weak (70 db) UCS overwhelmingly rated it as "neutral." It appears that the stimulus designated as non-noxious was actually perceived as such by a vast majority of subjects in these groups. It may also be seen that an overwhelming majority of the members of Groups HAST and LAST rated the strong (90 db) UCS as "unpleasant." Separation of these two pairs of subgroups is so patent as to invite no statistical assessment.

In summary, from the variance analysis of the unconditioned response to the UCS during the preliminary phase and from the verbal judgments, it is concluded that the methodology followed in this experiment did indeed produce two differing degrees of stress or noxiousness.

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[1]It is interesting to speculate on how the experimental subjects would have responded, if the inquiry had been conducted earlier during the experiment, perhaps right after the preliminary phase. It seems possible that the "loaded" form of question three might have led to stronger conditioning, since verbal threats of applying a stronger UCS have been successful in producing stronger eyelid conditioning in several studies (Taylor, 1951; Spence, Farber, & Taylor, 1954; Spence & Goldstein, 1961).

Table 7

PER CENT OF SUBJECTS RATING THE UNCONDITIONED STIMULUS AS "PLEASANT, NEUTRAL" OR "UNPLEASANT"

Group	N	Pleasant	Neutral	Unpleasant
HAWT	18	5	90	5
HAST	20	0	10	90
LAWT	20	0	95	5
LAST	17	0	12	88

Generalization

The records of the sixty-eight subjects who met the criterion of conditioning were used for the analysis of semantic conditioning. Mean GSR amplitudes (conductance change) in response to the CS, to the four generalization stimuli, and to the neutral word observed during the first extinction series are presented in Table 8. Differences in generalization among the four experimental groups are quite striking.

In contrast to Mednick's study (1957), there occurred some generalization to the presumably neutral word "square." To demonstrate that all groups showed a significantly greater response to the generalization words than to "square" (the control stimulus), mean differences between the lowest amplitude for a generalization word and the highest amplitude for the neutral word were compared by t test. The difference between "soft" (at 0.31 micromhos) and "square" (at 0.16 micromhos) was found to be significant at the .05 level ($t = 2.32$). Since all other generalization words yielded greater GSR amplitudes, and because all "square" amplitudes were smaller, it was concluded that the various groups were all probably significantly greater in GSR responsiveness to the generalization stimuli than to the "neutral" word.

Table 8

MEAN GSR AMPLITUDES IN MICROMHOS FOR EACH WORD DURING THE GENERALIZATION (FIRST EXTINCTION) SERIES

Groups	N	Light	Lamp	Dark	Heavy	Soft	Square
HAWT	17	1.02	0.67	0.60	0.53	0.51	0.12
HAST	20	1.27	0.95	0.89	0.68	0.46	0.16
LAWT	15	0.75	0.57	0.52	0.33	0.38	0.12
LAST	16	0.84	0.60	0.59	0.48	0.31	0.08

The means and standard deviations of total GSR amplitudes (Generalization Scores) to the generalization words "lamp, dark, heavy," and "soft" are shown in Table 9. The results of a variance analysis of these measures (see Table 10) clearly support the acute hypothesis, i.e., the interaction between anxiety and UCS intensity is seen to be highly significant ($P < .01$). Additionally, in accord with the general theory, as a main effect anxiety was found to be highly significant ($P < .01$). UCS intensity as a main effect was also found to be significant ($P < .05$).

Extinction

Table 11 shows mean GSR amplitudes in response to the word "light" during each of the six extinction series for the 68 individuals comprising the four experimental groups. High anxious subjects conditioned with a strong UCS (HAST) showed the greatest GSR responsiveness throughout the full extinction series. High anxious subjects who had experienced a weak UCS (HAWT) yielded a smaller GSR amplitude during extinction. The two low anxious groups (LAWT and LAST) demonstrated considerably less responsiveness during extinction than did the high anxious groups. Both manifested a GSR amplitude of zero after five extinction trials.

Table 9

MEANS AND STANDARD DEVIATIONS OF TOTAL GSR AMPLITUDES IN MICROMHOS DURING GENERALIZATION TO "LAMP, DARK, HEAVY," AND "SOFT"

Groups	N	Mean	S.D.
HAWT	17	2.32	0.75
HAST	20	2.98	1.12
LAWT	15	1.80	0.70
LAST	16	1.99	0.73

Table 10

ANALYSIS OF VARIANCE OF TOTAL GSR AMPLITUDES DURING GENERALIZATION TO "LAMP, DARK, HEAVY" AND "SOFT"

Source	D.F.	Mean Square	F
Anxiety	1	11.41	16.30**
Stimulus Inten.	1	3.24	4.62*
A x S Inten.	1	6.86	9.80**
Within	64		
Total	67		

*P < .05

**P < .01

Table 11

MEAN GSR AMPLITUDES TO "LIGHT" (CS) FOR FULL EXTINCTION SERIES

Groups	N	1	2	3	4	5	6
HAWT	17	1.02	0.78	0.45	0.30	0.44	0.33
HAST	20	1.27	0.84	1.03	0.68	0.51	0.48
LAWT	15	0.75	0.50	0.42	0.24	0.10	0.00
LAST	16	0.84	0.65	0.47	0.25	0.00	0.00

Table 12 presents the means and standard deviations of total extinction amplitudes and Table 13 summarizes an analysis of variance of these measures. Again, in agreement with the acute hypothesis, a significant interaction effect ($P < .05$) was found. Anxiety as a main effect was found to be significant ($P < .01$); as was UCS intensity ($P < .05$).

Table 12

MEANS AND STANDARD DEVIATIONS OF TOTAL GSR AMPLITUDES IN MICROMHOS DURING EXTINCTION

Groups	N	Means	S.D.
HAWT	17	3.32	1.56
HAST	20	4.81	1.91
LAWT	15	2.01	1.28
LAST	16	2.21	1.47

Table 13

ANALYSIS OF VARIANCE OF TOTAL GSR AMPLITUDES DURING EXTINCTION

Source	D.F.	Mean Square	F
Anxiety	1	63.65	24.96**
Stimulus Inten.	1	10.53	4.13*
A x S Inten.	1	11.99	4.70*
Within	64		
Total	67		

*P < .05

**P < .01

CHAPTER V

DISCUSSION

The present experiment revealed a significant interaction between anxiety and the intensity of unconditioned stimulation. Anxiety and UCS intensity were also found to be significant main effects. And these findings were consistent for both generalization and extinction measures.

Extinction and generalization scores were collected in the present study as indices of performance and learning (Kimble, 1961; Osgood, 1953) because of their relative neglect in past tests of the chronic - acute hypothesis (see also Table 1, page 24). A relation between anxiety and stimulus generalization has been demonstrated previously for semantic (Lacey & Smith, 1954; Mednick, 1957), spatial (Rosenbaum, 1953), and temporal generalization (Wenar, 1954). Extinction scores were significantly related to anxiety in two GSR studies (Bitterman & Holtzman, 1952; Mednick, 1957) and an eyelid study (Spence & Farber, 1953). In two additional studies, one of the GSR (Wickens, Allen, & Hill, 1963), and one of the eyelid response (Taylor, 1951), extinction scores reached only marginal significance.

It is interesting to speculate about the extent to which the results reflect long term (learning) and temporary (performance) changes in behavior. An inspection of the theoretical schema summarizing the Spence-Taylor theory (see Fig. 1, page 9) would suggest changes in performance rather than in learning. It can be seen that the learning factor (H) is affected only by the number of reinforcements (N). The two antecedent variables, anxiety scores (RA) and intensity of unconditioned stimulation (UCS), manipulated in the present experiment, influence only the motivational variable (D) via the hypothetical emotional response (r_e). Thus, any change in excitatory potential (E) and, hence, in the performance measure (Rp) must be attributed to drive (D) rather than habit strength (H).

Our findings can also be related to a recent study by Spence (1956, 1960) which suggests that motivational variables, such as the ones manipulated by us, influence both performance and learning. In this experiment, the factorial design was employed which has been traditionally used for untangling the effects of learning from those of performance (Kimble, 1961). During training, Spence conditioned one group of subjects with a weak air puff (UCS) to yield an eyelid response; the other group received a strong air puff. On the following day, the two groups

were each divided into two equal subgroups. Half of the subjects from each group continued with the same UCS; half were switched to the other intensity. The significant relation between response level and UCS intensity on the first day is in line with the notion that learning is affected by drive strength. A relation between drive strength and performance can be inferred from the effect of UCS intensity on conditioning during the second training period. While the present study was not specifically concerned with the learning - performance issue, our significant extinction and generalization findings would leave room for a similar "historical" or "habit strength" interpretation. Perhaps different amounts of habit strength (H) were developed during training which persisted when the UCS was removed. Spence (1956) actually suggested that an extinction procedure, rather than a second training procedure, might help solve the learning-performance issue, at least as far as the UCS intensity variable is concerned. Unfortunately, the application of our findings to this problem is limited since the extinction technique recommended by Spence differs considerably from the extinction procedure employed by us.

Our results are seen as having implications for a number of important theoretical and practical issues. The significant interaction effect obtained contributes

toward a solution to the chronic - acute problem, suggesting that anxiety as measured by the HFC-MAS (Heinemann, 1953) is largely an acute reaction to different levels of stress. Many items in the HFC-MAS and the MAS are indicative of physiological response to situational stress (Aiken, 1962; O'Connor, Lorr, & Stafford, 1957), and, intrinsically, reflect acute anxiety (Krause, 1961). Noting the noxious character of eyelid conditioning, where the MAS has enjoyed its most conspicuous success, Kimble (1961) and Spence (1964) seem to come to the same conclusion. An acute view of anxiety agrees well with clinical experience (Cameron, 1947; Dollard & Miller, 1950; Laughlin, 1956; May, 1950).

The present study stands alone in finding interaction between anxiety scores and UCS intensity in semantic GSR conditioning. However, three studies of relatively simple learning have yielded comparable results (Beam, 1955; Rosenbaum, 1953; Sweetbaum, 1963); one study (Beck, 1963) does not appear to be in agreement. Beam (1955) found significantly better GSR conditioning in subjects experiencing realistic stress (e.g., imminence of doctoral orals) than in subjects free of stress. The combination of fear of Ph.D. orals plus additional stress in the form of a noxious UCS (shock) could possibly have produced an interaction effect comparable to the one observed in this study.

In like manner, we can interpret the results of an experiment by Sweetbaum (1963), in which individuals about to undergo major surgery (high anxious group) conditioned more readily than those who had recovered from surgery (low anxious group). Using a reaction time situation to study the effects of anxiety scores and three levels of stressful stimulation on spatial stimulus generalization, Rosenbaum (1953) approximated our results. He, too, found a significant interaction effect. Results not in agreement with the acute hypothesis were reported by Beck (1963) who studied the effect of CS intensity, UCS intensity, and MAS scores on eyelid conditioning and failed to demonstrate interaction among these variables. The interpretation of this finding is clouded by Beck's use of anxiety scores less extreme than those recommended by Taylor (1953) and by his failure to validate the noxiousness of the CS and UCS intensities. Transitory anxiety (stress) can be reliably inferred only from the joint presence of a stressor, reported fear, and ANS activation (Krause, 1961). The present experiment met these requirements.

The reliable UCS intensity effect constitutes a novel finding. The only published study examing the relation between intensity of the UCS (shock) and extinction of the conditioned GSR (Wickens, Allen, & Hill, 1963)

yielded a marginal UCS effect (P=.16). Of relevance, it appears that these investigators, again, defined their noxious and non-noxious UCS intensities intuitively. Despite the present positive findings in favor of a UCS intensity effect in GSR conditioning, the need for continued investigation of this variable, alone as well as in conjunction with anxiety scores, is indicated.

A secondary purpose of this experiment was to add to our understanding of semantic generalization and extinction. It appears that our findings are in agreement with the Russian studies carried out under less well-controlled conditions (Luria, 1961; Luria & Vinogradova, 1959). The apparent ease with which semantic conditioning was established in our experiment and its sensitivity to motivational factors recommend the use of this method for the further study of simple conditioning as well as more complex learning.

Inspection of the generalization data (see Table 8) reveals the value of utilizing conditioning in the study of word meaning. It appears that GSR responsiveness during generalization conforms to a gradient defined by the degree to which each of the generalization words was associatively related to the conditioned stimulus. Thus, the word "lamp," which was given as a word association to "light" by the

majority of the anxious and nonanxious subjects on the Kent-Rosanoff Word Association Test, evoked the greatest GSR in all four groups. It was followed in responsiveness by the word "dark," which was the next most frequently associated word to "light." The two words, "heavy" and "soft," given least frequently as associations, produced the lowest GSR amplitudes during generalization. These findings hold true for all four experimental groups and suggest a highly reliable relation. The finding that the word "lamp" produced the greatest response, in both the present study and in Mednick's experiments, is in accord with the earlier studies of Riess (1940, 1947), who found that individuals generalized a conditioned GSR more strongly to synonyms of the CS than to both homonyms and antonyms. The word "dark," is an exception to the above since it elicited the weakest response in Mednick's experiment, although it was most frequently associated with the word "light" in her normative group. The greater responsiveness to the word "dark," observed in the present study may be attributed to differences in experimental conditions. Perhaps the present subjects responded more strongly to "dark" because conditioning took place in a dark room, while Mednick's subjects were conditioned in daylight.

The surprisingly strong response to the word "soft," which also occurred in Mednick's study, suggests that more than chance factors are responsible.

The scores representing the extinction of the conditioned GSR to the word "light" are irregular (see Table 11), but show the general pattern of extinction scores reported by previous investigators (Bitterman & Holtzman, 1952; Mednick, 1957). Both anxious groups yielded greater GSR amplitudes throughout the extinction series, duplicating the findings of Bitterman and Holtzman (1952) and of Mednick (1957).

CHAPTER VI

SUMMARY

The present study investigated two alternative hypotheses (chronic vs. acute) about the nature of human anxiety, its relation to intensity of noxious stimulation, and its energizing effect in simple learning situations. According to the chronic hypothesis, an interaction between anxiety scores and UCS intensity should not result. According to the acute hypothesis, a significant interaction should obtain.

Thirty-eight female students in the upper 20 per cent on the Heinemann Forced Choice Manifest Anxiety Scale (HFC-MAS) were randomly divided and used as high anxious groups. Thirty-seven female students comprising the lower 20 per cent constituted two low anxious groups. One high anxious and one low anxious group were then conditioned to the word "light" by pairing this CS with a tone (500 cps at 70 db) which served as a non-noxious UCS. The other two groups were conditioned utilizing a much louder tone (500 cps at 90 db) which served as the noxious UCS. After conditioning, tests were made of semantic generalization and extinction.

The main findings were: (a) a significant interaction between anxiety scores and the intensity of uncon-

ditioned stimulation obtained, (b) a significant anxiety effect was demonstrated, and (c) a significant UCS intensity resulted. These effects held true for both generalization and extinction measures.

The present results support the assumption that high scores on the Heinemann Forced Choice Anxiety Scale reflect an "acute" state of anxiety (acute hypothesis).

APPENDIX I

Kent - Rosanoff Word Association Test

Name:_____ Occupation:_____

Date:_____ Class standing:_____

Age:_____ School:_____

Sex:_____

"THIS IS ONE OF THE STUDIES IN VERBAL BEHAVIOR BEING CONDUCTED AT THE UNIVERSITY OF ALABAMA. THIS PARTICULAR EXPERIMENT IS CONCERNED WITH FREE ASSOCIATION.

PLEASE WRITE YOUR NAME ON THE TOP OF THE PAPER PASSED TO YOU.

WHEN YOU LOOK AT THESE SHEETS, YOU WILL SEE A LIST OF 100 STIMULUS WORDS. AFTER EACH WORD WRITE THE FIRST WORD THAT IT MAKES YOU THINK OF. START WITH THE FIRST WORD: LOOK AT IT: WRITE THE FIRST WORD IT MAKES YOU THINK OF: THEN GO ON TO THE NEXT WORD.

USE ONLY A SINGLE WORD FOR EACH RESPONSE.

DO NOT SKIP ANY WORDS.

WORK RAPIDLY UNTIL YOU HAVE FINISHED ALL WORDS.

ARE THERE ANY QUESTIONS?

READY? GO."

No.	Stimulus	Response	No.	Stimulus	Response
1.	Table	_____	23.	Woman	_____
2.	Dark	_____	24.	Cold	_____
3.	Music	_____	25.	Slow	_____
4.	Sickness	_____	26.	Wish	_____
5.	Man	_____	27.	River	_____
6.	Deep	_____	28.	White	_____
7.	Soft	_____	29.	Beautiful	_____
8.	Eating	_____	30.	Window	_____
9.	Mountain	_____	31.	Rough	_____
10.	House	_____	32.	Citizen	_____
11.	Black	_____	33.	Foot	_____
12.	Mutton	_____	34.	Spider	_____
13.	Comfort	_____	35.	Needle	_____
14.	Hand	_____	36.	Red	_____
15.	Short	_____	37.	Sleep	_____
16.	Fruit	_____	38.	Anger	_____
17.	Butterfly	_____	39.	Carpet	_____
18.	Smooth	_____	40.	Girl	_____
19.	Command	_____	41.	High	_____
20.	Chair	_____	42.	Working	_____
21.	Sweet	_____	43.	Sour	_____
22.	Whistle	_____	44.	Earth	_____

No.	Stimulus	Response	No.	Stimulus	Response
45.	Trouble	_____	67.	Hungry	_____
46.	Soldier	_____	68.	Priest	_____
47.	Cabbage	_____	69.	Ocean	_____
48.	Hard	_____	70.	Head	_____
49.	Eagle	_____	71.	Stove	_____
50.	Stomach	_____	72.	Long	_____
51.	Stem	_____	73.	Religion	_____
52.	Lamp	_____	74.	Whiskey	_____
53.	Dream	_____	75.	Child	_____
54.	Yellow	_____	76.	Bitter	_____
55.	Bread	_____	77.	Hammer	_____
56.	Justice	_____	78.	Thirsty	_____
57.	Boy	_____	79.	City	_____
58.	Light	_____	80.	Square	_____
59.	Health	_____	81.	Butter	_____
60.	Bible	_____	82.	Doctor	_____
61.	Memory	_____	83.	Loud	_____
62.	Sheep	_____	84.	Thief	_____
63.	Bath	_____	85.	Lion	_____
64.	Cottage	_____	86.	Joy	_____
65.	Swift	_____	87.	Bed	_____
66.	Blue	_____	88.	Heavy	_____

No.	Stimulus	Response
89.	Tobacco	_____
90.	Baby	_____
91.	Moon	_____
92.	Scissors	_____
93.	Quiet	_____
94.	Green	_____
95.	Salt	_____
96.	Street	_____
97.	King	_____
98.	Cheese	_____
99.	Blossom	_____
100.	Afraid	_____

APPENDIX II

Preliminary Word Lists
Conditioning Word List
Generalization-Extinction Word List

Preliminary Word Lists:

A	B
high	carpet
order	needle
house	order
moth	earth
state	light
girl	fruit
window	girl
rest	river
needle	state
river	high
carpet	house
light	hand
hand	moth
earth	window
fruit	rest

Conditioning Lists:

house	light	earth	carpet
light*	order	light*	needle
hand	river	rest	window
fruit	light	high	light
moth	carpet	river	fruit
light*	state	light*	earth
high	light	window	light*
order	fruit	house	rest
light	window	light	river
river	light*	fruit	light*
window	hand	needle	state
state	house	order	high
light*	moth	light	house
needle	light	girl	light
rest	earth	hand	moth
carpet	high	carpet	hand
light	girl	light	light
girl	needle	moth	order
light*	light*	state	light*
earth	rest	light*	girl

*CS-UCS

Generalization-Extinction Lists (sample order):

lamp	soft	heavy
light	heavy	square
heavy	light	lamp
square	dark	soft
dark	lamp	light
soft	square	dark

light	square	lamp
square	dark	soft
heavy	soft	dark
dark	lamp	heavy
soft	light	lamp
lamp	soft	light

APPENDIX III

A. Means and Standard Deviations of Total Unconditioned GSR Amplitudes During Preliminary Phase

B. Analysis of Variance of Total Unconditioned GSR Amplitudes During Preliminary Phase

C. Per Cent of Subjects Answering "Yes" to Questions 1, 2, 4, and 5 During Inquiry

D.-G. Summaries of Individual Scores for Each Experimental Group

Table A

MEANS AND STANDARD DEVIATIONS OF TOTAL UNCONDITIONED GSR AMPLITUDES IN MICROMHOS DURING PRELIMINARY PHASE (PRELIMINARY SCORES)

Groups	N	Mean	S.D.
HAWT	18	2.88	1.64
HAST	20	3.54	1.56
LAWT	20	1.94	1.32
LAST	17	2.53	1.20

Table B

SUMMARY OF ANALYSIS OF VARIANCE OF TOTAL UNCONDITIONED GSR AMPLITUDES DURING PRELIMINARY PHASE (PRELIMINARY SCORES)

Source	D.F.	Mean Square	F
Anxiety	1	13.60	6.66*
Stimulus Inten.	1	9.54	4.68*
A x S Inten.	1	3.20	1.57
Within	71		
Total	74		

*Significant at the .05 level

Table C

PER CENT OF SUBJECTS ANSWERING "YES" TO QUESTIONS 1, 2, 4, AND 5 DURING INQUIRY

Group	N	Question 1	2	4	5
HAWT	18	6	6	100	100
HAST	20	15	10	95	95
LAWT	20	25	5	100	100
LAST	17	6	12	94	100

TABLE D

SUMMARY OF INDIVIDUAL SCORES FOR GROUP HAWT (HIGH ANXIETY, WEAK TONE)

NUMBER	AGE	IQ	GPA	HFC-MAS	PSC	GSC[a]	ESC[a]
1	18	120	1	68	1.0	1.7	1.4
2	19	107	3	70	5.1	2.8	3.0
3	19	121	2	69	2.4	2.1	1.5
4	19	110	1	64	2.5	2.9	3.5
5	19	112	2	65	3.8	1.6	6.6
6	18	105	2	65	4.4	2.2	2.9
7	20	124	1	66	2.3	2.0	4.5
8	22	116	1	64	1.2	2.1	1.8
9	18	96	1	72	2.6	1.8	4.2
10	18	136	3	75	2.9	2.9	3.6
11	19	124	3	65	5.6	2.6	3.8
12	19	122	2	64	1.6	3.4	2.0
13	19	111	1	70	1.0	1.0	2.6
14	18	123	1	76	1.2	4.1	7.8
15	19	101	1	72	2.1	2.6	2.3
16	18	109	2	68	2.0	2.1	1.5
17	19	107	1	68	3.7	1.5	3.4
18	20	109	1	68	6.5		

Note.--The following abbreviations refer to scores contained in tables D-G: IQ = Intelligence; GPA = Grade Point Average; HFC-MAS = Score on Heinemann Forced Choice Anxiety Scale; PSC = Preliminary Scores in Micromhos; GSC = Generalization Scores in Micromhos; ESC = Extinction Scores in Micromhos.

[a]Generalization and Extinction scores are listed for the 17 individuals who conditioned.

TABLE E

SUMMARY OF INDIVIDUAL SCORES FOR GROUP HAST (HIGH ANXIETY, STRONG TONE)

NUMBER	AGE	IQ	GPA	HFC-MAS	PSC	GSC	ESC
1	18	119	1	71	6.6	2.5	4.7
2	20	105	3	79	2.2	3.0	8.0
3	18	126	1	76	3.8	2.7	5.9
4	21	138	3	76	1.5	2.9	2.1
5	20	106	1	71	7.3	5.7	4.0
6	19	118	2	66	2.9	5.1	5.9
7	19	116	1	64	1.8	2.7	1.0
8	18	119	1	65	4.9	4.0	3.4
9	20	116	2	66	3.8	1.7	4.5
10	18	101	1	68	4.6	3.5	8.9
11	18	116	2	69	4.3	2.5	3.9
12	20	124	2	65	3.5	2.4	2.5
13	20	109	2	64	5.2	2.9	4.3
14	20	128	3	73	3.7	1.7	2.8
15	20	103	1	70	2.9	4.4	3.1
16	17	117	1	68	2.0	2.3	5.7
17	18	120	1	65	1.7	1.7	5.3
18	18	117	1	72	2.8	3.8	5.2
19	18	117	1	70	2.1	2.8	6.6
20	20	101	1	68	3.2	1.3	8.4

TABLE F

SUMMARY OF INDIVIDUAL SCORES FOR GROUP LAWT (LOW ANXIETY, STRONG TONE)

NUMBER	AGE	IQ	GPA	HFC-MAS	PSC	GSC[a]	ESC[a]
1	18	120	1	42	2.6	2.1	0.4
2	22	108	2	40	1.1	0.9	2.8
3	18	114	2	44	1.9	1.7	4.6
4	22	112	1	44	2.0	2.8	0.8
5	18	126	1	25	5.4	1.5	3.5
6	18	111	1	43	3.3	1.6	1.3
7	22	128	2	39	2.9	1.8	0.5
8	21	108	1	44	0.6	1.8	3.6
9	18	117	3	42	0.5	0.9	2.4
10	19	101	1	44	0.1	0.6	1.7
11	18	128	1	42	2.8	1.6	2.5
12	18	109	1	41	3.4	3.0	2.6
13	19	135	2	32	2.1	2.0	1.8
14	19	129	3	40	1.5	2.8	0.7
15	21	129	3	41	0.4	0.9	0.9
16	20	100	2	42	1.8		
17	17	114	1	40	1.6		
18	18	124	1	38	3.0		
19	19	130	1	39	0.8		
20	21	109	3	37	1.0		

[a]Generalization and Extinction scores are listed only for the 15 individuals who conditioned.

TABLE G

SUMMARY OF INDIVIDUAL SCORES FOR GROUP LAST (LOW ANXIETY, STRONG TONE)

NUMBER	AGE	IQ	GPA	HFC-MAS	PSC	GSC[a]	ESC[a]
1	21	117	1	44	4.9	2.0	3.0
2	22	101	1	44	1.3	2.4	1.1
3	19	120	1	41	2.8	2.2	2.3
4	24	107	3	33	1.1	0.9	1.0
5	19	129	1	43	3.7	2.5	6.5
6	20	106	2	42	2.1	1.5	2.9
7	21	97	1	39	4.4	1.4	1.8
8	19	114	1	37	1.5	1.8	1.3
9	20	131	2	41	2.8	1.9	3.0
10	20	124	2	38	2.5	1.5	2.9
11	18	128	3	41	3.0	2.6	1.2
12	21	117	1	40	1.0	2.8	2.2
13	18	109	2	36	1.0	0.6	0.6
14	18	119	2	44	3.9	4.1	0.9
15	20	104	1	41	2.0	1.5	2.0
16	18	108	1	39	1.7	2.1	2.7
17	18	111	1	41	3.3		

[a]Generalization and Extinction scores are listed only for the 16 individuals who conditioned.

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