SERIAL ROTE LEARNING AS A FUNCTION OF ANXIETY

Thesis for the Degree of Ph. D.
MICHIGAN STATE COLLEGE
Ralph A. Enrick
1953

This is to certify that the

thesis entitled

SERIAL ROTE LEARNING AS A
FUNCTION OF ANXIETY

presented by

Ralph A. Enrick

has been accepted towards fulfillment
of the requirements for

Ph. D. degree in Psychology

M. Ray Denny
Major professor

Date September 18, 1953

O-169

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Ralph A. Enrick

A THESIS

Submitted to the School of Graduate Studies of Michigan State College of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

1953

ACKNOWLEDGMENTS

The writer is deeply grateful to his chairman, Dr. M. Ray Denny, who not only evolved the theoretical foundation for this thesis, but actively participated in the design and execution of the experiments. Dr. Denny's ever-helpful and constructive guidance was a constant source of encouragement to the writer. Grateful acknowledgments are also extended to the other members of the guidance committee, Drs. S. Howard Bartley, Alfred G. C. Dietze, Victor H. Noll, and Ingram Olkin for their many helpful suggestions. The writer especially wishes to thank Mr. James Kennedy and Dr. David Berger for their excellent technical advice and for their encouragement during all phases of the research.

Sincere thanks are due to Drs. Kurt Koster and Ruth S. Tibbits of Herman Kiefer Hospital, Dr. William Howard of Maybury Sanatorium, and Dr. E. W. Gentles of the Michigan State Sanatorium for their kind permission to use their facilities; to the hospital staffs and personnel for their fine cooperation; to Messrs. John Jordan, Oliver Agee, Miles Pothast, and Hugh Cranson for their assistance in the preparation and administration of the college

experiment; and to the students at Michigan State College who served as subjects. Above all, heartfelt thanks are extended to the patients of the tuberculosis hospitals, whose spiritual courage and friendly cooperation were an inspiration to the writer.

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AN ABSTRACT

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Approved M. Ray Denny

Two principal hypotheses respecting anxiety and verbal learning were under investigation: Spence's and Taylor's hypothesis (3) that anxiety, as drive, multiplicatively augments the absolute difference in strength between correct and incorrect response tendencies; and the present experimental hypothesis that task-oriented anxiety responses aid learning, while disruptive anxiety responses impede it. An attempt was made to minimize task-oriented anxiety by using a non-college population and a real-life stress situation as a source of anxiety.

A study by Berger (1), using Rorschach, Word Association, and Digit Span Tests, had indicated that newly admitted tuberculosis patients were significantly more anxious than long-term hospitalized tuberculosis patients. The present design therefore employed 40 new tuberculosis patients as an experimental group, and 40 old patients (hospitalized six months or more) as a control. Half of each group learned a list of nine nonsense-syllables plus a list of nine "anxiety-related words", with 20 trials for each; the other half learned one list of nine difficult nonsense syllables, being allowed 40 trials. A digit Span Test, which had succeeded in differentiating "high-anxious" from "low-anxious" subjects in Berger's and other studies, was given to all subjects.

Contrary to expectations, no significant differences between new and old patients were found on any of the three learning tasks or on the Digit Span Test. It was concluded that there was insufficient evidence for assuming that differences in anxiety level existed between the two groups. The comparison thus failed to provide an adequate test of learning under anxiety. If differences in anxiety level did exist, they failed to affect the learning tasks.

Using the same population, a comparison was also made between patients scoring high and low on Taylor's Anxiety Scale (4). Differences in learning were again statistically non-significant. In the case of the easy list, however, there was a trend in favor of the low-anxious group ($P = .10 - .20$). This was contrary to Montague's findings (3) and in line with the present hypothesis that high-anxious non-college subjects would do less well in the learning of the easy task, due to the prevalence of disruptive anxiety and the absence of task-oriented anxiety. The present tentative finding encourages hopes for a future investigation along similar lines with a larger sample.

An additional experiment was performed with 119 Michigan State College students, using the Anxiety Scale and a list of 12 easy nonsense syllables, allowing 19

trials. Top and bottom twenty per cent on the Anxiety Scale constituted high- and low-anxious subjects respectively. Group administration was used, and individual achievement was deemphasized in order to minimize anxiety arousal. In accordance with the experimenter's hypothesis that anxiety facilitates learning only when task-oriented anxiety responses are aroused, and contrary to Montague's findings (3), high-anxious subjects learned the list no better than low-anxious subjects.

The results of the second and third parts of the present investigation are held to be more in line with the present theoretical framework than with Spence's and Taylor's construct of anxiety as drive.

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CHAPTER I

INTRODUCTION TO THE PROBLEM

A. The Concept of Anxiety

Anxiety has been singled out by Freud as the crucial problem of emotional and behavioral disorders (7), and has been designated by Horney as "the dynamic center of neurosis" (13). In spite of its assumed importance as a concept, the word "anxiety" is applied rather indiscriminately in many contexts and situations. Most writers fail to define anxiety adequately prior to discussing it, and one rather gets the impression that the authors assume that anxiety is an obvious, universally understood phenomenon, one which is so common that the average reader is expected to have acquired an understanding of it through personal experience or contextual language learning. Such an assumption can hardly be considered justified, in view of the uniqueness of individual feeling and perception and the inadequacy of verbal communication.

While the loose use of such a concept in a clinical setting may have considerable usefulness, it becomes a grave obstacle when applied to rigorous experimental research and

thinking. In one sense, the concept "anxiety" refers to a state of inner disorder, uncertainty, and confusion, and thus represents the very antithesis of a clearly definable concept. Such analyses of anxiety as provided by psychoanalytic writers, in particular, do not usually lend themselves to rigorous experimental verification, in spite of the thorough probing into the dynamics of anxiety.

One example may serve to illustrate the lax use of the term "anxiety" which is so common today. Horney (13) points out that some people who "have anxiety" are unaware of its existence, but do experience "its physical concomitants", such as increased heartbeat, sweating, etc. Thus Horney assumes the presence of anxiety when certain physical manifestations are present. A logical objection to this is to ask whether anxiety is defined as a subjective experience or a physical manifestation, or either or both. If it is either, then it should bear a different name in each case. If it is both, then the absence of conscious awareness disqualifies a condition from being called "anxiety". To say that a person feels anxious and yet does not know it sounds to the present writer like a contradiction in terms.

Some of the following divergent ways in which the word "anxiety" has been used are presented below:

1. As a concept which designates a long-term generalized tendency toward insecurity.

The individual's anxiety may be restricted to certain areas and certain times, but a number of self-statements of occasional or lasting insecurities is taken as evidence of a certain static degree of anxiety. This is the type of concept used for Taylor's Anxiety Scale (36).

2. As a concept of acute stress in such situations as a final examination or prior to a surgical operation, etc. (cf. Berger, 1).
3. As a dynamic concept (cf. Freud (7), Horney (13), May (21). In this context, anxiety may be an acutely experienced stress situation, or it may be inferred as a long-term personality factor from the presence of certain defense mechanisms such as compulsions, rationalizations, etc.
4. As a general concept denoting stress of varying degrees. Used in this way, the term anxiety may subsume even fear of a specific object, as long as it causes some degree of discomfort. An example of this is Mowrer's early work, in which fear and anxiety are used interchangeably (27).
5. As a concept qualitatively differentiated from "fear". Anxiety here is treated as generalized and diffuse, without being attached to any

specific object, whereas fear is regarded as a reaction to a specific threat (cf. Freud (7), Horney (13), May (21) . Occasionally psychoanalytic writers, including Freud (7), have made the distinction that fear is a rational, justified apprehension of a real danger, whereas anxiety is irrational and unfounded. This distinction fails to consider that the reality of a danger is largely dependent upon subjective perception. What seems trifling to one person may be very threatening to another. For this and similar reasons, this distinction has been abandoned by recent writers such as May (21).

6. As a state of affairs assumed to exist because of the presence of certain physiological "signs", such as palpitation, increased perspiration, etc. (cf. Horney, 13).

The above list is by no means exhaustive, but it serves to illustrate the wide variety of possible meanings of "anxiety".

Webster's New International Dictionary (40) provides the following definition of anxiety: "A painful uneasiness of mind, respecting an impending or anticipated ill; the state or an instance of being anxious; also, solicitous desire."

"Anxious" is defined by Webster's Dictionary as follows: "Disquieted over a possible or impending ill; concerned or solicitous, especially respecting something future or unknown; being in painful suspense...."

It is readily evident that Webster's definition would be hard put to account for some of the widely divergent uses of anxiety.

Traditionally anxiety, as any other emotion, denotes a subjective experience which is unique to the individual. One of the most thorough and comprehensive definitions of anxiety as an experiential concept is given in Rollo May's recent book The Meaning of Anxiety (21):

> It is agreed by students of anxiety-Freud, Goldstein, Horney, to mention only three- that anxiety is a diffuse apprehension, and that the central difference between fear and anxiety is that fear is a reaction to a specific danger, while anxiety is unspecific, 'vague', objectless. The special characteristics of anxiety are the feelings of uncertainty and helplessness in the face of the danger. The nature of anxiety can be understood when we ask what is threatened in the experience which produces anxiety. The threat is to something in the 'core or essence' of the personality. Anxiety is the apprehension cued off by a threat to some value which the individual holds essential to his existence as a personality. The threat may be to physical or psychological life (death, or loss of freedom), or it may be to some other value which the individual identifies with his existence (patriotism, the love of another person, 'success', etc.)..... The occasions of anxiety will vary with different people as widely as the values on which they depend vary, but what will always be true in anxiety is that the threat is to a value held by that particular individual to be

> essential to his existence and consequently to his security as a personality.... The diffuse and undifferentiated quality of anxiety refers to the level in the personality on which the threat is experienced. An individual experiences various fears on the basis of a security pattern he has developed; but in anxiety it is this security pattern itself which is threatened. However uncomfortable a fear may be, it is experienced as a threat which can be located spatially and to which an adjustment can, at least in theory, be made. The relation of the organism to a given object is what is important, and if that object can be removed, either by reassurance or appropriate flight, the apprehension disappears. But since anxiety attacks the foundation (core, essence) of the personality, the individual cannot "stand outside" the threat, cannot objectify it, and thereby is powerless to take steps to meet it. In common parlance, he feels caught, or if the anxiety is severe, overwhelmed; he is afraid but uncertain of what he fears. The fact that anxiety is a threat to the essential rather than to the peripheral, security of the person has led some authors to describe it as a 'cosmic' experience (Sullivan)..... In fine, the objectless nature of anxiety arises from the fact that the security base itself of the individual is threatened, and since it is in terms of this security base that the individual has been able to experience himself as a self in relation to objects, the distinction between subject and object also breaks down (21, pp. 190-193, italics his).

This is an excellent, thoroughgoing attempt at definition, and yet, in the present state of knowledge all such definitions are subject to certain limitations. For one thing, no subjective experience can be adequately represented in words. The feeling itself can be experienced only by the one individual who is subject to it. Since no outside observer

can experience the feeling, it is impossible to make exact comparisons of the states of "anxiety" of different individuals, even assuming that these should bear certain similarities. Moreover, a definition such as May's, though scholarly and searching, includes of necessity much overgeneralization and speculation. It depends on descriptive concepts, which are themselves in need of definition. Finally, it must be remembered that while all the elements mentioned by May might be present at one time or another, there is no indication as to how strongly or consistently they are associated with anxiety. In view of the difficulties encountered by psychologists who have attempted to devise adequate tests of anxiety, one would suspect that the verbalized attitudes posited by May are far less consistently linked to anxiety than it appears.

From all this, it becomes evident that it is extremely difficult to study anxiety in a rigorous, precise manner. Neither verbalizations nor overt behavior provide reliable indices of experiential anxiety.

Up to the present time, however, most researchers have used constructs of anxiety which do not conform too well with experiential anxiety. The same is true of the present thesis. It is hoped that some light will be shed upon the construct of anxiety, as "drive", as defined by Hull (16).

We shall now turn to some recent studies which have employed anxiety as a hypothetical construct. While the use of the term "anxiety" in such studies is not rigorous, they nevertheless tend to shed some light on some of the phenomena subsumed under anxiety. Roughly speaking, anxiety has been handled experimentally by use of two major constructs.

In the first place, it has been defined in terms of a stimulus, such as a stress situation. For example, stress has been created by subjecting students to electric shock during a performance task (29). While such techniques do not reveal much concerning any individual's anxiety, it is nevertheless plausible to assume that a shocked group is more anxious than an equivalent control-group which is not shocked. The shocked group in such a case might be considered as operating under anxiety, although this is true only in a vague sense.

Secondly, anxiety has been treated in terms of response. Such personality tests as Taylor's Anxiety Scale contain a number of statements which the subject answers as "true" or "false" in relation to himself (cf. App. C). Examples of such statements are: "I believe I am no more nervous than most others"; or "I feel hungry almost all the time", etc.

These statements were selected from the Minnesota Multiphasic Personality Inventory (MMPI) by a group of clinical psychologists, who included only such items which in their judgment reflected clinical anxiety, and on which

they had a high degree of mutual agreement (36). Many of the items on the MMPI are verbalizations of anxiety as experienced by the subject and thus lend partial support to the use of the test as an index of experiential anxiety. Other statements such as, "I frequently notice my hand shakes when I try to do something", are behavioral in nature and reflect anxiety inferentially if at all. As previously explained, neither verbal nor behavioral indices of anxiety are very reliable measures of subjective anxiety. Such inventories have however been widely used in the study of anxiety, perhaps because no better criterion has been available. Empirically the A-Scale of the MMPI has been useful mostly by comparing the performance of the upper and lower 20 per cent of subjects (cf.12, 25); attempts to establish complete correlations between the A-Scale and any measure of performance have not been successful.

In the present study, both the A-Scale and a stressful stimulus situation (tuberculosis hospitalization) have been employed as "anxiety" variables. Calling these variables "anxiety" made it possible to check on certain hypotheses which had employed the construct similarly.

B. The Concept of Anxiety as Drive

In recent years, a number of studies relating to the problem of learning under anxiety have been made. A good

many of these have employed the construct of anxiety as drive, as defined by Hull (16). For this reason, this construct will be briefly explained.

Hull's theory of behavior has the advantage of being a carefully worked out system of testable postulates. Hull conceived of drive as similar to Freud's "libido", i. e. a common denominator of all striving (16, p.24). Hull at first dealt with more easily controllable drives such as hunger, thirst, and sex. He tried to pave the way for studying more complex human social behavior, but died before he was able to work out the details. Others, notably Miller (22), Spence (35), and Taylor (36) have formulated and utilized the concept of anxiety as drive. In most of these studies, when human subjects were used, anxiety was determined by means of Taylor's A-Scale from the MMPI.

The rationale for treating anxiety as a drive is elaborated by Miller (23). He postulates that anxiety has the following characteristics of drives:

1. It can be learned readily.
2. Its reduction serves as reinforcement in the learning of new responses.
3. It tends to intensify any response tendencies that are present during its period of evocation.

The Hullian framework postulates that drive strength (D) multiplied by habit strength (S^HR) determines the response evocation potential (S^ER); (16, p. 242). Expressed as a formula, this reads:

$$S^ER = f(S^HR) \times f(D).$$

According to this postulate, any increase in anxiety as drive will multiplicatively augment the strength of the response tendencies evoked in a particular situation.

This hypothesis was borne out, for instance, in a simple defense conditioning experiment by Taylor (36), in which she found that "manifest anxiety" - i. e. anxiety as measured by the Taylor Scale (A-Scale) tends to facilitate the conditioning of the eyelid response. Taylor interpreted this as indicating that the anxiety drive facilitated the most dominant response tendency in the situation, i. e. the eye blink response to a blast of air.

In another study by Welsh and Kubis (38) it was found that patients psychiatrically classified as anxious developed a conditioned galvanic skin response faster than a " normal" group. In this study the unconditioned stimulus was a buzzer, and the conditioned stimulus was a nonsense syllable. This was confirmed in a similar study by Bitterman and Holtzman (3), who found that the GSR (galvanic skin response) conditioned faster and extinguished more slowly in anxious subjects.

However, in more complex learning situations, it was often found that anxiety resulted in poorer learning. This was found for example by Spence and Taylor (35) in a serial learning experiment involving the presentation of a series of 20 choices between two verbal responses, e. g., saying "left" or "right" at each point of choice in a memory drum experiment. High-anxious subjects, as determined by the A-Scale, made a significantly greater number of errors and learned more slowly than low-anxious Ss.

Another investigation by Farber and Spence (6) compared the performance of high-anxious and low-anxious Ss on a stylus-maze. The performance of the more anxious Ss was significantly poorer than that of the low-anxious Ss, with the most difficult points of choice providing the greatest differences between the two groups.

This finding and other similar ones have been accounted for in terms of Hull's theory by positing that the presence of competing choices in a situation causes the anxiety to increase the strength of the incorrect as well as that of the correct responses. Thus, if the incorrect responses are very strong, anxiety would tend to retard rather than facilitate the desired learning.

A recent study by Montague (25) makes thorough use of this hypothesis. Three lists of nonsense syllables, one easy,

one difficult, and one of intermediate difficulty, were given to independent groups of twenty anxious and twenty non-anxious Ss, as determined by the A-Scale. The results were that anxious Ss performed less well than non-anxious Ss on the difficult task, showed greater improvement of performance as the task became easier, and surpassed non-anxious Ss on the task with the least number of incorrect tendencies. Montague interpreted his findings as indicating that anxiety tended to increase the difference between stronger and weaker response tendencies in a learning situation, aiding performance if correct tendencies were more frequent and stronger, decreasing performance if incorrect tendencies were dominant.

Montague also considers the possibility that anxiety involves a number of responses that tend to interfere or "compete" with verbal learning, such as self-preoccupation, worry about failure, etc. He observes, however, that such an explanation only accounts for a general inferiority of anxious people in verbal tasks, while failing to explain their superiority in easy tasks.

C. Some Related Studies

In a conditioning study by Hilgard, Jones, and Kaplan (12) the responses of 46 adults to the A-Scale were obtained. The unconditioned stimulus was an air puff, whereas the conditioned

stimulus was an illumination increase in one of two windows. A non-significant correlation (+ .12) was found between anxiety and simple conditioning. Correlations approaching significance were obtained between anxiety and two measures of lack of discrimination (+ .37 and + .32).[1]

In a paired associate verbal learning experiment, Russell and Farber (6) found that Ss who were told that they had failed to reach the criterion during original learning had immediate recall scores which were significantly below those of a control group. After a few relearning trials, however, there appeared to be a reversal of these results, with the failure group performing more adequately than the control group. However, a parallel experiment with a pursuit rotor failed to reveal either a disruptive effect of failure or an eventually facilitative effect.

Patrick (29) found in a problem solving situation that human subjects who first exhibited a rational and systematic approach to the problem made many perseverative errors in their attempts at solution when they were electrically shocked or showered with water or startled by a loud horn. He concluded that the presence of stress is detrimental to rational problem solving.

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[1]The low correlations illustrate the common finding that the A-Scale only discriminates at the upper and lower extremes, while not showing any appreciable correlations with measures of learning.

McKinney (18) created experimental stress in a stylus maze learning problem by requiring Ss to work against time and by disparaging their intellectual ability. His comparison between stress and non-stress conditions showed that stress produced more errors, required more trials to reach a learning criterion, and resulted in poorer relearning scores.

Sears (33) induced "failure" in a card sorting task by means of repeated reproof of the subjects, thus causing decrements in their time scores. He also found that this led to "persistent non-adjustive behavior, a lessening of the possibility of initiating new modes of response, and a general reduction in the effectiveness of adjustment to a problem situation." It should, however, be noted, as Lazarus, Deese, and Osler point out (17, p. 311) that telling an intelligent subject that he has done poorly will force him to alter his mode of attack, so that it may be less efficient. Thus, the decrements may not be directly attributable to failure.

Pomeroy (30) induced a stress situation consisting of a bell, a buzzer, a rapidly beating metronome as well as prodding and derogatory remarks from the experimenter, while the Ss were engaged in stylus maze learning. He found that this caused a decrement in learning. Afterwards he "counseled" half of the Ss who had been under stress by reassuring them that their performance had been allright; the other Ss served

as a control group. He found that in a subsequent series of trials the "stress-counseled" group did significantly better than the control group in terms of number of errors, but not in terms of speed. This study, although it is a valiant attempt at studying the effects of "counseling", suffers from the fact that this is too complex a variable to be properly evaluated. One wonders just which aspect of the counseling may have been effective in this case.

Sarason, Mandler, and Craighill (32) constructed a questionnaire concerning subjects' reactions to tests of various kinds, on the basis of which they classified Ss as high or low-anxious. The learning task was a Digit Symbol Test, prior to which half of the Ss were told that they were expected to complete the task, whereas the other half were advised that they were not expected to finish. The time allowed made it very difficult to finish the task. The results showed that the anxious Ss did less well when "expected to finish", while the low-anxious did better under these conditions. However, when "not expected to finish", the high-anxious Ss learned better, whereas the low-anxious Ss did poorly. The theoretical interpretation of these results by the authors will be discussed later in this chapter. It is interesting to note that in this experiment the performance of the less anxious Ss was more appropriate to the requirements of the situation than that of the anxious Ss.

McKnelly (19), in an unpublished study, compared the effects of anxiety as determined by the A-Scale upon stimulus generalization in verbal learning tasks in a group of college students. The high-anxious group was superior on two types of negative transfer tasks (i. e. it showed less negative transfer), while there was no group difference in the case of one positive transfer task. McKnelly attributed the high-anxious group's superiority in the negative transfer tasks to disruptive responses evoked by anxiety which competed with responses based upon stimulus generalization. Alternatively the finding may be ascribed to the facilitating effects of "task-oriented anxiety responses" in the high-anxious group, a construct which will be explained in Chapter II.

An experiment by Birch (2) is relevant to this discussion although it dealt with "motivation" rather than anxiety. Birch worked with six chimpanzees, who were given 17 "insight" problems, including 6 "patterned string" problems, 10 Stick problems, and one "hooked rope" problem. Food deprivation varying from 2 to 48 hours served as the motivating force. The experiment is described as follows:

> When motivation is very low the animals are easily diverted from the problem by extraneous factors, and behavior tends to deteriorate into a series of non-goal-directed acts. Under conditions of very intense motivation, the animals concentrated upon the goal to the relative exclusion of other features of the situation, which were essential to the solution of the problem. Also, the frequent occurrence of frustration responses, such as tantrums and screaming when a given stereotyped

> pattern of response proved to be inadequate, hindered the animals in their problem-solving efforts. Those animals who worked at the problems under the intermediate conditions of motivational intensity behaved in a manner which indicated that although the food acted as a central factor in determining the direction in which they organized new patterns of response, they were not so dominated by a desire to obtain the food that they were incapable of responding to other relevant features of the problem situation. Their behavior was characterized by both direction and flexibility in response (2, p. 316).

Inasmuch as food deprivation is a form of stress, this study may also throw some light upon the problem of learning under anxiety.

D. A Critique of Studies on Learning Under Anxiety

A recent article by Lazarus, Deese, and Osler on The Effects of Psychological Stress Upon Performance (17) undertakes a thorough survey and analysis of research in the area of learning under various forms of stress. A good deal of this is relevant to the understanding of learning under anxiety. The authors emphasize the difficulty of producing realistic stress situations and making effective measurements of the stress effects which are independent of the task itself. It is pointed out that no two experimental studies ever duplicate exactly the same technique, with much resulting confusion (17, p. 295). The great difficulty of obtaining

measurements of the effects of stress independent of other factors is also noted:

> If it were possible to match individuals beforehand on ability to learn or perform the skill, then one of the pair could be given to the control condition and the other to the experimental condition. Pretests actually could be used to match subjects. However, this technique has not been used because it would be necessary to match not only initial score, but also rate of learning, approach to the task, motivation, etc. And besides, a good matching is practically unattainable because there are a great number of uncontrolled variables (17, pp. 300-301).

Lazarus, Deese, and Osler are unable to arrive at any broad generalizations which consistently apply to performance under stress. They advocate a fresh start in research on performance under stress (17, p. 315).

The area of learning under anxiety may be similarly characterized as lacking in consistent methods of attack, with a resulting scarcity of useful findings.

The present thesis undertakes specifically to question the generality and validity of the drive theory of anxiety as related to learning, championed by Spence, Taylor, Montague, et al.

The sponsors of the drive theory attempt to treat anxiety as a unitary concept, which they try to apply to a wide variety of subjects and situations without heeding the special characteristics of each. This appears fallacious, first of all because of the ambiguity of the concept of anxiety itself,

which was pointed out previously in this chapter. Moreover, each situation and learning task has characteristics of its own, which bring different psychic forces into play. The interaction between task, situation, and personality is too complex to be accounted for by means of a simple concept of drive alone. Instead, it is proposed that the total situation be taken into consideration in evaluating the relation between anxiety and learning.

In most of the studies on learning under anxiety the subjects were college students, in whom anxiety, if present and aroused, would have a strong motivational component, which would act as an incentive toward academic learning. Thus, the more anxious students probably compensate for their anxiety by cooperating as much as possible with the experimenter and by following instructions closely. On the other hand, there would probably be a certain disruptive and disabling factor in this anxiety, which would be aroused if the student felt severely threatened by the difficulty of the task and the nature of the situation.

The writer here assumes that both the motivational and the disruptive aspects of anxiety are potentially present in a given subject, but not equally aroused in particular situations. In an easy verbal learning situation, for instance, assuming that the learner has adequate intellectual

ambition and ability, his anxiety may serve to help him toward efficient task completion. If, on the other hand, the learning situation becomes so difficult that success appears more and more hopeless to the subject, certain disruptive aspects of the anxiety may come into play. This would account for the poor performance of anxious subjects in difficult learning situations.

This hypothesis is supported by Sarason, Mandler, and Craighill, who interpret the poor performance of anxious subjects under pressure as due to "responses which are not task-relevant, self-centered feelings of inadequacy and attempts at leaving the situation" (32, p. 564). In a related article (20), Mandler and Sarason distinguish between two types of "anxiety responses". Responses which are directly related to the completion of a task and which reduce anxiety by leading to the completion of the task; and, on the other hand, responses which are unrelated to the task, manifested by "feelings of inadequacy, helplessness, heightened somatic reaction, anticipation of punishment or loss of status and esteem, and implicit attempts at leaving the test situation" (20, p. 166). These two types of "anxiety responses" roughly correspond to the motivational and disruptive aspects of anxiety postulated by the present writer.

Hilgard, Jones, and Kaplan (12), stressing the disruptive aspects of anxiety, similarly state: "Anxious Ss, reacting more to their own apprehensions than to carefully discriminated environmental objects, will exhibit less discrimination of positive and negative stimuli than will non-anxious Ss" (12, p. 94).

Birch (2), in analyzing the learning of his chimpanzees, observes a similar phenomenon. He reports: "Under the conditions of extremely high motivation, the animal becomes so much concerned with the goal *per se* that it becomes incapable of responding to other, relevant aspects of the situation" (2 , p. 315).

Lazarus, Deese, and Osler (17) add some weight to the present hypothesis when they say:

> One of the effects of anxiety might be to produce a powerful distraction. Threatened subjects frequently report that their productive thinking is disrupted by the compelling preoccupation with the thought of the consequences of failure or danger. We might consider that in some tasks, e. g., those that require fairly automatic responses, this preoccupation would have little effect, whereas in others, e. g., those that require concentration, this preoccupation would be very disrupting (17, p. 312).

The present thesis, then, questions the generality and validity of the drive theory of anxiety and instead proposes that the study of learning under anxiety should take account of the total situation and the motivational as well as the disruptive aspects of anxiety which are brought into play.

CHAPTER II

THE NATURE OF THE PROBLEM

In the present study, anxiety was defined partly in terms of Taylor's Anxiety Scale, commonly referred to as the A-Scale, and partly as a function of the impact of tuberculosis hospitalization on the individual. Since the latter method is unique, certain aspects of institutional tuberculosis care and their implications will now be examined.

A. Tuberculosis Hospitalization and Its Relation to the Study of Anxiety

At present, approximately half a million people in the United States are afflicted with active tuberculosis (1). The mortality from the disease in recent years averages approximately 34,500 per annum for the nation as a whole. In 1900, the likelihood of any individual's dying of tuberculosis was more than five times as great as today. Bed rest, institutional care and modern techniques such as the use of drugs and surgery have markedly lowered the death rate over the last 50 years.

In the State of Michigan, tuberculosis has dropped out of the ten leading causes of death during the last two years (28). In spite of the encouraging progress that has been

made, the disease is far from being under control. Even now, the number of new cases in Michigan is as high as ever. Although new case-finding methods such as mobile X-ray units have speeded the detection of active cases, more than two thirds of the patients entering Michigan sanatoria have advanced disease. Many of these people have had tuberculosis for months or even years, often unknowingly. Moreover, the number of available hospital beds still is far from adequate.

Metropolitan Detroit, located in Wayne County, is Michigan's worst tuberculosis area. With 38 per cent of the Michigan population, Wayne County accounts for 67 per cent of the deaths in Michigan. In the last five years, the tuberculosis death rate in Wayne County has fallen more than 40 per cent, while the rate of new cases has risen 13 per cent. In comparison to other American cities with populations of over half a million, Detroit ranks seventh lowest in the number of tuberculosis deaths.

For the purpose of the present study, it was desirable to find a real life stress situation which would have a high likelihood of causing anxiety in a majority of people. Many previous investigations which have employed artificial stress situations by such means as electric shock, sudden loud noise, or induced failure have lacked the element of reality which is so important in this type of research. It was felt that

the situation faced by the newly admitted tuberculosis patient, who has just recently received a positive diagnosis is both traumatic and real, and thus tends to create anxiety in most people. This is the conclusion reached by Berger (1) in a recent investigation entitled The Emotional Reaction on Admission to a Tuberculosis Hospital. Berger used the Rorschach Test, a Word Association Test, and the Digit Span Test from the Wechsler-Bellevue Scale (37) with newly admitted tuberculosis patients and with a control group of long-term hospitalized patients. The new patients' responses on the three tests indicated the presence of marked anxiety. Among other things, their performance showed a relative deficit in digit span, a finding which has been commonly interpreted as due to poor concentration and the presence of anxiety. Berger concluded as follows:

> It seemed that patients, on entering the hospital, were psychologically distressed. Their ability to behave integratively and to deal maturely with their situation was hampered. They were fearful and unable to mobilize their best efforts to understand the new environment.
>
> It has been shown that this reaction is a generalized anxiety pattern, in which the tension is affixed to any convenient environmental object (1, p. 96).

Berger further states:

> The present study is also thought to have heuristic value insofar as it describes a sample and a situation which seemingly may be employed for future research in the problem of anxiety. The methodological limitations of 'laboratory' stress have been acknowledged by most reputable workers. The possibilities for extending our information and understanding of the real-life response to stress seem promising (1, pp. 97-98).

Pointing out some of the anxiety-producing aspects of tuberculosis hospitalization, Berger writes:

> We have had considerable opportunity in the gathering of our data to observe the patient on his arrival at the sanatorium and in his response to treatment. Many patients bring with them rather distorted ideas of what the sanatorium will be like. Some anticipate a dismal, perhaps bleak institution with coughing patients suffering all about them. Others arrive, bolstered by a spirited health official, expecting to find a sumptuous hotel. All feel the sudden impact of their separation from the community and react accordingly.....
> .....
>
> The first few weeks of sanatorium life are many times tearful ones. Admission to a sanatorium means to many patients that the ranks of the family have closed behind them, and that they are isolated and abandoned. Sanatorium life many times involves an intrinsic alteration in the life expectancies of the patient. On the other hand, some patients may react to the situation in a positive manner. Such people usually respond to treatment by maintaining prolonged hospital residence (1, pp. 9-10).

Elsewhere Berger states:

> Typically, the admission situation in some measure interrupts ties with the previous way of life.
>
> Different patients may resist hospitalization for various periods of time, but the act of arriving and taking up residence is both sudden and abrupt. It is temporally discrete (1, p. 15).

The present writer, while conducting his investigation, found considerable evidence in support of Berger's evaluation. New patients frequently expressed feelings of discouragement and bewilderment in connection with their unexpected hospitalization. For example, one new patient, a middle-aged police lieutenant, who failed to master the practice-test and therefore had to discontinue, averred that if the

experimenter would only come back a week later he would be sure to do much better. He protested that the sudden shock of the hospitalization was to blame for his poor performance. Another patient, who gave up after a short time, claimed: "People can't concentrate when they have financial and other worries. I can't do it."

While undoubtedly in many cases the patients sincerely felt that the shock of hospitalization was impeding their performance, it should be remembered that this sort of explanation may also have served as a rationalization for inability or unwillingness to perform a challenging task.[1]

Nevertheless, the writer found unmistakable indications that tuberculosis hospitalization caused severe distress and worry among patients, as one would expect under such circumstances. The hospital doctors confirmed this impression, and one of them expressed the belief that medical treatment during the first few weeks was mostly non-functional, because, in the doctor's opinion, the patients' restlessness prevented any physical improvements.

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[1]It is interesting to note that more people in the "low-anxious" group verbalized feelings indicative of anxiety than in the "high-anxious" group. (17 Ss as opposed to 10). Thus, many of the old-time patients complained that the unheralded administration of a test worried and upset them (cf. Ch. III).

Although phthisiologists differ widely in their estimation of the importance of emotional factors in tuberculosis, one medical source might be quoted here which stresses these factors. Hawes and Stone in The Diagnosis and Treatment of Pulmonary Tuberculosis (11) state:

> Undoubtedly tuberculosis and the treatment it requires must be considered a definite and distinct psychological crisis in the life of an individual. Subjected to a strain from the moment the diagnosis is made, with the sudden anticipation of a complete change in his condition of living, the patient finds his normal emotional outlets closed from physical activity.....
> .....
> Fear and anxiety are predominating emotions in tuberculosis patients. In tuberculosis the fear of death is acute, especially at first, and the reaction to this fear is intense. In some cases, however, the manifestations and effects of fear are not shown at once, but may appear later in the course of the disease. Many patients become apprehensive throughout the course of the disease (11, p. 238 f.).

In view of all the above evidence, it was assumed in the present study that newly admitted tuberculosis patients were, on the whole, more anxious than patients who had been hospitalized for six months or more.

B. Statement of the Problem

In a large proportion of the experiments on the influence of anxiety upon learning, anxiety has been determined by means of self-inventories, using the subjects' statements

about themselves as indices of the degree of underlying anxiety. The type of anxiety thus measured was named "manifest anxiety". The experimental subjects were usually college students, in whom anxiety, if present and aroused, would tend to motivate them toward doing well in any type of academic verbal task such as those used in these experiments.

In order to adequately determine whether the effects of anxiety are best explained as due to a strengthening of all response tendencies, including competing ones, or whether they had better be regarded in the light of the present writer's hypothesis, i. e. the coexistence of task-oriented and disruptive aspects of anxiety, a change in methodology was required. Instead of studying "manifest anxiety", it was proposed to study an acute type of anxiety, such as is found in a real-life stress situation. For this purpose, newly admitted tuberculosis patients were studied.

The specific problem was: How will anxiety induced by admission to a tuberculosis sanatorium affect performance in the serial rote learning of nonsense syllables, as compared with "manifest" anxiety, such as exhibited in the study by Montague (25)?

Montague used three lists of nonsense syllables with high-and low-anxious subjects as determined by the A-Scale. List I employed syllables of high similarity and low association

value, List II syllables of low similarity and low association value, while List III consisted of syllables of low similarity and high association value. These lists were assumed to represent tasks along a continuum of relative difficulty, List I being the most difficult. Montague found that anxious subjects did relatively better when the task was easy, whereas non-anxious subjects outdid the anxious subjects as the difficulty of the task increased. Improvement in performance from difficult to easy tasks for the anxious group was significantly superior to that of the low-anxious group, at the five per cent level of significance.

List 1 in the present experiment is a shortened form of Montague's difficult list, while List 2 is an abbreviation of Montague's easy list (see App. A). The lists were abbreviated because hospital regulations restricted the time for experimentation to one hour per patient. The present List 3, consisting of "anxiety-related words" was devised as an attempt to present a number of words which might reflect some of the preoccupations of newly admitted tuberculosis patients (cf. App. A).

Since the present subjects were not students, but people from various fields of endeavor, their motivation for the academic tasks given them was assumed to be relatively low. In terms of the present hypothesis, they were expected

to have a minimum of "task-oriented anxiety" and a maximum of "disruptive anxiety".

If the present experimenter's hypothesis were correct, the subjects' disruptive anxiety responses would interfere to a small extent with the learning of the easy nonsense syllables and to a much greater extent with the difficult nonsense syllables, while possibly facilitating the learning of the words, which were presumably related to this disruptive anxiety. If, however, the hypothesis concerning the strength of competing response tendencies were correct, then the anxious subjects would do well on the easy list and the word list, but poorly on the difficult list.

C. Experimental Methodology

1. The Hospital Experiment

a. Sample. The sample consisted of 80 adult tuberculosis patients at hospitals and sanatoria in or near Detroit. These included Herman Kiefer Hospital and Rest Haven Sanatorium in Detroit, Maybury Sanatorium at Northville, Michigan, and the State Sanatorium at Howell, Michigan. The number of patients tested at each facility is shown in Table 1.

TABLE 1

NUMBER OF PATIENTS TESTED AT EACH HOSPITAL

Hospital	Experimental Group	Control Group	Total
Herman Kiefer Hospital	25	9	34
Maybury Sanatorium	8	31	39
Michigan State Sanatorium	2	0	2
Rest Haven Sanatorium	5	0	5
Total	40	40	80

40 of the subjects, the experimental group, were newly admitted tuberculosis patients, who were tested within three days after their hospitalization. Only persons who had had no previous hospitalization for tuberculosis were included in this group. The control group consisted of 40 subjects who had been hospitalized for six months or more. The average length of hospitalization of this group was 19½ months.[2] An effort was made to exclude from this group any patients who were facing surgery, discharge or other upsetting experiences.[3]

[2]This excludes one atypical subject, a woman who had been hospitalized for 17 years.

[3]In two cases, pre-surgery cases were inadvertently included in the control group.

It will be noted that most of the new patients were tested at Herman Kiefer Hospital, whereas the bulk of the long-term hospitalized patients were seen at Maybury Sanatorium. This is due to the fact that the majority of new admissions are made at Herman Kiefer Hospital, whereas Maybury Sanatorium specializes in the treatment of patients who are recovering and require prolonged rest cures. Constant transfers are made between the two facilities. All surgical operations are performed at Kiefer, and most of the severely ill patients are treated there, in addition to a number of recovering cases. A few patients were seen at Rest Haven Sanatorium, which accommodates Negro patients exclusively. Occasionally Wayne County patients were hospitalized at the State Sanatorium in Howell, Michigan, and a few of these are included in the present sample.

The subjects' ages ranged from 17 to 46 years. All of them were able to speak and read English, which was necessary for participation in the experiment. All had been born and raised in English-speaking countries, with one exception. Out of the 80 subjects, 43 had been born in Michigan. The remainder had been born in other parts of the United States, with the exception of one Canadian, one Irishman, and one Mexican-born person.[4]

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[4]This Mexican-born woman had come to live in the United States when she was three months of age. Her command of English was good.

The subjects in the experimental and control groups were matched as well as possible for age, education, sex, color, and marital status. The reason for matching on these variables was the fact that they had been used in Berger's study (1) the methodology of which was used as a guidepost for the present experiment.[5] [6]

The matchings are shown in Table 2; summated characteristics of experimental and control samples are listed in Table 3. Matchings for sex and race were exact. Age matchings were fairly close; in all except six cases, matched partners' ages did not deviate by more than four years; in no case was the difference between partners greater than six years. Average age of the experimental group was 29 years; for the control group, it was 29½ years.

Since the number of subjects available after equating on sex, color, and age was limited, the matchings in terms of marital status and education were not close (see Tables 2 and 3). Nevertheless the average education of the

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[5]Originally it had been planned to use another variable, i. e. degree of illness, for matching. This was later abandoned, primarily because there were not enough Ss available for this purpose, secondly because up-to-date hospital records of degree of illness were not always obtainable, and thirdly because the degree of illness did not correspond too well with patients' feelings of well-being.

[6]Matching on the basis of intelligence was also considered, but not carried out, in view of the negligible correlations found between serial rote learning, intelligence, and other indices of learning ability (cf. Woodrow, 39).

TABLE 2

MATCHED CHARACTERISTICS OF THE SAMPLE (HOSPITAL EXPERIMENT)

A Code No.		B Age		C Sex		D Race		E Marital Status		F Education	
I	II	I	II	I	II	I	II	I	II	I	II
1	101	17	20	F	F	W	W	S	S	9	12
2	102	30	30	M	M	W	W	D	S	10	8
3	103	22	21	F	F	W	W	D	M	12	12
4	104	34	31	M	M	W	W	M	S	12	12
5	105	24	25	F	F	W	W	M	M	10	10
6	106	32	30	F	F	N	N	M	M	7	4
7	107	28	27	M	M	W	W	M	D	12	12
8	108	23	25	F	F	W	W	M	S	12	16
9	109	33	34	M	M	W	W	D	M	12	9
10	110	24	26	M	M	W	W	M	M	11	8
11	111	46	41	F	F	N	N	D	S	12	12
12	112	38	41	M	M	W	W	S	S	8	12
13	113	39	42	M	M	W	W	M	M	12	13
14	114	37	37	M	M	W	W	S	M	11	9
15	115	27	31	F	F	W	W	M	M	12	12
16	116	28	25	M	M	W	W	M	S	9	5
17	117	32	38	M	M	W	W	M	S	12	11
18	118	38	32	M	M	W	W	M	S	12	8
19	119	32	34	M	M	W	W	M	S	7	5
20	120	19	18	M	M	W	W	S	S	12	12
21	121	26	24	F	F	N	N	M	S	12	7
22	122	25	25	M	M	W	W	S	S	8	8
23	123	35	39	M	M	N	N	M	D	12	9
24	124	43	45	M	M	W	W	M	M	12	8
25	125	25	22	F	F	W	W	M	S	16	12
26	126	20	25	F	F	W	W	S	S	12	12
27	127	23	28	F	F	W	W	M	D	12	10

TABLE 2 (Cont'd)

TABLE 2 (Cont'd)

A Code No.		B Age		C Sex		D Race		E Marital Status		F Education	
I	II	I	II	I	II	I	II	I	II	I	II
28	128	28	27	M	M	W	W	D	S	12	14½
29	129	33	34	F	F	W	W	M	M	12	10
30	130	21	23	F	F	N	N	M	S	12	16
31	131	28	28	F	F	N	N	S	S	10	12
32	132	18	17	F	F	W	W	S	S	12	8
33	133	32	30	F	F	N	N	M	M	5	5
34	134	36	39	M	M	W	W	M	M	6	10
35	135	30	36	M	M	W	W	M	M	10	5
36	136	39	40	M	M	N	N	M	M	10	4
37	137	21	18	M	M	N	N	S	S	8	11
38	138	18	19	F	F	W	W	M	S	8	10
39	139	33	32	F	F	N	N	M	M	7	13
40	140	22	20	M	M	N	N	M	S	10	12

Explanation:

Column C--M-Male, F-Female
D--W-White, N-Negro
E--M-Married
S-Single
D-Divorced or Separated
F--Number of years (to nearest full year)

Sub Column I--Experimental Group
II--Control Group

TABLE 3

SUMMATED CHARACTERISTICS OF EXPERIMENTAL AND CONTROL SAMPLES (HOSPITAL EXPERIMENT)

Population Variables	Experimental Sample No.	Control Sample No.
Male	22	22
Female	18	18
White	29	29
Negro	11	11
Male White	18	18
Female White	11	11
Male Negro	4	4
Female Negro	7	7
Married	26	15
Single	9	22
Divorced or Separated	5	3
Mean Age	29	29.5
Mean Education*	10.5	10
Mean Length of Hospitalization	1 day	19.5 months**

*Number of years in terms of nearest full year.
**This figure excludes one atypical subject, who had been hospitalized for 17 years.

experimental group - (10½ years) - is close to that of the control - (10 years).

Product moment correlations between education and the learning of the three memorization tasks were computed, in order to ascertain whether the lack of educational matching is important (see Table 10, Ch. III). The only one of the three correlations which differs significantly from zero is that between education and the learning of anxiety-related words; this is significant at the 5 per cent level. However, this correlation accounts for only 10½ per cent of the variance in the learning involved. Thus, none of the obtained correlations is high enough to make the deficiency in educational matchings a serious matter.

Similarly, the lack of matching in terms of marital status should not be considered too serious, since there is little reason to assume that marital status is significantly related to the learning of nonsense syllables or to anxiety.

No attempt was made to match the two groups in terms of occupation. It was noted, however, that with the exception of two Ss[7] in the control group, the sample consisted of non-professional people in the lower income brackets.

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[7]One of these was an engineering student, the other a history teacher.

b. Apparatus and materials. A Missouri-type memory drum was mounted on a table. Syllables and words appeared through an opening, 1.6 by 0.8 inches, which was lighted by a shaded 60-watt bulb and was at eye level. A practice list of four nonsense syllables and two experimental lists of nine nonsense syllables each, as well as one list of nine meaningful "anxiety-related" words were typed in capital letters on an endless white tape attached to the drum. All the nonsense syllables consisted of three letters each. The lists are reproduced in Appendix A.

Practice List A consisted of items of intermediate difficulty and was given to all Ss. List 1 was made up of items of high similarity and low association value; it was the "difficult list". List 2 consisted of syllables of low similarity and high association value; this was the "easy" list. Both were modifications of lists used by Montague[8] (25), which came from Melton's compilation of verbal learning materials (25), using association values determined by Glaze (9). List 3 was made up of words tending to reflect the anxiety and emotional threat faced by the newly admitted

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[8]Montague's lists contained 12 syllables each, whereas the lists in the present experiment consisted of only nine syllables. Limitations in testing time due to medical considerations necessitated this modification.

tuberculous patient, as indicated in Berger's study (1). Such words as "afraid", "pain", "depressed", and "hope" were included, which presumably reflected some of the patients' feelings.[9] Four of these words (WORRY, UPSET, AFRAID, DEPRESSED) were chosen because of their apparent kinship to feelings of anxiety (cf. the A-Scale, Appendix C). Three of them (HOMESICK, ESCAPE, PAIN) were included because of Berger's observation that the patients' anxiety centered about leaving the home, a wish to escape from their present plight, and the painful aspects of their illness. The words RECOVERY and HOPE were used because of their obvious relation to illness and also because they added a cheerful note to a generally gloomy list of words.

Syllables and words were presented serially, with a one-and-a-half second exposure time and a two-second interval between exposures.[10] An interval of six seconds elapsed between the disappearance of the final syllable or word on one trial and the appearance of the first item on the next trial. During this interval three asterisks appeared, which

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[9]The use of these words was exploratory in nature, inasmuch as there was no prior experimental evidence for their usefulness.

[10]Due to the mechanical nature of the Missouri-type memory drum, it was necessary to present one exposure between syllables, during which time a dash appeared in the drum window.

indicated that the list was about to start over again.[11] Instructions were of the usual type for anticipation learning and were made as simple and clear as possible, in order to enable a non-college population to understand them (see Appendix B). The Ss were instructed to use each syllable or word as the cue for calling out the next one before its appearance. They were further told that three "stars" (asterisks) were the cue for the first syllable or word. Subjects were asked to spell out syllables and read words aloud. They were encouraged, but not required to make a verbal response at each exposure.

In addition, the Digit Span Test from the Wechsler Intelligence Scale (37) was used with all Ss subsequent to the serial rote learning. This test has been commonly used as an indicator of anxiety. It was also included in Berger's study with tuberculous patients (1).

A few weeks after the completion of the learning experiments, it was decided to administer the Taylor Scale of Anxiety (A-Scale) to those patients who were still at the hospitals. This instrument has been described in Chapter I (pp. 8-9) and is reproduced in Appendix C.

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[11]This represents a deviation from Montague's procedure, who presented only one asterisk. The decision to use three asterisks was governed by mechanical considerations.

c. **Procedure.** The design of the experiment provided for the use of an experimental and a control population. A group of first admission patients, hereafter referred to as the experimental group, were seen and tested within three days after their hospitalization for tuberculosis. Of these patients, 12 were seen on the day of admission, 17 one day after, 7 two days after, and 4 three days after.[12] The control population was composed of a matched group of long-term patients, who had been hospitalized continuously for six months or more.

The investigation was conducted from December 1952 to June 1953. The experimenter periodically obtained a list of the daily tuberculosis admissions from Detroit and Wayne County at the diagnostic clinic of Herman Kiefer Hospital, through which all infectious cases for the metropolitan area are processed. This included admissions to Herman Kiefer Hospital, Maybury Sanatorium, Rest Haven Sanatorium, and the Michigan State Sanatorium at Howell. Assignment of the patients to the different facilities depended upon position on the waiting list, severity of illness, and available bed

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[12]It had at first been planned to conduct all the experiments with new patients on the first day of hospitalization. Since this tended to conflict with the hospital admission routine, a three-day limit was chosen.

space. The experimenter arranged his schedule for experimentation at the various hospitals in such a manner that a maximal number of patients could be seen.

Medical permission for testing was routinely secured prior to contacting patients. The experimenter wore a white gown, the common attire of the professional staff. In the case of the new patients the experimenter wore a facial mask. When working with patients who were free from tuberculosis germs, as shown by laboratory tests, the mask was dispensed with in order to promote better rapport.

In many cases the patients' physical condition was so poor that testing was not possible. In other cases, language and reading difficulties obviated testing. Occasionally patients refused to participate. Some patients dropped out because they failed to learn the practice test of four syllables within the allowed 15 trials (cf. List A, App. A).

Experiments were conducted in various rooms at the hospitals and sanatoria, depending on available space. Most frequently, the nearest doctor's office was used. Occasionally a nurse's office served instead. In each case, privacy and as much quiet as possible was assured. In no case was a patient tested in the presence of other patients. The nature of memory-drum learning made bedside testing impossible, and patients were therefore usually brought to

the experimental room in a wheel-chair. In a few cases, patients walked to the testing-room if they had medical permission to do so.

The new patients were informed that the experiments were a regular part of admission procedure, lest the individual should feel that he was being "picked upon". In the case of the old patients the experiments were simply introduced as a research project for which volunteers were wanted. In all other essential aspects, the procedure for new and old patients was identical.

Several minutes were spent with each patient prior to the testing in an effort to establish rapport and to ascertain whether they met the language and reading requirements for the task. It was explained to them that the research was sponsored by the hospital. The importance of psychological factors in overcoming tuberculosis was emphasized to them. The purpose of the study as described to the Ss was to get an idea of patients' ability to learn to adjust to a novel situation and thereby to gain an idea as to how well patients in general were likely to adapt themselves to the services offered by their hospital, such as educational rehabilitation, etc. Patients were given the option of participating in the experiment or of declining. Due to the fact that many Ss were found to be extremely diffident and inclined to give

up at an early stage, the experimenter found it necessary to give an unusual amount of encouragement to the Ss, in order to induce them to complete the task. Therefore Ss were told prior to the test that they were not expected to learn all the syllables or words at once, nor to achieve perfection in memorizing each list. The stress was placed on showing some progress during successive trials, rather than on the achievement of perfection. The patients were further assured that poor learning in the present task was no sign of any general lack of intelligence or learning ability.

Immediately following the instructions and the answering of any questions, the learning task began, with the experimenter seated next to the subject, recording responses. Spelling and reading errors were corrected by the experimenter whenever they occurred. Between trials, Ss often were told, "You are doing fine", or "You are learning all right", and the like. This procedure was followed with experimental and control Ss alike, whenever it seemed necessary, in order to dissuade Ss from giving up prematurely.

The procedure for the experimental group, consisting of 40 Ss was the following (see Table 4): Ss were alternately assigned to Group A or B, in the order in which their names had been obtained. Each of the two groups included 20 Ss.

TABLE 4

EXPERIMENTAL DESIGN (HOSPITAL EXPERIMENT)

Group	Experimental (New patients) N	Task	No. of Trials	Control (Old patients) N	Task	No. of Trials
A	20	List 1 & Digit Span Test	40	20	List 1 & Digit Span Test	40
B	20	List 2 & List 3 & Digit Span Test	20 20	20	List 2 & List 3 & Digit Span Test	20 20

Explanation of lists:

List 1--Difficult nonsense syllables
List 2--Easy nonsense syllables
List 3--Anxiety-related words

Group A. Ss were given Practice List A consisting of four nonsense syllables, until one perfect trial was attained (see App. A). If after 15 trials the S had failed to achieve one completely correct trial, further work with the S was discontinued. Then the Ss took List 1 ("difficult"), consisting of nine nonsense syllables of high similarity and low association value, for 40 trials (cf. App. A).[13] Subsequently they were given the Digit Span Test from the Wechsler Intelligence Scale (37).

Group B. These Ss also were given Practice List A, in the same manner as Group A. They then took List 2 ("easy"), consisting of nine nonsense syllables of low similarity and high association value, for 20 trials (cf. App. A).[13] After a five-minute rest period, the same 20 Ss were given List 3, consisting of nine "anxiety-related" words for 20 trials (cf. App. A).[13] They were also subsequently given the Digit Span Test.

The average amount of time spent in experimentation for Ss of both groups approximated 45 minutes.

The procedure for the control group which likewise consisted of 40 Ss was identical with that of the

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[13]Whenever an S completed three consecutive trials without an error, he was given credit for all subsequent trials in the list without having to complete the regular number of trials.

experimental group, except that each control S was matched with an experimental S for age, education, sex, color, and marital status, instead of being randomly chosen. The combined number of Ss in experimental and control groups totaled 80.

Several weeks after the learning experiment, the Taylor Anxiety Scale (36) was administered to the patients who had originally participated, except in cases where patients had left the hospital or were otherwise unavailable (see App. C). The scale was filled out individually by each patient and was collected within a day or two by the E.

d. Hypotheses. The following hypotheses were formulated for the hospital experiment:

1. Experimental Ss will learn the easy nonsense syllables less well than control Ss.

2. Experimental Ss will learn the difficult nonsense syllables less well than control Ss.

3. Experimental Ss will learn the meaningful anxiety-related words better than control Ss.

4. Experimental Ss will have a lower digit span than control Ss.

e. Rationale. It was expected that disruptive anxiety responses would operate to interfere with the learning of both easy and difficult lists of nonsense syllables.

In the case of the meaningful anxiety-related words, disruptive anxiety is reflected in the task, the learning of which should thus be facilitated.

People with "manifest" anxiety such as those studied by Spence and Taylor (35), Montague (25), and others may be presumed to compensate for anxiety to a certain degree at all times. Thus, for a college student, an intellectual challenge may be perceived as a chance to compensate for deep-rooted anxiety and thus be a motivating force. If, however, in such a situation, the intellectual task becomes so difficult and threatening that the subject can no longer cope with it, then disruptive responses to anxiety would become predominant, and the subject's performance would tend to disintegrate. This state of affairs is represented at point x in Figure 1.

It will be observed in this graph that the gradient for the task-oriented anxiety is pictured as a gradually accelerating curve, which levels off before reaching its asymptote, but that the disruptive anxiety responses at a certain point increase very sharply and continue to do so. At point x they surpass the task-oriented anxiety responses and become dominant.

It was postulated that at a certain level of difficulty, disruptive anxiety responses would tend to outweigh task-oriented

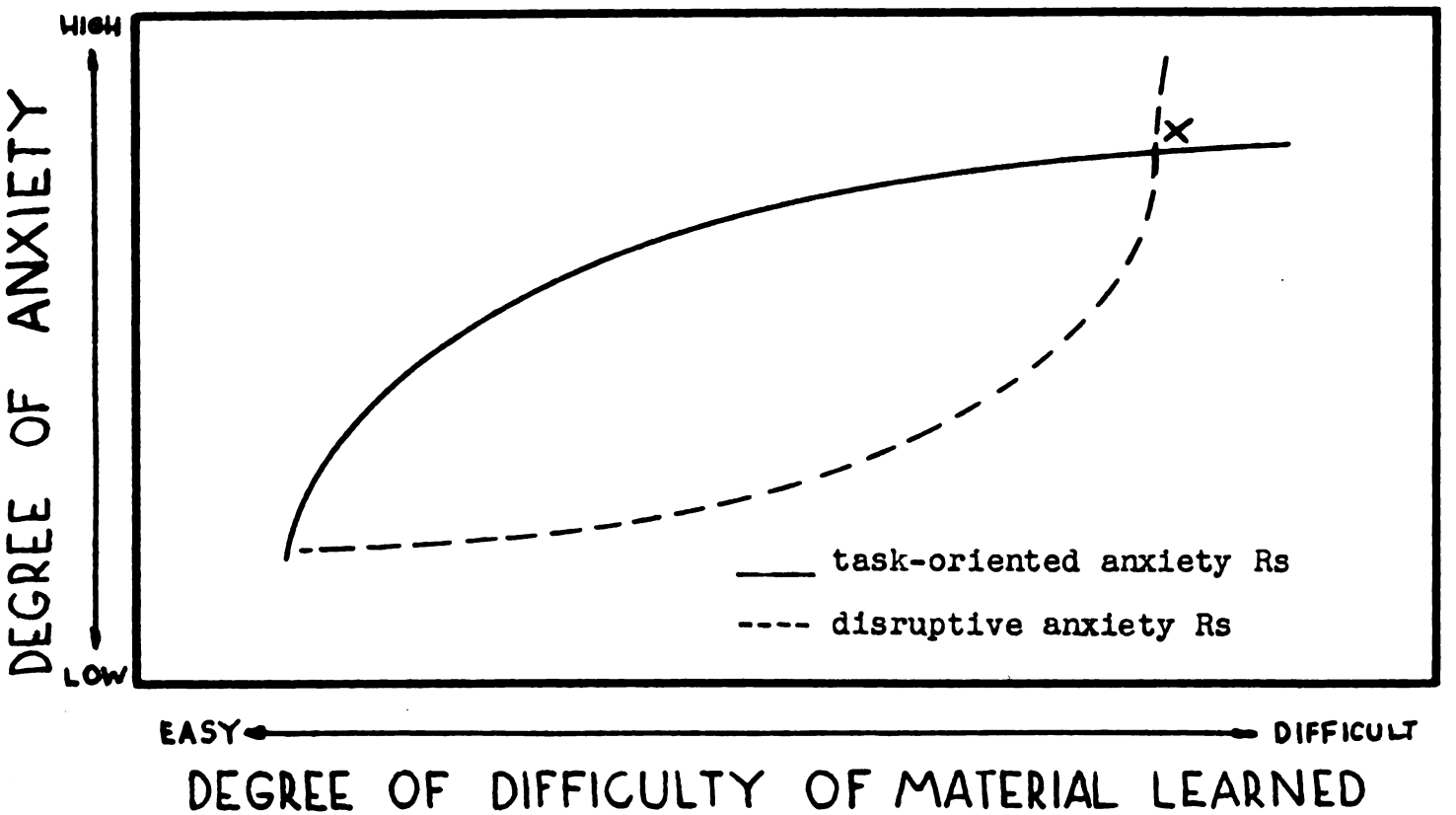

Fig. 1. Hypothetical curves of the relative strength of task-oriented and disruptive anxiety responses as a function of task difficulty.

anxiety responses. This would account for the poorer performance of anxious students on difficult tasks. In the case of the newly admitted tuberculous patients, disruptive anxiety was expected to predominate even at a low level of difficulty because of the absence of task orientation. It was expected that the patients would not have the motive of compensating through intellectual excellence, since their anxiety was not essentially related to any deep-seated feelings of personal inadequacy, but rather to a severe situational threat against the life and well-being of the subject.

2. The College Experiment

An additional experiment with college students was decided upon after the analysis of the hospital data. The analysis of the results of the hospital study left considerable doubt as to whether the experimental group was actually more anxious than the control (cf. Ch. III). If anxiety was not a variable in the hospital study, then the investigation was not a proper test of differential theories of the relation of anxiety to learning. It was therefore decided to repeat a part of Montague's study with college students. Only Montague's "easy" list was used, and administration

was in a group instead of individually. This was to provide a further test of the generality of Montague's results.

a. Sample. The population for this experiment consisted of 119 students in courses in Introductory Psychology and Effective Study at Michigan State College during the Summer Session of 1953. The group was split up on the basis of their scores on the A-Scale, scored by means of Rosenbaum's 50-item key (31). The 24 Ss with the highest 20 per cent of the scores constituted the high-anxious group, while the 24 Ss with the lowest 20 per cent of the scores formed the low-anxious group.[14] The high-anxious group included 9 men and 15 women, while the low-anxious group consisted of 14 men and 10 women.

b. Apparatus and materials. Nonsense syllables were flashed onto a screen by means of a slide projector. Large capital letters were used, so that the syllables were plainly visible to all Ss in a classroom.

Practice List A, consisting of four syllables of intermediate difficulty was used for demonstration purposes.

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[14]In Montague's study, Ss from the top 10 per cent and the bottom 20 per cent of scores on the A-Scale were used, with 20 Ss in each group. This procedure could not be duplicated here, because it required a much larger population to draw from originally

List 2a, consisting of 12 "easy" nonsense syllables, was the learning task (see App. D). List 2a in the present experiment is a complete reproduction of Montague's "easy" list (25), using syllables of high association value and low similarity.[15]

Syllables were presented serially, with a three-second exposure time and a three-quarter second interval between presentations; between trials, six seconds elapsed. Instructions were modified from Montague (25) for group administration and are shown in Appendix E. The word START, printed in capital letters, served as the cue for the first syllable during each trial. Ss were asked to print their anticipations on pads of blank paper, consisting of 12 sheets each. After each presentation, a clacker was sounded, and the Ss were then required to turn over a new sheet. At the end of each trial, the Ss put aside the used pad and picked up a new one. Thus Ss were unable to gain any improper cues from their own previous recordings.

In addition to the nonsense syllables, the Taylor Anxiety Scale (A-Scale) was administered as a measure of anxiety (see App. C).

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[15]The complete list was used in this case, since more time was available than in the case of the patients, whose time was restricted due to medical considerations.

c. Procedure. The learning experiment was carried out in seven separate group administrations during regularly scheduled class periods. During each administration, one person read the instructions, another operated the projector, and one or two other persons acted as proctors.[16] The experiment was introduced as a verbal learning study, and the cooperation of the students was solicited by telling them that their efforts would contribute to the "scientific value" of the investigation and by stressing that the E was concerned with group, not individual performance. After a brief demonstration with Practice List A, the experimental task began. List 2a was presented for 19 trials. Each S had 19 pads of 12 sheets each, on which to record his anticipations. The experiment lasted for about 45 minutes.

The A-Scale was in all cases administered by a person other than the one who had administered the nonsense syllables, lest the Ss should see a connection between the two tests.[17] In all cases except one, the A-Scale was

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[16]The writer is indebted to Professor M. Ray Denny and to Messrs. John Jordan, Miles Pothast, and Oliver Agee for their participation in the administration.

[17]The writer expresses his appreciation to Dr. M. Aborn, Dr. S. M. Poch, Dr. G. R. Thornton, Mr. E. L. Shelley, and Mr. H. H. Fink, Instructors of Psychology, for their fine cooperation in administering the scale.

given a few days after the learning task. In one case, it was administered immediately before the learning task. It was administered in class, except in one case, in which students took the test home and returned it at the time of the next class meeting. The scale was introduced as "an example of a personality test", and Ss were asked to fill in personal data at the side of the answer sheet, in addition to their answers. They were assured that results would be kept confidential.

d. Hypothesis. The following hypothesis was formulated:

5. High-anxious Ss will perform no better than low-anxious Ss in the learning of the easy nonsense syllables.

e. Rationale. The present situation presumably involved a minimum of anxiety arousal, inasmuch as group administration was less of a personal challenge than individual administration such as used in Montague's study. Moreover, the instructions deemphasized individual achievement and stressed the scientific value of group performance. By minimizing the arousal of task-oriented anxiety responses, it was expected that the anxiety potential of the high-anxious Ss would not result in increased dedication to the task. Thus, high-anxious Ss, who in Montague's study were found to perform better on the easy task, were expected to do no better than low-anxious Ss in the present case.

CHAPTER III

RESULTS OF THE STUDY

A. The Hospital Experiment

1. The Digit Span Test. Results of the Digit Span Test, on the basis of the t-test for matched samples, are presented in Table 5. No statistically significant differences between experimental and control Ss were found in digit span forward,[1] backward, or combined digit span. Hypothesis 4, which predicted a lower digit span for experimental than control Ss was not confirmed.

TABLE 5

COMPARISON OF MEAN DIGIT SPAN SCORES
(HOSPITAL EXPERIMENT)

Score	Exp.	Cont.	D (Cont. Minus Exp.)	t
Digits Forward	6.10	6.45	0.35	1.46*
Digits Backward	4.65	4.575	-0.075	0.31
Total Digit Span	10.85	11.025	0.175	0.41

*p = .05 - .10 (one-tail test of the null hypothesis)

[1] In the case of digit span forward, the difference approached significance (P = .05 - .10) when the one-tail test for differences in the predicted direction was applied.

These findings are in sharp contrast with those of Berger (1), who, working with a similar population, found that the digit span of long-term hospitalized patients was very significantly higher (.005 level of confidence) than that of new patients. Berger concluded from this and other results that newly hospitalized patients were under stress or anxious. He further concluded that the Digit Span Test is a sensitive tool for measuring the type of anxiety which is aroused in tuberculosis hospitalization.

In light of the present results, it becomes quite doubtful whether a similar difference in anxiety existed between the present two groups. It is very possible that the inordinate amount of encouragement given by the present experimenter may have equalized any existing differences in anxiety. For this reason, the results of the present hospital experiment must be treated cautiously and cannot be interpreted by assuming that the newly hospitalized patients were more anxious than patients of long standing.

2. The learning tasks. Learning curves for Lists 1, 2, and 3 are reproduced in Figures 2, 3, and 4 respectively.[2] Table 6 presents the comparative performance of the two groups on

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[2]In each case, trial 1 was the second presentation of the list, since correct anticipations before the first presentation do not occur.

TABLE 6

MEAN NUMBER OF CORRECT ANTICIPATIONS PER SUBJECT PER TRIAL* (HOSPITAL EXPERIMENT)

List	Trials	Exp.	Cont.	D (Cont. minus Exp.)
1	1-40	2.86	2.98	0.12
2	1-20	5.54	4.815	-0.725
3	1-20	6.97	6.66	-0.31

*All trials are included here

TABLE 7

MEAN NUMBER OF CORRECT ANTICIPATIONS PER SUBJECT PER TRIAL OVER SELECTED TRIALS* (HOSPITAL EXPERIMENT)

List	Trials	Exp.	Cont.	D (Cont. minus Exp.)	t
1	21-40	4.18	4.44	0.265	0.36
2	5-20	6.49	5.61	-0.88	1.52**
3	5-20	7.86	7.41	-0.45	0.88

*The trials included were the ones showing maximal group differences

**P = .10 - .20

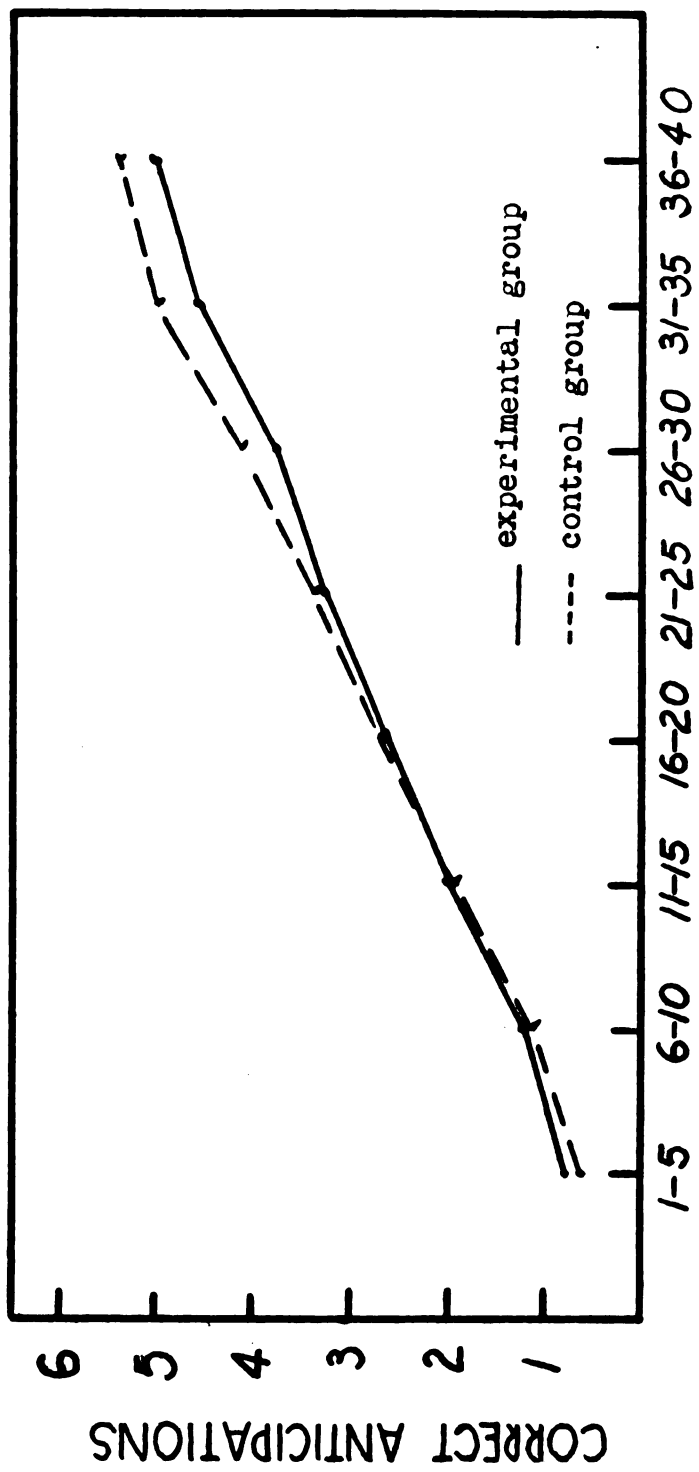

Fig. 2. Learning curves for List 1 (Difficult). Mean number of correct anticipations per subject per trial.

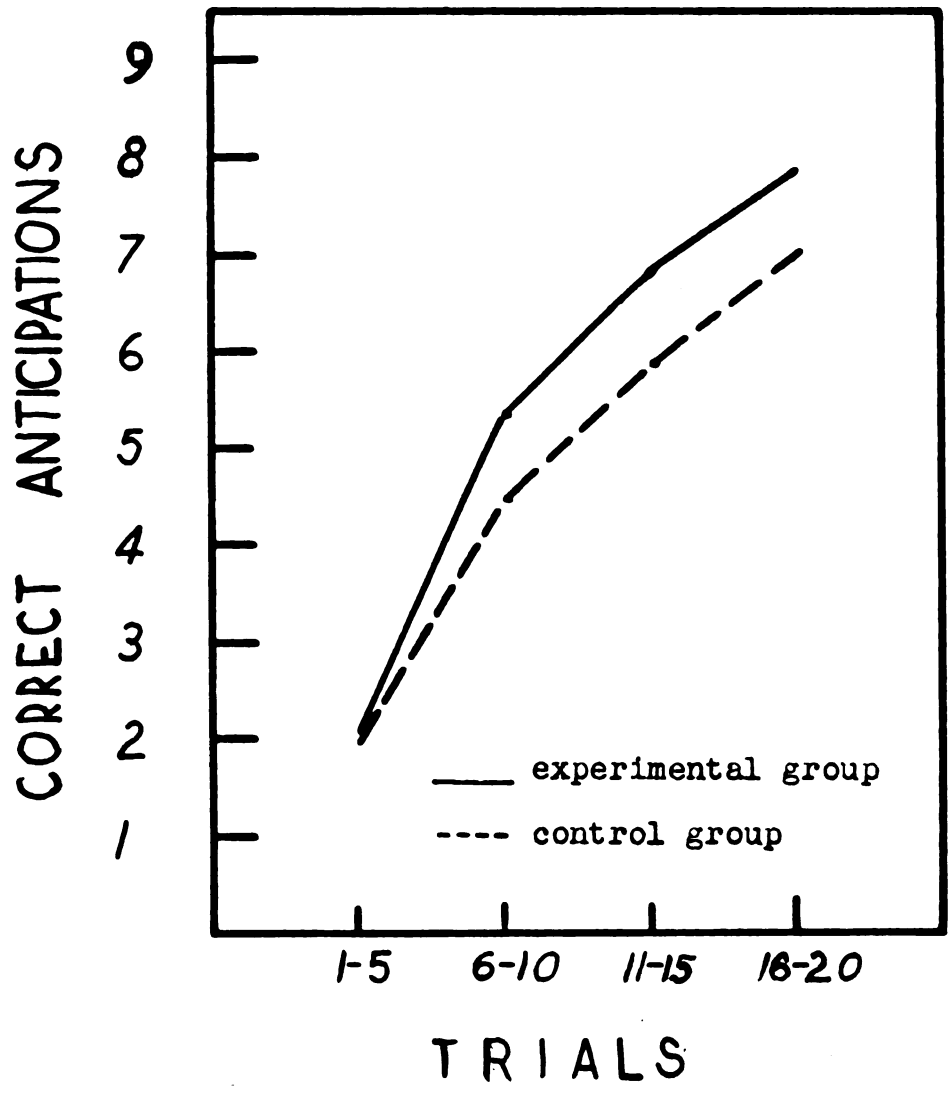

Fig. 3. Learning curves for List 2 (Easy). Mean number of correct anticipations per subject per trial.

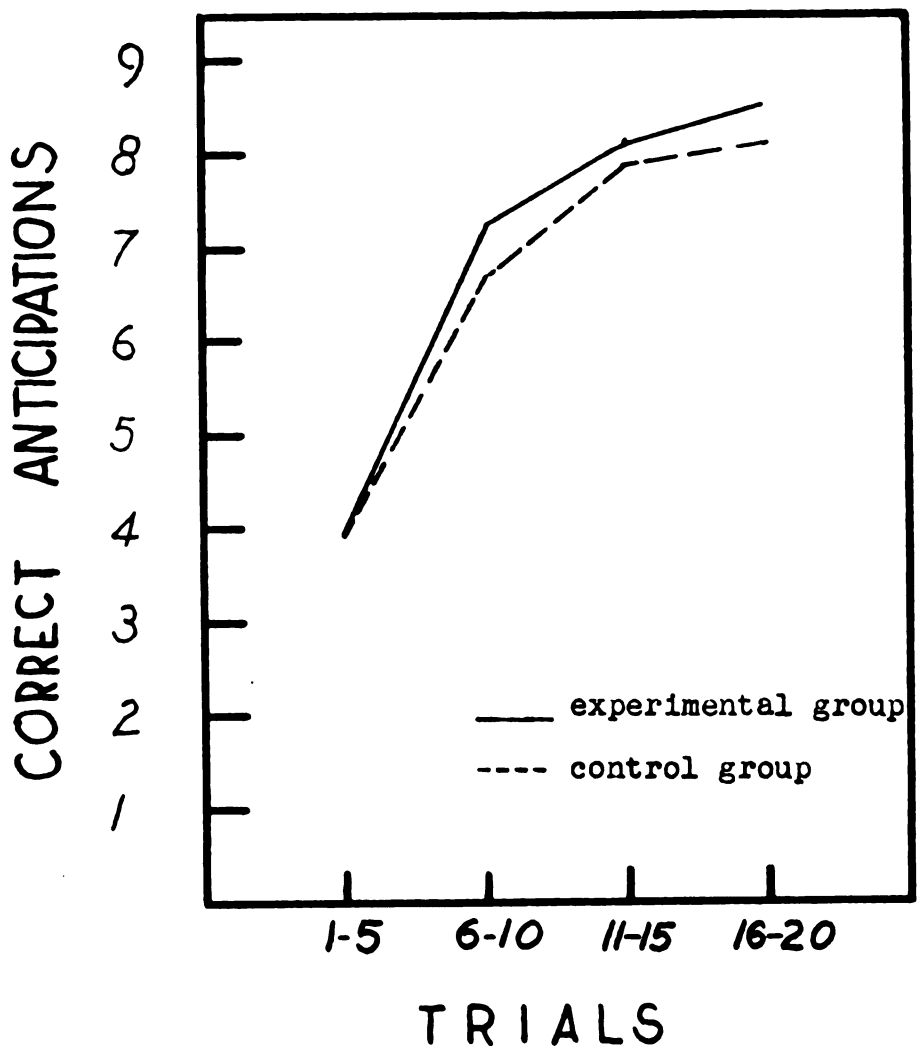

Fig. 4. Learning curves for List 3 (Anxiety-related words). Mean number of correct anticipations per subject per trial.

the three tasks, using the mean number of correct anticipations per S per trial over all trials as the basis for comparison. Table 7 presents the difference between experimental and control groups on those trials for which the differences between groups were most evident, according to the learning curves. The t-test for matched samples was used to test the significance of differences.[3]

There were no statistically significant differences between experimental and control Ss in any of the three learning tasks. Thus, hypothesis 1 and 2, which predicted that experimental Ss would learn both easy and difficult nonsense syllables less well than control Ss was not confirmed; nor did the results confirm hypothesis 3, which predicted that experimental Ss would learn the anxiety-related words better than control Ss.

These findings may mean that there was no consistent difference in anxiety level between groups. If differences in anxiety level existed, they failed to affect the learning of the tasks. In view of the existing doubts regarding the presence of group differences in anxiety, the present findings

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[3]For matchings, see Table 2, Ch. II.

do not provide an adequate test of Spence's, Taylor's, and Montague's theory, which predicts better performance for high-anxious Ss on easy nonsense syllables and for low-anxious Ss on difficult nonsense syllables. For the same reason, the results are inconclusive in regard to the present writer's theory of the coexistence of task-oriented and disruptive anxiety responses.

An analysis of variance was performed for Lists 1 and 2, in order to study the effects of length of hospital stay (experimental vs. control group) and difficulty upon nonsense syllable learning. The measure used was the mean number of correct anticipations on the last 16 trials for both tasks. The trials were chosen in such a manner as to make the two tasks as comparable as possible and include trials showing maximal difference on the learning curves. Results of the analysis of variance are presented in Table 8.

The only significant F-ratio obtained is the one due to degree of difficulty, which is statistically significant at a level of less than one per cent, indicating that List 2 was significantly more difficult than List 1. This result is in accord with previous findings and not relevant to the present problem. The most important finding is the fact that length of hospital stay and interaction between length

TABLE 8

ANALYSIS OF VARIANCE (HOSPITAL EXPERIMENT)
LAST 16 TRIALS FOR ALL GROUPS

	Source of V.	d.f.	V.	F
a.	Length of Hospital Stay* (Exp. vs. Cont. Group)	1	304.20	0.26
b.	Level of Difficulty	1	11,186.45	9.65**
c.	Interaction axb	1	2,060.45	1.78

*The experimental Ss had been tested within three days of hospital admission: the control Ss six months or more after hospital admission

**Very significant (P less than .01)

of hospital stay and difficulty do not result in significant F-ratios. Thus, length of hospital stay produced no significant effect upon learning, nor was there any reliable variation in performance between experimental and control Ss from easy to difficult task.

If the interaction factor had been significant, this might possibly have constituted a confirmation of Montague's observation that high-anxious Ss improve significantly more than low-anxious Ss as the task becomes easier. While the present data show a slight trend in the same direction as Montague's, this trend is far from being statistically significant. The results of the analysis of variance indicate either a lack of difference in anxiety level between groups, or a failure of anxiety to influence performance in the learning tasks.

3. Other results. The A-Scale was administered to 59 Ss remaining at the hospital three weeks after the conclusion of the learning experiments,[4] from June 9 to June 17, 1953.

A comparison of the A-Scale scores of the two original experimental groups yielded a mean of 15.9 for the experimental group (N=26), and a mean of 18.8 for the control group (N=33).

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[4]Of the other 21 Ss, 17 were no longer at the hospitals, and 4 refused to participate.

The resulting t-ratio of 1.02 is far from significant. The direction of the difference was toward higher anxiety for the control group. The failure of the A-Scale to differentiate between the two groups was not unexpected, since it purports to tap an individual's overall tendency toward anxiety, whereas tuberculosis hospitalization was used as an acute anxiety variable. Moreover, the A-Scale was administered from three to 24 weeks after the original experiment, so that the immediate effects of hospital admission, whatever they may have been, had probably largely dissipated.

Twenty-seven of the Ss tested on the A-Scale had learned List 1, and 32 had learned Lists 2 and 3. In the case of List 1 and the Digit Span Test, Ss in the top and bottom 20 per cent of A-Scale scores were compared, regardless of whether they had originally been in the experimental or control group; in the case of Lists 2 and 3, Ss in the top and bottom 25 per cent formed the comparison groups. Group differences were tested by means of the t-test of significance, as presented in Table 9.

No significant differences in learning were obtained between Ss who scored high and low on the A-Scale. In the case of the easy nonsense syllables, the moderate mean group difference of 1.40 ($P = .10$ to $.20$) favors the low-anxious group.

TABLE 9

MEAN SCORES OF HOSPITAL GROUPS CHOSEN BY A-SCALE SCORES*

Task	Trials	High Anxious N	High Anxious M	Low Anxious N	Low Anxious M	D (LA minus HA)	t
List 1	1-40	5	3.44	5	4.04	0.60	0.32
List 2	5-20	8	5.29	8	6.69	1.40	1.61**
List 3	1-20	8	6.67	8	7.00	0.33	0.45
Digit Span	----	12	11.50	12	11.80	0.30	0.32

*The mean score in Lists 1, 2, and 3 is the mean number of correct anticipations; for the Digit Span it is the maximum number of digits repeated forward plus backward

**P = .10 - .20

Explanation of Criterion Groups (N):
List 1--Upper and lower 20% of 27 Ss
List 2--Upper and lower 25% of 32 Ss
List 3--Upper and lower 25% of 32 Ss
Digit Span--Upper and lower 20% of 59 Ss

In view of the extremely small sample used, this finding, although it does not attain accepted levels of confidence, is suggestive of a possible real difference and makes it appear worth-while to conduct a study along similar lines with a larger sample in the future. The trend shown here gives at least some encouragement to the hypothesis that high-anxious non-college subjects under stress have fewer task-oriented anxiety responses and more disruptive anxiety responses in a verbal learning situation than a corresponding group of college students.

The direction of the trends of the patient population, using the same index of anxiety as Montague did (the A scale), is opposite to Montague's results. This tentative finding tends to indicate that Montague's results lack generality and apply only to his specific experimental population and conditions.

Table 10 lists product-moment correlation coefficients between educational level and various measures of learning, as well as the correlation between the learning of Lists 2 (easy nonsense syllables) and 3 (anxiety-related words).

List 3 is the only learning task which was significantly correlated with education, namely at the 5 per cent level of confidence ($r = .323$). This correlation is of a negligible degree, accounting for only about 10 per cent of the variance

TABLE 10

PRODUCT MOMENT CORRELATIONS BETWEEN EDUCATION AND LEARNING AND BETWEEN LISTS (HOSPITAL EXPERIMENT)

Comparison	r	t	P
Educ.*-List 1	0.194	1.21	(n.s.)
Educ. -List 2	0.284	1.775	.05-.10 (n.s.)
Educ. -List 3	0.323	2.02	.05 (signif.)
List 2-List 3**	0.689	4.31	.01 (very signif.)

*Number of years, in terms of nearest full year

**These two lists were learned by the same Ss

in verbal learning. These low correlations are in accord with previous findings (cf. Woodrow, 39).

The correlation between the learning of Lists 2 and 3 ($r = .689$) is statistically very significant and constitutes an unusually high relationship between the learning of nonsense syllables and meaningful words.

An attempt was also made to compare the new and old patients on the basis of verbalizations which might indicate anxiety. Contrary to expectations, more Ss in the control group voiced feelings of distress and anxiety than in the experimental group (17 as opposed to 10). This finding as well as the results of the Digit Span Test tends to cast considerable doubt on the assumption that new patients are more anxious than long-term hospitalized patients.

B. The College Experiment

The results for List 2a (easy nonsense syllables), which was administered to students at Michigan State College, are given in Table 11, and the learning curve is shown in Figure 5. The performance of the top 20 per cent of Ss on the A-Scale (high-anxious), with a mean of 9.31 correct anticipations, was essentially identical with that of the bottom 20 per cent (low-anxious), whose mean was 9.38, the difference being statistically non-significant. When results

TABLE 11

MEAN NUMBER OF CORRECT ANTICIPATIONS PER SUBJECT PER TRIAL (COLLEGE EXPERIMENT) AND COMPARISON WITH MONTAGUE'S RESULTS

	List	Trials	High Anxious N	High Anxious M	Low Anxious N	Low Anxious M	D (LA minus HA)	t
(a)	2a (Easy)	1-19	24	9.31	24	9.38	0.07	0.145
(b)	2a (Easy)	5-19	24	10.21	24	10.47	0.26	0.52
(c)	2a (Easy)	5-19	10	10.17	14	10.66	0.49	0.57
(d)	Montague's Easy*	6-25	20	9.91	20	8.69	-1.22	2.15**

*Reproduced from Montague (25).
**P = .05 (significant)

Explanation of Criterion Groups (N):
(a and b)--Upper and lower 20% of 19 Ss
(c and d)--High-Anxious: A-Scale Scores of 30 and above
Low-Anxious: A-Scale Scores of 9 and below

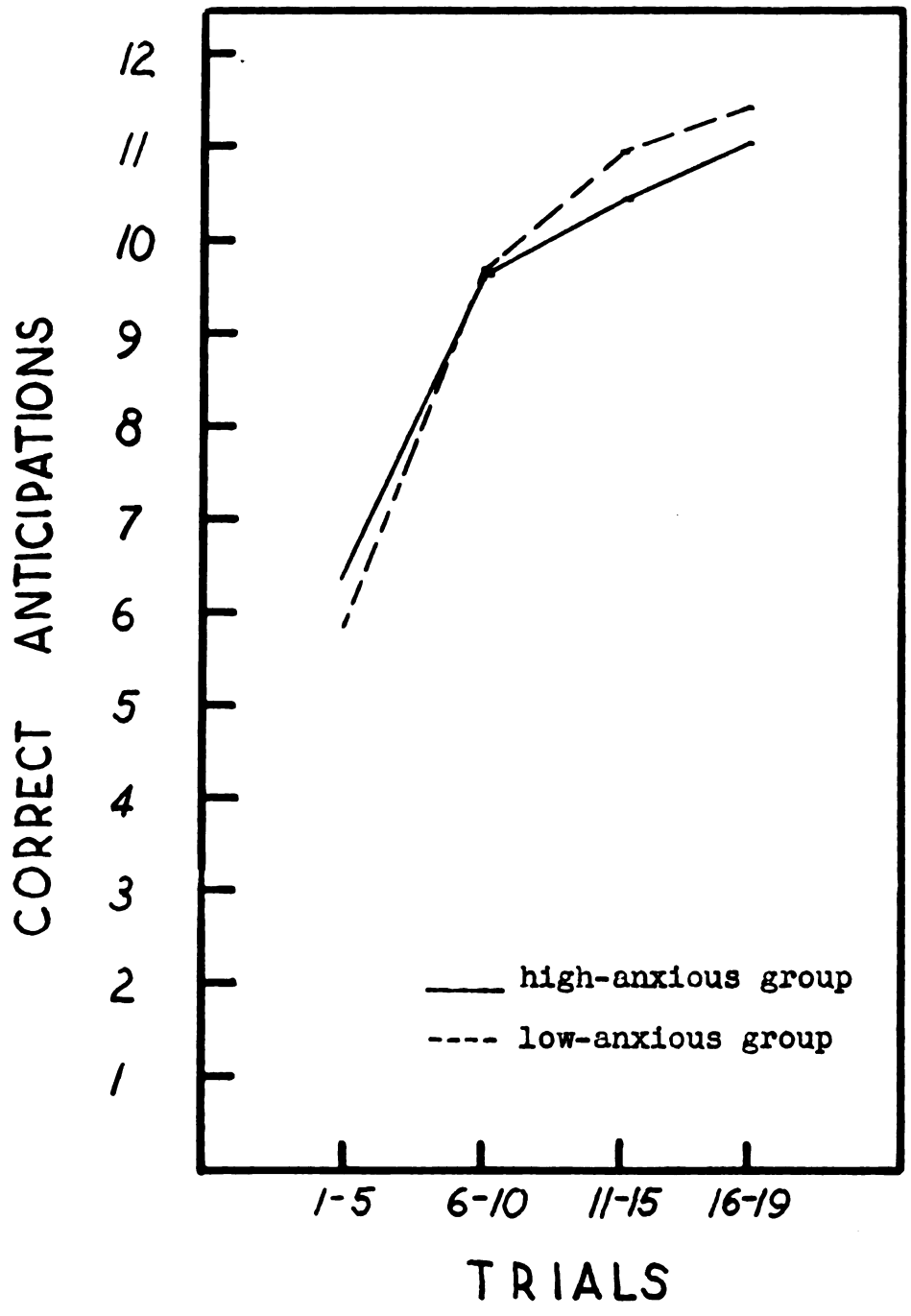

Fig. 5. Learning curves for List 2a (Easy). Mean number of correct anticipations per subject per trial.

were computed on the basis of A-Scale scores of 30 and above for the high-anxious group and 9 or below for the low-anxious group, as was done in Montague's study, the mean for the high-anxious group (N=10) became 10.17, and that for the low-anxious group (N=14) became 10.66. This difference though negligible, is in the opposite direction from that found by Montague. The present results are in agreement with hypothesis 5 (see Ch. II), and contrary to Montague's findings with the same list administered individually to college students in 25 trials. The generality of Montague's findings concerning the superiority of high-anxious Ss on easy tasks is thus contraindicated. Apparently the type of administration and the instructions are important variables in determining the performance of high- and low-anxious Ss in verbal learning tasks.

In comparing trials 5-19 in the present experiment with the roughly analogous trials 6-25 of Montague's study (cf. Table 11), it will be noted that the low-anxious group in the present study does considerably better than Montague's corresponding group, whereas both high-anxious groups perform about equally well. One possible reason for this may be that the present procedure made the task easier for all Ss, while group administration eliminated anxiety and its

beneficial effects on the learning of the high-anxious group, thus causing their performance to equal that of the low-anxious group. Another possible explanation is that low-anxious Ss are better motivated in a group task than the self-preoccupied high-anxious Ss, and that this additional social motivation makes up for the high-anxious group's task-oriented anxiety.

The present writer is inclined to favor the former hypothesis for the following reasons:

1. Since individual and group administration are not strictly comparable, it would be unreasonable to compare the absolute performance of the present group with that of Montague; only the differences between high-and low-anxious groups in the present sample as compared with that of Montague should be considered.

2. There were several features in the present experiment which probably tended to make it easier than Montague's: Syllables were exposed for three seconds instead of Montague's two; there was a demonstration prior to learning; the word START served as the cue for the first syllable, whereas Montague used an asterisk for this purpose.

The findings are consistent with hypothesis 5 to the effect that high-anxious Ss learn the easy nonsense syllables no better than low-anxious Ss. It is felt that the discrepancy

between Montague's and the present findings is due to differences in the manner of administration and instructions used. Individual testing, which places Ss under close personal scrutiny is likely to arouse more anxiety in the high-anxious Ss, who tend to compensate for this by being especially cooperative and attentive, thereby excelling in the learning of an easy task. Presumably task-oriented anxiety responses were minimized in the present group testing situation, so that high-anxious Ss performed no better than low-anxious Ss.

The findings are interpreted as indicating that Montague's results were largely dependent on the specific experimental conditions employed and cannot be accounted for on the basis of anxiety alone.

C. Summary of the Results

There were no statistically significant differences between "high-" and "low-anxious" Ss in serial rote learning, either in the hospital or the college experiment. Similarly there was no difference in digit span between experimental and control Ss in the hospital experiment. A high relationship was found between the learning of easy nonsense syllables and anxiety-related words ($r = .689$).

The results of the hospital experiment make it appear quite doubtful whether the experimental group was actually more anxious than the control group. If the experimental group was more anxious, then anxiety had no noticeable effect on the learning of the tasks used in the present study.

The results of the college experiment indicate that Montague's finding of better performance for high-anxious Ss on easy tasks lacks generality and is dependent upon a specific type of anxiety-arousal.

CHAPTER IV

DISCUSSION

A. Tuberculosis Hospitalization as a Source of Anxiety

Several findings in the present study make it appear quite doubtful whether the experimental group of patients were more anxious than the control group, as had been assumed in this experiment. There was no reliable difference in digit span between experimental and control groups, and more long-term hospitalized patients than new patients verbalized feelings of anxiety. Also, the hypothesized superiority of the control group in the rote learning tasks did not materialize. The digit span findings were especially puzzling since Berger had obtained significant differences in favor of the long-term patients under almost identical conditions a year earlier. The writer has attempted to find the reasons for this discrepancy, and the following possibilities have been considered:

1. It seemed conceivable that the present experimental group had a longer average waiting period from diagnosis to hospitalization than Berger's, during which time they might have become adapted to the idea of having tuberculosis.

However, hospital authorities, upon questioning, denied any change in this direction since the time of Berger's study.

2. While Berger's experimental Ss were always tested on the day of admission, the present experimental Ss were seen within a period of three days from the day of hospitalization. A spot check indicates, however, that in the present study patients tested on the day of admission were not different in their performance from those who were tested on subsequent days.

3. While Berger's study employed personality tests in which Ss did not experience any direct failure, the present learning tasks were sufficiently difficult to cause some Ss to fail the practice test and thus be eliminated, or to give up in discouragement. However, approximately an equal number of Ss in the experimental and the control group were so affected,[1] so that this variable probably did not change the relative makeup of the two groups.

4. Perhaps the present experimenter gave an inordinate amount of reassurance to the subjects, so that differences in anxiety level may have been largely eliminated. The

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[1]Four experimental and five control Ss failed the practice test; four experimental and three control Ss gave up before completing the task.

reason for giving so much reassurance was the fact that Ss frequently became discouraged when they failed to learn the entire list right away, and refused to continue. Personality differences between Berger and the present experimenter may have influenced subject performance similarly. Perhaps Berger's approach was more "matter-of-fact" than that of the present E, who was probably too concerned with putting patients at ease, thereby causing differences in anxiety to diminish.

Of all the possible reasons why results of the Digit Span Test in the present investigation differed from Berger's, the latter seems the most plausible. On the other hand, it is conceivable that either Berger's or the present experimenter's findings were an artifact. In any case, the differences between new and old patients found by Berger and ascribed by him to differences in anxiety level seem to be somewhat elusive and perhaps dependent upon a particular experimenter's personality and approach. Therefore the usefulness of Berger's method of studying anxiety may be limited.

It is concluded that in interpreting the results of the hospital experiment, there is no justification for assuming that the experimental group was more anxious than the control group.

B. Verbal Learning in a Hospital Setting

The hypothesis that newly admitted tuberculosis patients would do less well both in the learning of easy and difficult nonsense syllables than long-term hospitalized patients was not borne out by the results. The fairly equal performance of the two groups indicated either that no consistent difference in anxiety level existed between them, or, if it existed, it failed to influence the learning of nonsense syllables.

The experiment failed to shed any light upon the writer's hypothesis that disruptive anxiety would operate so as to impair the learning of the experimental group. Nor was the experiment an adequate test of Spence's, Taylor's, and Montague's interpretation of anxiety as a drive which increases the absolute difference between strong and weak response tendencies.

The writer's assumption that patients would be less motivated than students toward doing well in an academic task, though plausible, may also have been unfounded, at least in the case of the new patients, who may have felt that their performance in the test would be related to their standing at the hospital. Task-oriented anxiety responses in an academic test situation may be present in non-college subjects as well as in college students.

The writer had hypothesized that the learning of anxiety-related words such as "worry", "homesick", "upset", etc. would be facilitated in the newly admitted patients, whose feelings might be reflected in these words. However, contrary to expectations, there was no significant difference between the experimental and the control group in the learning of the words, with a slight edge in favor of the control group. As in the case of the nonsense syllables, two possible interpretations are suggested: There may have been no consistent difference in anxiety between the two groups, or anxiety may not have affected the learning of anxiety-related words.

Incidentally, the verbalizations of several patients indicated that they associated the words with their hospital stay, e. g. the statement: "All these words have to do with being in a hospital."

In retrospect, the writer feels that his expectation of better learning of the anxiety-related words on the part of the new patients was not fully warranted. On the contrary, one might well argue that patients of long standing, who have gone through a number of stress situations in connection with their illness, have had more opportunity to assimilate such concepts as "worry", "pain", etc., which are contained

in the word list. In any case, the actual results indicate that neither group's learning of anxiety-related words was superior to that of the other.

An attempt to differentiate the learning of the tuberculous patients on the basis of their scores on Taylor's Anxiety Scale was also unsuccessful. While the A-Scale is usually effective only when much larger samples than the present one are used, the direction of the results contravenes the generality of Spence's and Taylor's theory of anxiety as a drive factor which multiplies strong and weak response tendencies. One of the trends, i. e. in the case of the easy task, seemed to offer some promise for the further use of non-college subjects in experiments utilizing the A-Scale in connection with learning tasks.

C. Anxiety and Learning Among College Students

In the college experiment, in which group administration of Montague's list of easy nonsense syllables was employed, the A-Scale again failed to differentiate between the learning of high-anxious and low-anxious Ss, although a large sample (N=119) was used, with 24 subjects in each of the two criterion groups. These results run counter to Montague's observation that high-anxious subjects learn the easy list better than low-anxious subjects. Montague

was able to observe these differences only at the five per cent level of confidence, and only by choosing special criterion groups (upper 10 per cent and lower 20 per cent of A-Scale scores). Even when the same absolute A-Scale scores as in Montague's study were used in the analysis of the present data, the results failed to uphold his findings and showed a slight trend in the opposite direction. The general validity of Montague's findings appears to be contraindicated. His observations may be applicable to cases of individual administration of learning tasks, which may mean that in threatening situations the anxiety potential of the high-anxious subjects operates so as to influence learning. However, anxiety per se can hardly be said to have drive characteristics in its influence upon learning, contrary to Spence's and Taylor's contentions.

The present experiment throws no light on Sarason's, Mandler's, and Craighill's theory of the coexistence of task-oriented and disruptive anxiety responses, which served in part as the basis for the writer's theoretical orientation. The nature of the task and administration were such as to make the arousal of disruptive anxiety responses quite unlikely.

D. Concluding Remarks

In the case of the hospital study, it was dubious whether there was any reliable difference in anxiety level between experimental and control group. If there was, then this difference in anxiety level had no noticeable effect on the learning tasks involved here.

In the case of the college experiment, the results failed to show the often claimed effects of anxiety on learning. The lack of any significant difference in performance between high- and low-anxious subjects in the present investigation should lead the researcher to considerable caution in accepting the results of past studies concerning the effects of anxiety upon learning as generally valid. In particular, the theory of Spence and Taylor, which conceives of anxiety as a drive which augments the absolute difference between strong and weak response tendencies seems to be lacking in general validity and was not substantiated by the present study.

The hospital investigation has failed to support the utilization of tuberculosis hospitalization as a source of anxiety for experimental purposes. This may have been due to a tendency on the part of the experimenter to give excessive encouragement to the subjects. If this were

the case, then the usefulness of the technique would be highly dependent on a particular experimenter's approach and personality. It is also possible that tuberculosis hospitalization, while causing anxiety in some patients, may be a welcome refuge from trouble to others, and these two types of reaction would tend to counterbalance each other. In any case, the present study raises some doubt in regard to Berger's conclusion that newly admitted tuberculosis patients are more anxious than old patients.

A worth-while by-product of the hospital investigation was the finding of a highly significant correlation between the learning of easy nonsense syllables and anxiety-related words ($r = .689$). The writer has not encountered any reports of a similar relationship between the learning of nonsense material and meaningful words.

The two present investigations conjointly serve to stress the fact that the study of the effects of anxiety upon learning cannot be carried on successfully without considering such aspects as the source of anxiety, the characteristics of the subjects, the nature of the task, the type of administration and instructions, as well as the interaction of these factors. Inasmuch as the present results tend to support the hypothesis that so-called

anxiety can be conceived of in terms of (a) task-oriented responses and (b) disruptive responses, they are evidence that anxiety is not a unitary phenomenon. This applies to the construct of anxiety as drive as well as to other conceptualizations of anxiety. The study further illustrates a need for better definitions and methods in studying the relationship between anxiety and learning, as well as greater caution in generalizing the results of restricted studies.

CHAPTER V

SUMMARY

The present thesis was designed to investigate the construct of anxiety as drive, as used by Hull, Spence, and Taylor with respect to the effects of anxiety on rote learning. According to Spence and Taylor, any increase in anxiety, as drive, will multiplicatively augment the strength of the response tendencies evoked in a particular situation. In an easy task, in which the correct tendencies are stronger than the incorrect ones, the presence of anxiety would multiply the absolute difference in strength between these tendencies, thereby resulting in faster learning. Conversely, in a difficult task in which the incorrect response tendencies are stronger than the correct ones, anxiety would impede learning. Evidence supporting this theory has been gathered by Spence, Taylor, and Montague in several experiments in which anxiety was determined by means of Taylor's A-Scale.

In the present thesis, the following alternate theory was proposed: Two major aspects are involved in learning under anxiety: 1. Task-oriented anxiety responses; 2. Disruptive anxiety responses. The former tend to

spur an individual on to greater effort, thus helping to improve his performance. This is exemplified by the anxious college student, who compensates for his anxiety by trying to excel in academic tasks. Disruptive anxiety responses, on the other hand, consist of self-preoccupation, worry about failure, and similar responses, which tend to interfere with efficient performance. Both types of response may be potentially present in a given individual. A person's anxiety potential affects his learning only when anxiety responses are aroused in a specific threatening situation. In the case of a "high-anxious" individual, a lower threshold for the arousal of anxiety responses exists than in a "low-anxious" individual. Task-oriented anxiety is recruited only when the learning task is related to the individual's specific interests and ambitions, while disruptive anxiety responses may occur in any threatening situation.

Most experiments on human learning and anxiety have used college students as subjects. Usually, high-anxious subjects were found to be superior in the learning of easy verbal tasks, whereas low-anxious subjects were found to be slightly superior in difficult verbal tasks.

In order to adequately determine whether the effects of anxiety upon learning are best explained in terms of

Spence's and Taylor's theory or that of the present writer, an attempt was made to minimize the task-oriented aspects of anxiety by using a non-college population and a real-life stress situation as a source of anxiety.

A study by Berger, using Rorschach, Word Association, and Digit Span Tests, had indicated that newly admitted tuberculosis patients were significantly more anxious than long-term hospitalized tuberculosis patients. The present design therefore employed new tuberculosis patients as an experimental group, and tuberculosis patients who had been hospitalized for six months or more as a control.

Two lists of nonsense syllables, one "easy" and one "difficult", as well as a group of "anxiety-related" words were the learning tasks. A Digit Span Test, which is commonly used as an indicator of anxiety and which had successfully differentiated "high-anxious" from "low-anxious" subjects in Berger's study, was also included.

Contrary to expectations, and contrary to Berger's findings, no significant differences between new and old patients were found on any of the three learning tasks or on the Digit Span Test. It was concluded that there was insufficient evidence for assuming that differences in anxiety level existed between new and old patients. The comparison between new and old patients therefore failed

to provide an adequate test of the two investigated hypotheses concerning learning under anxiety. If differences in anxiety level did exist, they failed to affect the learning tasks.

Using the same population, a comparison was also made between patients scoring high and low on the A-Scale. The size of the available sample was unfortunately rather small for a breakdown of this sort. Differences in learning were again statistically non-significant. In the case of the easy list however there was a trend contrary to the finding of Montague in favor of the low-anxious group. This trend was consistent with the present experimenter's hypothesis that high-anxious non-college subjects would do less well in the learning of the easy task, due to the prevalence of disruptive anxiety and the absence of task-oriented anxiety. Although this difference does not meet the accepted levels of confidence, further investigation with a larger sample would seem promising.

An additional experiment was performed with college students, in which anxiety was determined by means of the A-Scale and in which a list of easy nonsense syllables was used. In this case, it was endeavored to minimize anxiety arousal by means of group administration and by deemphasizing individual achievement. In accordance with the experimenter's hypothesis, and contrary to Montague's

findings, high-anxious subjects learned the list no better than low-anxious subjects. This finding was held to support the view that anxiety, as measured by the A-Scale, affects learning only when it is aroused by a specific threat situation and that anxiety facilitates learning only when task-oriented anxiety responses are aroused.

The results of the second and third parts of the present investigation are held to be more in line with the present theoretical framework than with Spence's and Taylor's construct of anxiety as drive.

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APPENDIX A

LISTS USED AND RULES FOR CONSTRUCTION[1] (HOSPITAL EXPERIMENT)

List A (Practice)	List 1 (Difficult)	List 2 (Easy)	List 3 (Anxiety-related) Words
BEW	FOZ	DAR	WORRY
HAJ	ZIS	FUZ	HOMESICK
MIP	MOF	TEL	UPSET
VOH	SIF	SIK	RECOVERY
	SOZ	ROP	ESCAPE
	MIF	JUN	AFRAID
	FOS	LAF	PAIN
	ZOF	HIR	DEPRESSED
	MIZ	KOM	HOPE
40%	25%	90%	(Approximate association values)

List 2 has the following characteristics, the purpose being to reduce formal similarity of items and intralist interference:

1. A consonant appears as the first letter of a syllable only once.
2. A consonant appears as the third letter of a syllable only once.
3. Only in one case does a vowel occur more than once within four consecutive syllables.
4. Only twice does any consonant appear more than once in four consecutive syllables.
5. No two letters of a syllable are the same as any two adjacent letters of another syllable in the same list.
6. Letters used in the ninth syllable are not used in the first.
7. Alphabetical sequences of consonants or vowels have been avoided as much as possible.

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[1] Adapted from Montague (25), Melton (25), and Glaze (9).

The above rules were not followed in the construction of List 1. It uses only consonants S, F, M, Z, and vowels I and O. Vowels and consonants are about evenly distributed throughout the list in order to avoid a concentration of several of a particular vowel or consonant in any single part of the list. Such a distribution minimizes the possibility of having a certain part of the list being more easy or difficult than other parts.

APPENDIX B

INSTRUCTIONS
(HOSPITAL EXPERIMENT)

E starts out by showing S the drum (placed on List A (Practice), with a star showing). "What you see here is a memory drum. Watch the little window here. I am going to start the machine now.... You notice it move? What you see there are nonsense syllables. I am going to ask you to memorize some of these.... At the end of the list, a series of stars appear. Then the list of syllables starts over again."

When an asterisk appears after two runs of List A, the E stops the machine. If S does not comprehend, further explanation follows. Then:

"Your task is to learn to spell <u>aloud</u> each nonsense syllable just before it appears in the window. You get your cue for each syllable from the syllable before it. Now, on the first run, you don't have to spell them in advance. Just spell each syllable out aloud as soon as it appears in the window. After the first run, on all runs after the first, spell each syllable out aloud just <u>before</u> it appears.

"Now remember, each syllable is the cue for the next syllable. The cue for the first syllable is the series of stars. Don't be afraid to call them out if you think you

have any idea what they are. There is no penalty for mistakes. However, if you should make a mistake, or if you don't know what the syllable is, give the correct response aloud when the syllable does appear. In other words, spell out the syllable before it appears if possible, but if not possible, spell it out after it appears.

"That is all. Remember, the first time through, spell them as soon as you see them. After that, try to spell them before you see them.... Any questions?"

The subsequent first trial on List A is actually the third run, because of the two prior demonstrations. No record is made until the fourth run of List A. On subsequent lists, the second run is the first one to be recorded.

The following is added before presenting List 3 (anxiety-related words):

"Now I am going to show you another list. But this time the list is made up of words instead of syllables. So please read the words instead of spelling them. Everything else is the game as before."

APPENDIX C

THE A-SCALE[1]

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[1]This is a short form of the Minnesota Multiphasic Personality Inventory (MMPI). Ss were required to fill out 225 items, but were scored only on the 50 items forming the A-Scale, which are here reproduced. Responses scored as anxious are indicated at the left margin. The higher a person's score, the more anxious he was judged to be.

BIOGRAPHICAL INVENTORY

Do not write or mark on this booklet in any way. Your answers to the statements in this inventory are to be recorded only on the separate Answer Sheet.

Print your name, the date, the date of your birth, age, sex, etc., in the blanks provided on the Answer Sheet. Use only the special pencil provided for this test; this pencil must be used because the Answer Sheet will be checked by a machine. If your special pencil runs out of lead, get another pencil from the Examiner. Do not use any other type of pencil. After you have completed filling in the blanks, finish reading these instructions.

The statements in this booklet represent experiences, ways of doing things, or beliefs or preferences that are true of some people but are not true of others. You are to read each statement and decide whether or not it is true with respect to yourself. If it is true or mostly true, blacken the answer space in column T on the Answer Sheet in the row numbered the same as the statement you are answering. If the statement is not usually true or is not true at all, blacken the space in column F in the numbered row. You must answer the statement as carefully and honestly as you can. There are no correct or wrong answers: we are interested in the way you work and in the things you believe.

Remember: Mark the answer space in column T if the statement is true or mostly true; mark the answer space in column F if the statement is false or mostly false. Be sure the space you blacken is in the row numbered the same as the item you are answering. Use only the first two columns, the ones labeled T and F. Mark each item as you come to it; be sure to mark one, and only one, answer space for each item. Here is an example:

	T	F
I would like to be an artist.	. .	. .

If you would like to be an artist, that is, if the statement is true as far as you are concerned, you would mark the answer space under T. If the statement is false, you would mark the space under F.

If you have any questions, please ask them now.

DO NOT MARK ON THIS BOOKLET

F 4. I do not tire quickly.

F 7. I believe I am no more nervous than most others.

F 11. I have very few headaches.

T 13. I work under a great deal of tension.

T 14. I cannot keep my mind on one thing.

T 16. I worry over money and business.

T 18. I frequently notice my hand shakes when I try to do something.

F 24. I blush no more often than others.

T 26. I worry quite a bit over possible misfortunes.

F 27. I practically never blush.

T 33. I am often afraid that I am going to blush.

F 36. My hands and feet are usually warm enough.

T 38. Sometimes when embarrassed, I break out in a sweat which annoys me greatly.

F 41. I hardly ever notice my heart pounding and I am seldom short of breath.

T 43. I feel hungry almost all the time.

F 44. I am very seldom troubled by constipation.

T 46. I find it hard to make talk when I meet new people.

T 47. People often disappoint me.

T 51. I have had periods in which I lost sleep over worry.

T 56. I dream frequently about things that are best kept to myself.

T 58. Some of my family have habits that bother and annoy me very much.

T 66. I am easily embarrassed.

T 67. I am more sensitive than most other people.

T 74. I easily become impatient with people.

T 77. I frequently find myself worrying about something.

T 82. I wish I could be as happy as others seem to be.

F 83. I am usually calm and not easily upset.

T 86. I cry easily.

T 87. I feel anxiety about something or someone almost all of the time.

F 94. I am happy most of the time.

T 99. It makes me nervous to have to wait.

T 100. I have periods of such great restlessness that I cannot sit long in a chair.

T 103. Sometimes I become so excited that I find it hard to get to sleep.

T 107. I have sometimes felt that difficulties were piling up so high that I could not overcome them.

F 108. At times I have a strong urge to do something harmful or shocking.

T 111. Sometimes I am sure that other people can tell what I am thinking.

T 112. I must admit that I have at times been worried beyond reason over something that really did not matter.

F 117. I have very few fears compared to my friends.

T 123. I have been afraid of things or people that I know could not hurt me.

T 133. I am afraid when I look down from a high place.

T 136. I certainly feel useless at times.

T 138. I find it hard to keep my mind on a task or job.

T 152. I am inclined to take things hard.

T 153. I am a high-strung person.

T 163. Life is a strain for me much of the time.

T 164. At times I think I am no good at all.

T 168. I am certainly lacking in self-confidence.

T 183. I sometimes feel that I am about to go to pieces.

T 187. I shrink from facing a crisis or difficulty.

F 190. I am entirely self-confident.

APPENDIX D

LEARNING LISTS[1] (COLLEGE EXPERIMENT)

List A (Demonstration)	List 2a[2] (Easy)
BEW	DAR
HAJ	FUZ
MIP	TEL
VOH	SIK
	ROP
	JUN
	LAF
	HIR
	MED
	BUX
	PAC
	KOM
40%	90% (Approximate association values)

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[1]Adapted from Montague (25), Melton (25), and Glaze (9).

[2]Rules for construction are analogous to those for List 2 (Hospital Experiment), which is an abbreviation of the present list.

APPENDIX E

INSTRUCTIONS
(COLLEGE EXPERIMENT)

"This is a verbal learning experiment. The purpose is to find out something about how people learn verbal material. We are mostly interested in the performance of the entire group, and we are not concerned with the performance of any one individual.

"This experiment will be of scientific value if you give us your whole-hearted cooperation and carry out instructions as accurately and honestly as possible."

(Bags with pads and pencils are distributed.)

"Please open the bags that were handed to you and take out the paper pads. You should each have 19 pads of paper.

"Please write your names on the back of each pad."

(E waits till every S completes this.)

"We will project some material onto that screen. When the projector starts, a nonsense syllable will appear on the screen. (Demonstration) ... It is exposed for a short time, then, after a brief interval, a new syllable appears. (Demonstration) This in turn is exposed for a short time and then followed by the next syllable and so on. This procedure is repeated until all the syllables in the list have been shown. Then the word "start" appears in the window.

(Demonstration) This indicates that the list is about to begin again."

(E waits until the demonstration list has been presented twice.)

"The list you have just seen was for demonstration purposes only. From now on, we will use another list."

"Your task is to learn to <u>print</u> each nonsense syllable on a piece of paper <u>before</u> it appears on the screen, using the syllable just before it as your cue. The first time through the list, just watch the screen and try to learn some of the syllables. After the first time, on all trials after the first, as soon as you see a syllable, try to print the following one before it appears. Each syllable then is the cue for the one following. The cue for the first syllable is the word "start".

"At the start of each trial, pick up one of the 19 pads handed to you and put the number I tell you on the back underneath your name. Use the top sheet for your first anticipation, the second sheet for your second anticipation, etc. Every time a syllable is removed, you will hear a clacker. (Demonstration) At this time, you all are to turn over the sheet you are working on and proceed to the following sheet. <u>Do not delay</u> your page turning. Let us all do it at the same time. That is, as soon as the clacker sounds, you turn a page, regardless of whether you have printed a syllable or not. If you cannot think of the next syllable, leave the sheet blank.

"At the end of each trial, put your pad down, face down, and pick up another pad, and write down the number of the trial, which I will give you.

"Don't be afraid to put down a syllable if you think you have any idea what it is going to be. There is no penalty for mistakes.

"That is all. Remember, the first time through, just watch them and try to learn them. After that, try to anticipate them by printing them on your pad before the clacker sounds and the syllable appears. As soon as the clacker sounds, you all turn over to the next page. Do not race ahead. Don't turn a page until the clacker sounds.

"Your score is the number of syllables you can learn correctly in the number of trials given.

"Any questions?"

"Put all the blank pads to one side. Do not use a pad until the second trial."

(Exposure time 3"; between exposures 3/4"; between trials 6".)

(Initial presentation of List 2a follows. Then:)

"Now pick up one pad and put number 1 on the back. Now turn it to the front...Proceed."

(Trial 1 now takes place. After Trial 1:)

"Now put the finished pad to one side, face down. Pick up a new blank pad and put number 2 on the back...Proceed."

(After Trial 2:)

"Now pick up another pad. Write No. 3 on the back... Proceed."

(Etc.)

(At End:)

"Please put your pads back into your bag." (All materials are collected.)

"The results of this experiment will be given to your instructor."