THE EFFECT OF TWO LEVELS OF NOISE, TWO TYPES OF NOISE, AND ANXIETY ON STUDENT PERFORMANCE OF A CODING TASK

DISSERTATION

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF EDUCATION

By

William E. Nearing, B. S., M. A.

Denton, Texas

August, 1978

Nearing, William E., The Effect of Two Levels of Noise, Two Types of Noise, and Anxiety on Student Performance of a Coding Task. Doctor of Education (Higher Education), August, 1978, 60pp., 4 tables, 2 appendices, bibliography, 65 titles.

This study dealt with the effect of low-level noise and high-level noise, of white noise and varied noise, and of high manifest anxiety and low manifest anxiety on college students' performance on a coding task.

Subjects were eighty undergraduate college students drawn from enrollments at North Texas State University during the spring and summer of 1974. The Taylor Manifest Anxiety Scale was administered and was used to identify high-anxiety from low-anxiety subjects. Four equal groups were formed, each group consisting of an equal number of high-anxiety and low-anxiety subjects.

Two experimental groups were exposed to high-level noise, and two experimental groups were exposed to low-level noise. Two experimental groups were exposed to white noise, and two experimental groups were exposed to varied noise. (Varied noise was produced by playing backward a tape of a popular musical selection.)

A three-way analysis of variance was made of the number of coding responses. There was found to be no significant difference between high-anxiety and low-anxiety types in

performance on the coding task. There was found to be no significant difference between those exposed to high-level noise and those exposed to low-level noise in performance on the coding task. There was found to be a significant difference between those exposed to varied noise and those exposed to white noise.

The conclusions of the study, based upon the hypotheses, were as follows.

1. Level of anxiety does not affect performance on a coding task.

2. The level of white and level of varied noise does not affect performance on a coding task.

3. Varied noise has a positive effect on performance on a coding task.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Education should make use of the research findings of the various behavioral sciences, particularly psychology. As stated by Symonds,

> Sometimes it seems as though, in spite of all the discoveries made by psychologists in the past two generations that have application to the process of education, in too many places education is still coasting along on traditional rule of thumb methods. There are some who believe that education, as an art or a technology, should be based on scientifically determined and tested principles that are supplied by the life sciences, psychology in particular, just as engineering is solidly based on principles of mathematics, physics, and chemistry (18, p. 1).

Motivation has been a topic of interest both to psychologists and to educators. Recent research has increased our understanding of motivation through the concept of arousal. The arousal hypothesis, proposed by Hebb (12), states that changes in the environment are perceived by the organism as changes in stimulation. These changes are transmitted to areas of the cortex. When the cortex perceives a great change in stimulus, the organism is put into a state of alert. It is in this state that the organism is most ready to react. This ability is not specific to the sense organ that has perceived the change in stimulus, but is generalized to all areas of the organism's activities. It is in this state that the organism is capable of optimum performance.

The importance of the concept of arousal in future motivational research is projected by Haber:

> The concept of arousal and activation make possible large leaps ahead in understanding motivational processes. They have forced a recognition that central nervous system behavior has two components: a patterning that occurs at its higher centers, and a level of activity that occurs in the lower centers. A single sensory input contributes to both of these--the patterning at the terminus of the sensory pathway, and arousal of the brain stem through which collaterals of that sensory pathway pass.
>
> Hebb has perhaps contributed more to this area theoretically than any other psychologist, beginning with his attention to a careful separation of the level of arousal of the nervous system and the pattern of activity within it. . . . His (Hebb's) work and thinking has perhaps altered the course of contemporary psychology more than any other single man. His work taken in conjunction with several others will lay the foundation for the next several decades (9, p. 266).

In testing the arousal hypothesis, noise has often been used as additional stimulus in attempts to induce high states of arousal. There have been varying degrees of success in inducing arousal states with noise by such experimenters as Broadbent (5), Davenport (6), Harris (10), and Haynes (11). There are several possibilities for accounting for the fact that results sometimes support and sometimes refute the arousal hypothesis. Among these are differences in population, types of noise, amount of noise, and tasks used to demonstrate a state of arousal.

A variable that has not been sufficiently treated is the effect of personality factors in the ability of subjects to reach a state of high arousal. Mandler and Sarason (15) demonstrated that anxiety can exert a strong effect on performance. It thus seems that the abilities of high and low anxiety types to reach a state of high arousal through additional stimulus is a viable area of research. It was to this question that this research was directed.

Hypotheses

Hypotheses 1-3 were the main hypotheses of the study. Other hypotheses were to be generated were two or more of the main hypotheses to be accepted.

1. The subjects displaying high manifest anxiety will perform significantly better on a coding task than subjects displaying low manifest anxiety.

2. The subjects exposed to high level noise will perform significantly better on a coding task than subjects exposed to low level noise.

3. The subjects exposed to random noise will perform significantly better on a coding task than subjects exposed to white noise.

Definition of Terms

For the purposes of this study, the following definitions of terms will be used.

Anxiety. That which is measured by the *Taylor Manifest Anxiety Scale* developed by J. A. Taylor.

Low Level Noise. Noise that registers 74db on a sound survey meter.

High Level Noise. Noise that registers 93db on a sound survey meter.

White Noise. A complex mixture of sound waves of all possible frequencies, analogous to white light.

Varied Noise. Noise produced by playing a recorded musical selection backward.

Limitation of Study

The findings and conclusions reached in this study were limited in their application to undergraduate college students similar to those who took part in this study performing a coding task similar to that used in this study.

Basic Assumptions

1. It was assumed that all subjects would perform to the best of their ability on the coding task.

2. It was assumed that none of the subjects had prior experience on a task similar to the coding task.

3. It was assumed that no subject would possess a disability which would limit performance on the coding task.

Description of Subjects

The subjects who took part in this study were undergraduate students who were attending North Texas State University during the spring semester and summer semester of 1974. They were all volunteers from enrollments in the following courses: Psychology 163, Psychology 165, Education 345, and Education 349.

Description of the *Taylor Manifest Anxiety Scale*

Taylor (19) based the *Taylor Manifest Anxiety Scale* on the *Minnesota Multiphasic Personality Inventory*. Five specialists selected those items from the *Minnesota Multiphasic Personality Inventory* which they considered suitable for determining chronic or manifest anxiety as defined by Cameron. The panel were in 85 per cent agreement that on sixty-five items responses would indicate manifest anxiety. Taylor later reduced the number of items to fifty and revised some of the items to clarify their meaning.

Taylor (20) presented data suggesting a reasonably high reliability for this instrument. Taylor found the reliability to be .81 and .89 in a test-retest situation. In the first study, fifty-nine students were tested with three weeks separating tests, In the second study, 163 students were tested; 113 were re-tested after five months, fifty were re-tested after nine to seventeen months. It was found that there was a direct correlation between the time that elapsed between the two testing situations and the difference between test scores.

Description of the Coding Task

The coding task was based on the Digit-Symbol Test, a subtest of the _Wechsler Adult Intelligence Scale_ with additional problems from the coding subtest of the _Wechsler Intelligence Scale for Children_. The additional problems lengthened the task without altering the design.

Zimmerman and Woo-Sam (21) describe the Digit Symbol subtest of the _Wechsler Adult Intelligence Scale_ as being nine symbols that paired with the numbers 1-9. The numbers and the symbols are always visible to the subject while he is performing the task. His task is to fill in the spaces below a series of numbers with the appropriate symbol for each of the numbers.

Procedures for Collecting Data

The _Taylor Manifest Anxiety Scale_ was administered to each of the subjects who participated in the study. A copy of the _Taylor Manifest Anxiety Scale_ is found in Appendix A. The completed _Taylor Manifest Anxiety Scale_ of each subject was scored. The resulting scores were placed in descending order with the score indicating the highest manifest anxiety on top and the score indicating the lowest manifest anxiety at the bottom. Since the _Taylor Manifest Anxiety Scale_ has not been standardized as to levels of manifest anxiety, the examiner used the mean of this population as the point of division between the high manifest anxiety group and the low manifest anxiety group.

A population of eighty subjects was used in this study. The forty subjects with the highest scores on the Taylor Manifest Anxiety Scale were designated the high-anxiety group and the forty subjects with the lowest scores on the Taylor Manifest Anxiety Scale were designated the low anxiety group. A table of random numbers was used to divide the forty subjects in the high manifest anxiety group into four mutually exclusive subgroups of ten subjects each. A table of random numbers was used to divide the forty subjects in the low-anxiety group into four mutually-exclusive subgroups of ten subjects each. A table of random numbers was used to increase the probability that each of these subgroups would be a sample of the population.

One of the four high-anxiety subgroups and one of the four low-anxiety subgroups was assigned to perform the coding task in an environment of low-level white noise. One of the four high-anxiety subgroups and one of the four low-anxiety subgroups was assigned to perform the coding task in an environment of high-level white noise. One of the four high-anxiety subgroups and one of the four low-anxiety subgroups was assigned to perform the coding task in an environment of low-level varied noise. One of the four high-anxiety subgroups and one of the four low-anxiety subgroups was assigned to perform the coding task in an environment of high-level noise.

The time allotted for performing the coding task was six minutes. It was performed in ordinary college classrooms. The noise was provided to all groups through an ESS AMT-1 speaker. The number of subjects taking the test at one time varied from one to four. Subjects were placed about one yard from the speaker for these experiments. During testing, the sound level was monitored at the position of the subjects by a Realistic sound-survey meter. The residual noise found in the room was included in the sound level used in this experiment. All subjects were given the same instructions on how to perform the coding task. The instructions are those found in the manual of the *Wechsler Adult Intelligence Scale*, with the exception that no practice examples were allowed. The white noise was supplied by a tuner with the dial placed between stations. The varied noise was supplied by backward playback of a recording of the *Poem for Violin and Orchestra* by Ernest Chausson.

Background and Significance of Study

The study explored the arousal properties of anxiety and of external stimulation on performance on a coding task.

It has been recognized that high-anxiety levels can be detrimental to performance. Atkinson and Litwin (4) suggest that the highly anxious individual does not put forth his full effort. They feel that he does not put forth his full effort so that when he fails, he knows that he did not try. Thus, he did not really fail, because he was not trying. Malmo (14) feels that some anxiety is beneficial to performance, however excessive anxiety can interfere with performance.

The prediction of performance in low-anxiety and high-anxiety individuals is complexly determined by a number of variables that include the situation as perceived by the individual, personality characteristics, and the task which the individual will be performing. If anxiety has the ability to arouse, its presence might be used to improve student performance. Use of anxiety as an aid to improved student performance would require determination of anxiety level of the student, the task to be attempted, and the environment in which the task is to be performed.

The study will test the effect of low and of high anxiety on the performance of students of a coding task.

Duffy (7), Hebb (12), and Malmo (14) suggested that when an individual is in a state of arousal, increased sympathetic activation and motor activity is manifest. It is postulated that in the state of arousal the individual is faster and more active, which is evidenced by shorter latency, less time taken to make or complete a response, and by more responses made with greater force or amplitude in a given period.

Lindsley (13) described the way the central nervous system shows change through increased activity. This is accomplished through the reticular activating system and involves the reticular formation, thalamus, and cortex. The reticular activation system includes fibers that ascend to the cortex and fibers that descend from the cortex. When stimuli impinge on a sense organ, some sensory impulses are diverted to the ascending reticular activation system. This route is used by all the sense organs to reach the reticular formation and from it impulses are transmitted to the cortex.

Research suggests that the reticular formation activates the cortex upon sensory stimulation. This in turn produces an awake individual. It is further thought that the amount of neural activity in the reticular formation is the primary determinant of the level of cortical activation and behavioral arousal at a given moment.

Noise has been used as a means to induce arousal. Archer and Margolin (3) used white noise to see if it would increase recall. If external stimulation does increase memory, educators might reconsider the use of accoustical tile and other means of reducing noise. It might be that the unsupressed noise might increase arousal with a corresponding increase in student productivity.

The present study used white noise and varied noise as an external stimulus to test their effects on students' performance on a coding task.

Glasser and Zimmerman (8) described the coding subtest of the *Wechsler Intelligence Scale for Children* as requiring the subject to match and copy symbols in blank spaces which are found on the test form. Anastasi (2) indicates that the coding task was introduced in the *Woodworth-Wells Association Tests* and has been often included in non-language intelligence tests. The coding test is popular because it is quick and simple to administer.

It is thought that the coding test measures the ability to memorize abstract symbols in conjunction with numbers. Visual dexterity and small motor control are factors in influencing performance on this test. Oakland (16) found a significant correlation between achievement orientation scores and coding scores in a population of handicapped children.

The coding test is a monotonous task which requires a high degree of visual-motor coordination. Writing exercises would seem to be similar to the coding task.

The present study uses a coding task to measure the effect of levels of anxiety and levels of external stimulation on student performance.

It is suggested that anxiety and external stimulation affect performance. It is felt that the coding task is suitable for experimental measure of performance. Thus, if levels of anxiety influence performance, that should be reflected in the scores of the coding task. If levels of external stimulation affect performance, that should be reflected in the scores of the coding task.

CHAPTER BIBLIOGRAPHY

1. Alpert, Richard and Ralph N. Haber, "Anxiety in Academic Achievement Situations," Journal of Abnormal and Social Psychology, LXI (September, 1960), 207-215.

2. Anastasi, Anne, Psychological Testing, New York, Macmillan Company, 1961.

3. Archer, Barbara U. and Robert R. Margolin, "Arousal Effects in Intentional Recall and Forgetting," Journal of Experimental Psychology, LCCCVI (October, 1970), 8-12.

4. Atlinson, John W. and George H. Litwin, "Achievement Motivation and Test Anxiety Conceived as Motivation to Approach Success and Motivation to Avoid Failure," Journal of Abnormal and Social Psychology, LX (January, 1960), 52-63.

5. Broadbent, Donald E., "Effects of Noise on Behavior," Handbook of Noise Control, edited by Cyril M. Harris, New York, McGraw-Hill Book Company, 1957, 10-34.

6. Davenport, William G., "Vigilance and Arousal: Effects of Different Types of Background Stimulation," Journal of Psychology, LXXXII (November, 1972), 339-346.

7. Duffy, Elizabeth, "The Psychological Significance of the Concept of 'Arousal' or 'Activation,'" Psychological Review, LXIV (September, 1957), 265-275.

8. Glasser, Albert J. and Irla Lee Zimmerman, Clinical Interpretation of the Wechsler Intelligence Scale for Children, New York, Grune and Stratton, 1968.

9. Haber, Ralph Norman, Current Research in Motivation, New York, Holt, Rinehart and Winston, Inc., 1966.

10. Harris, C. Stanley, "Effects of Intermittent and Continuous Noise on Serial Search Performance," Perceptual and Motor Skills, XXXV (October, 1972), 627-634.

11. Haynes, Jack R., "Effects of White Noise and Presentation Rate on Serial Learning in Mentally Retarded Males," American Journal of Mental Deficiency, LXII (January, 1970), 574-577.

12. Hebb, Donald O., "Drives and the C.N.S. (Conceptual Nervous System), Psychological Review, LXII (July, 1955), 243-253.

13. Lindsley, Donald B., "Emotion," Handbook of Experimental Psychology, edited by S. S. Stevens, New York, Wiley, 1951, 473-516.

14. Malmo, Robert B., "Studies of Anxiety: Some Clinical Origins of the Activation Concept," Anxiety and Behavior, edited by C. D. Spielberger, New York, Academic Press, 1966, 157-177.

15. Mandler, Geroge and Seymore B. Sarason, "Anxiety as a Factor in Test Performance," American Psychologist, VI (August, 1951), 341-352.

16. Oakland, James A. "WISC Coding as a Measure of Motivation," Journal of Experimental Psychology, XLII (October, 1969), 411-412.

17. Spence, Kenneth W. and Janet A. Taylor, "Anxiety and Strength of the UCS as Determiners of the Amount of Eyelid Conditioning," Journal of Experimental Psychology, XLII (September, 1951), 183-188.

18. Symonds, Percival Mallon, What Education Has to Learn from Psychology, New York, Teachers College Press, 1968.

19. Taylor, Janet A., "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, XLVIII (April, 1953), 285-290.

20. _______________, "Drive Theory and Manifest Anxiety," Psychological Bulletins, LIII (July, 1956), 303-320.

21. Zimmerman, Irla and James M. Woo-Sam, Clinical Interpretation of the Wechsler Adult Intelligence Scale, New York, Grune and Stratton, 1973.

CHAPTER II

RELATED LITERATURE

The studies presented in this chapter have been divided into three groups: 1) Studies related to anxiety and its effect on performance; 2) Studies related to the effect of noise on performance; and 3) Studies related to the task of coding.

Anxiety and Its Effect on Performance

Spielberger (41) believes that confusion has resulted from the overuse of the term "anxiety." He indicated that the term is used for two conditions which are, in reality, quite different. The term is used to describe a personality trait and also to describe a transitory state on an individual at a given time. The latter is a situational type of anxiety where the individual feels he is in danger from a specific cause. Sarason (35) has suggested that studies that have investigated the personality trait of anxiety have ignored the situational anxiety of the test situation. It is suggested that the situation may have influenced the results of the experiment.

Basowitz (6) believes that during low levels of anxiety, the organism is in a state of preparedness with increased vigilance, sensitization to events within his environment, and ability to cope with danger. It seems that at this level of anxiety the individual has better integration of behavior and is better able to perform. It seems that some anxiety will aid in obtaining maximum productivity.

To study the effect of anxiety, as a motivational force on learning, Taylor (42) developed the _Taylor Manifest Anxiety Sacle_. Cameron's description of chronic anxiety was used as a basis for the scale. It was felt that those subjects who received high scores on the _Taylor Manifest Anxiety Scale_ would be high-drive individuals, and those who scored low on the scale would be low-drive individuals.

Taylor (43) studied eyelid conditioning of sixty subjects who were selected because of their extreme scores on the _Taylor Manifest Anxiety Scale_. This study indicated that those who achieved high scores on the anxiety scale achieved eyelid conditioning more rapidly than those who scored low on the scale. Spence, Farber and McFann (40) performed a similar eyelid study using the _Taylor Manifest Anxiety Scale_ as a screening device. The results of this study were similar to those reported by Taylor.

Weiner (49) studied high- and low-anxiety individuals' key-pressing responses to external stimuli. His study indicated that the high-anxiety individuals had a shorter response time than the low-anxiety individuals. Mednick (27) used a light stimulus to study response time in high- and low-anxiety individuals. In the study, the high-anxiety individuals adapted to the light stimulus more rapidly than did the low-anxiety individuals.

Martens, Gill and Scanlan (24) studied the effect of anxiety on performance of a complex motor maze. One hundred and eighty fifth and sixth grade children took part in the study. The study concluded that anxiety did not significantly affect the performance of the children on the motor maze.

Taylor and Spence (45) studied serial learning in high-anxiety and low-anxiety individuals. Those individuals who received high-anxiety scores did not perform as well as individuals with low-anxiety scores. Mandler and Sarason (23) studied the effect of high- and low-anxiety groups in a test situation. The study indicated that the presence of anxiety is an important variable in the testing situation.

Sarason (35) studied the academic achievement of high- and low-anxiety boys. He concluded that the high-anxiety boys were less academically capable, having impaired concept formation, than were the low-anxiety boys.

Taylor and Chapman (44) studied the performance of high- and low-anxiety individuals on a task of pairing nonsense syllables. The conclusion of the study was that high-anxiety individuals achieved a predetermined ability level more rapidly than did the low-anxiety individuals. Spence, Farber, and McFann (40) studied low-anxiety and high-anxiety groups in a situation which required the pairing of words. The high-anxiety group was able to pair the words correctly in less time than the low-anxiety group.

Gynther (14) studied the face-to-face communication ability of individuals at various anxiety levels. The study suggests that highly anxious individuals were less able to communicate effectively. Goodstein (13) studied the amount of verbal production of individuals of various levels of anxiety during the administration of the Rorschach. The study found the highly anxious individuals were superior in verbal production. Davis (10) administered the Word Association Test to individuals of high and low anxiety. The high-anxiety individuals were superior in word production in this study.

The studies seem to demonstrate that there is a correlation between anxiety and productivity. These studies indicate this correlation even though often different methods were used to determine the presence of anxiety.

The Effect of Noise on Performance

Hebb (19) has hypothesized that the organism uses the perceived change in its environment not only as clues for orientation, but also to arouse areas of the cortex. The state of arousal is increased by increased variability of stimulation within the environment. If this hypothesis is correct, the increased state of arousal should be discernible by an increase in the ability to perform those tasks which are concurrent with the increase in stimulation.

Parks and Payne (29) studied the effect of noise on the ability to perform math problems. Forty college students of equal math ability were divided into four groups for this study. Two of the groups worked math problems in quiet rooms which contained about 50-70db of noise. The two other groups worked math problems in rooms containing high intensity noise of about 108db.

Groups in each noise environment received math problems which were rated as difficult and problems which were rated as not being difficult. The results of the study indicated that noise did not significantly affect the performance of the group with the difficult problems or the group with the problems which were not considered difficult. Mech (26) achieved the same results in a similar study which used four groups of fifteen subjects each.

Kassinove (21) studied the effect of noise on the performance of third and sixth grade students on addition and subtraction problems. The students were allowed to perform at their own rate of speed. Forty subjects from each grade were selected for this study. Several types of auditory stimulation were used during the study. The study indicated that the noise had not influenced the students' performance.

Frankenhaeuser and Lundberg (11) studied the effect of noise on performance of mental arithmetic. Fourteen college students were exposed to intermittent noise of from 65 to 85db. The study found no significant difference in performance between the session with noise and the session without noise.

Haynes (18) studied the effect of noise on serial learning. The subjects used in this study were classified as mentally deficient. The study indicated that noise did not improve the performance of this group in serial learning.

Benignus, Otto, and Knelson (5) studied the effect of noise on the performance of twenty-seven males on a numeric monitoring task. Noise 11.5 to 350 Hz at 80db was used in this experiment. The study found that more signals were missed when noise was present than when noise was not present.

Mikol and Denny (28) studied the effect of noise on the performance of a pursuit rotor task. The performance of thirty-two subjects was tested in an environment of silence and also in an environment of music. The study concluded that the music had not improved the performance of this group. However, twenty-eight subjects indicated that they felt that the music had aided their performance.

Samuel (33) designed a study which required the subjects to shift attention from one screen to another. The subjects who performed the task in an environment with induced noise tended to perform better than those in a quiet environment.

There have been several other studies on the effect of noise on individuals' performance of a vigilance task. Broadbent (7) has shown considerable interest in this area. Several of his studies have shown noise to affect performance. He concluded that his subjects tended to make more mistakes in a noise environment than in a quiet environment. After reviewing the literature, he concluded that the majority of studies indicate than an environment with noise tends to lead to active, but inaccurate behavior.

Davenport (9) studied the effect of four types of noise on the performance of a visual vigilance task. The study indicated that there were significantly different detection rates with each type of noise. The group which consistently showed superior performance was that group which was provided with random noise. Watkins and Fechrer (47) suggested that bursts of noise provided better performance than silence. The study involved seven subjects performing a visual detection task.

Westman and Carter (48) studied the effect of noise on performance of a letter cancelling task. The sixty-two college students that took part in the study were exposed to three types of noise and control during the experiment. The study concluded that there was no significant relationship between noise and performance on a letter cancelling task.

Sherrod, Hage, Halpern, and Moore (38) studied the effect of noise on a task that required attention to detail.

The study was conducted on sixty college students. The students made less errors when the noise was not present in this study.

Angetino and Mech (3) administered the California Test of Personality to a population of 150 undergraduate students. The fourteen students that scored highest in adjustment on this test and the fourteen students that scored lowest in adjustment on this test were selected for the study. The students performed a routine task in quiet and also with a constant tone of about 85db. The low adjustment group performed significantly better in the noise condition. The study suggests an inverse relationship between adjustment and performance under conditions of noise. Jerison (20) studied the effect of noise as an aid to production on a monotonous task. He concluded that noise aided production on monotonous tasks which extend over a long period of time.

Hartley and Carpenter (17) studied the effect of noise on the performance of a five-choice serial reaction test. Continuous loud noise was used for the experimental environment. The study found that noise impaired performance on the five choice serial reaction test.

Harcum and Monti (15) studied the effect of noise on performance of a card sorting task. For this study, 100db of ambient noise was used for the experimental condition. The study concluded that noise did not affect performance on a card sorting task.

Schwartz (36) studied the effect of noise on fact retrieval. For this study, seventy-five undergraduate college students were told stories and later asked to recall facts from those stories. The study found that there was better recall ability when medium to high noise was present.

Theologus, Wheaton, and Fleishman (46) studied the effect of noise on reaction time. For the study, sixty male subjects were exposed to from 0 to 85db noise of a random or patterned type. It was found that patterned noise had no effect on reaction time; however, reaction time was increased by the presence of random noise.

Auble and Britton (4) administered the Taylor Manifest Anxiety Scale to 174 college women. The sixteen highest-scoring women and the sixteen lowest-scoring women were selected to participate in the study. The two groups performed a routine task in a quiet environment and with the introduction of noise in the form of a narration at about 80db. The individuals who scored high in anxiety on the Taylor Manifest Anxiety Scale performed significantly better in the environment with the noise, while those who scored low in manifest anxiety performed significantly better in the quiet environment.

Kryter (22), after reviewing the conflict in the findings on the effect of noise on performance, has suggested that part of the conflict may be the result of the design of the studies. In addition to poor experimental design, he cited small numbers of subjects used in many of the studies and the failure to report significant information that would allow proper evaluation of the findings by those who read the study.

Harris (16) and McBrain (25) have suggested that noise might compete for the attention of the subject with the task that is being studied. Kryter (22) has suggested in some arousal studies, the slight improvement in performance caused by the presence of noise might have been offset by the distraction caused by the noise, leading to the conclusion that no arousal effect had taken place.

Several of the studies of the arousal effect have used constant noise as a stimulus. McBrain (25) suggests that the steady noise, over an extended period of time, would be adapted to by the subject. The subject would cease to react to a change in this case. He suggested that the noise should be changing and have no intellectual meaning to the subject. If the noise had no intellectual meaning to the subject, there would be less chance of the noise competing with the task for the attention of the subject.

The above studies suggest that the introduction of auditory stimulation does not influence the performance of subjects asked to perform math problems. It seems that in visual monitoring tasks, however, auditory stimulation does affect performance in some studies. Since the studies were not identical as to task, population, type or loudness of auditory stimulation, it is not possible to determine what factors or combination of factors resulted in auditory stimulation influencing, or not influencing performance of visual monitoring tasks. The conflicting results of the studies cited above suggest that the outcome of an individual study on the effect of induced auditory stimulation will be the result of an interaction of population, task, type, and loudness of auditory stimulation, and perhaps other factors rather than a constant result from the presence of the induced auditory stimulation.

The Coding Task

The coding sub-test of the Wechsler Intelligence Scales has been described by Zimmerman and Woo-Sam (50) as a series of symbols which are associated with the numbers 1-9. The subject is to associate the proper symbol with the presented number and reproduce the symbol in a blank box below the number. The key with the numbers and their associated symbols is always available to the subject at the top of the coding sheet. Anastasi (2) has indicated that the symbols would be familiar to an individual who was raised in our civilization, but they are unrelated to the number with which they are associated.

A coding task, according to Zimmerman and Woo-Sam (50), was part of the original Army Performance Tests and the

Cornell-Coxe Performance Scale. Patterson (30) indicates that a coding task was a substitution sub-test for the Army Beta.

There seems to be some difference of opinion on the abilities which the coding task measures. Glasser and Zimmerman (12) indicate that the coding sub-test was originally thought to measure the ability to learn combinations of symbols and numbers, and to recreate these combinations. He feels, however, that the sub-test is really a measure of speed and accuracy. Shaw (37) is of the opinion that the coding sub-test is a measure of perceptual speed. Repaport, Gill, and Schafer (31) feel that the coding sub-test is primarily a test of speed with a learning function of a visual organization type which requires attention being of secondary importance.

Anastasi (2) feels that memory is not an important skill on the coding sub-test. She feels that coding is primarily a measure of two kinds of motor activity. The first is a head-eye movement from the empty space to the key and back. The second is the hand action that forms the symbol which is a writing activity. Cohen (8) has indicated that the coding sub-test is primarily a measure of a subject's freedom from distraction.

The same diversity of opinion exists concerning factors that can affect performance on the coding sub-test as exists concerning the skill that the sub-test measures. There seems to be general agreement concerning the effect of brain injury on the coding sub-test. Russell (32) found that brain-injured individuals did not perform well on this sub-test. Aita, Armitage, Reitan, and Rabinowitz (1) have stated that brain injury may result in poor performance on this sub-test. They suggest that this may be the result of a decrease in learning ability, impaired neurological coordination, and a disturbance in visual-motor coordination. They speculate that the brain-injured individual operates at the matching level without being able to use the number order as a guide when using the key.

Sarason and Minard (34) studied the performance of high- and low-anxiety individuals and concluded that there was no difference in performance between these groups on this sub-test.

Mandler and Sarason (23) and Siegman (39) studied the effect of anxiety on several sub-tests of the Wechsler Scales. They concluded that anxiety significantly affected several sub-test scores. The coding sub-test was one of the sub-tests which was adversely affected.

Most authorities seem to agree that memory is not a primary factor in performance of a coding task such as found on the Wechsler Intelligence Scales. It seems that the primary factor to influence success is the visual-motor coordination of the subject. The influence of anxiety as a factor in successful performance on a coding task has not been conclusively determined. Part of the problem may be the lack of a standardized criterion to determine levels of anxiety.

Summary

Although much research has been done in the area of sound stimulation as a means to increase productivity, there still seem to be large areas of conflicting research findings.

There seems to be little agreement as to the sound pressure level at which productivity will increase, or whether the introduction of sound will increase productivity at any sound pressure level. Nor is there agreement on the nature of the sound which will be the greatest aid to productivity, although among those who have found sound to be an asset, there is a tendency to feel that the sound should be of an inconsistent, or variable type, such as music, rather than a steady tone.

The findings of the studies seem more consistent when the nature of the task being performed is reviewed. Studies involving the performance in solving math problems have indicated no improvement in performance with the introduction of noise, although several types of noise were used in these studies. Serial learning and studies with mental deficients have similarly shown no significant performance improvement which could be attributed to the presence of noise.

Although there are conflicting findings, the majority of studies concerned with visual monitoring have found improved performance in the presence of noise. Repetitious tasks which must be performed over an expanded period of time seem to benefit from the introduction of noise.

Anxiety has also received much study to determine whether it is a factor influencing performance, and there are here also conflicting findings. It seems that the influence of anxiety on performance is also dependent on the task which is being performed. Academic achievement has been shown to be adversely influenced by anxiety. Studies have also shown serial learning to be adversely affected by anxiety.

Studies on eyelid conditioning have suggested that anxiety shortens the time needed to develop the conditioned response. The time required to learn paired syllables also is shortened by the presence of anxiety. Anxiety also has been shown to shorten the response time needed to press a key when presented with an external stimulus.

The effect of anxiety on the performance of a coding task has been studied with conflicting results. Some studies have found that anxiety does not influence performance on a coding task. Other studies indicate that anxiety tends to significantly depress coding scores.

The present study attempted to determine if the level of noise has an effect on the performance of a coding task in the presence of two levels of noise. The study also attempts to determine if the type of noise presented to the subject has an influence upon performance. The effect of anxiety was also evaluated to determine if it has an influence on the ability to perform a coding task.

Although it is important to determine the effect of sound on performance, the effect of anxiety on performance of a coding task is of particular importance to the fields of Education and Psychology. This is because coding has been a part of several psychological tests that are widely used to determine intelligence. Since the intelligence scores, which are partly derived from the subjects' performance on the coding task, are widely used to aid in educational planning, it seems important to know how anxiety affects performance in this area.

CHAPTER BIBLIOGRAPHY

1. Aita, John A., Stewart G. Armitage, Ralph M. Reitan, and Aron Rabinowitz, "The Use of Certain Psychological Tests in the Evaluation of Brain Injury," Journal of General Psychology, XXXVII (July, 1947), 25-44.

2. Anastasi, Anne, Psychological Testing, New York, MacMillan Company, 1961.

3. Angetino, Henry and Edmund Mech, "Factors Influencing Routine Performance Under Noise: An Exploratory Analysis of the Influence of Adjustment," Journal of Psychology, XL (October, 1955), 397-401.

4. Auble, Donald and Nancy Britton, "Anxiety as a Factor Influencing Routine Performance Under Auditory Stimuli," Journal of General Psychology, LVIII (January, 1968), 111-114.

5. Benignus, Vernon A., David A. Otto, and John H. Knelson, "Effect of Low-frequency Random Noise on Performance of a Numeric Monitoring Task," Perceptual and Motor Skills, XL (February, 1975), 231-239.

6. Basowitz, Hareld, Anxiety and Stress, New York, McGraw-Hill, 1955.

7. Broadbent, Donald E., "Noise, Paced Performance, and Vigilance Tasks," British Journal of Psychology, XLIV (Novmeber, 1953), 295-303.

8. Cohen, Jacob, "A Factor-analytically Based Rational for the Wechsler Adult Intelligence Scale," Journal of of Counseling Psychology, XXI (December, 1957), 451-457.

9. Davenport, William G., "Vigilance and Arousal: Effects of Different Types of Background Stimulation," Journal of Psychology, LXXXII (November, 1972), 339-346.

10. Davis, Anthony and Charles W. Eriksen, "Some Social and Cultural Factors Determining Relationships Between Authoritarianism and Measures of Neuroticism," Journal of Counseling Psychology, XXI (April, 1957), 155-159.

11. Frankenhaeuser, Marianne and Ulf Lundberg, "Immediate and Delayed Effects of Noise on Performance and Arousal," Biological Psychology, II (January, 1974), 127-133.

12. Glasser, Albert J. and Irla Lee Zimmerman, Clinical Interpretation of the Wechsler Intelligence Scale for Children, New York, Grune and Statton, 1968.

13. Goodstein, Leonard D., "Interrelationship Among Several Measures of Anxiety and Hostility," Journal of Consulting Psychology, XVIII (February, 1954), 35-39.

14. Gynther, Ruth A., "The Effects of Anxiety and of Situational Stress on Communicative Efficiency," Journal of Abnormal and Social Psychology, LIV (March, 1957), 274-276.

15. Harcum, E. Rae and Peter M. Monti, "Cognition and 'Placebo' in Behavioral Research on Ambient Noise," Perceptual and Motor Skills, XXXVII (August, 1973), 75-99.

16. Harris, C. Stanley, "Effects of Intermittent and Continuous Noise on Serial Search Performance," Perceptual and Motor Skills, XXXV (October, 1972), 627-634.

17. Hartley, Larry R. and Arnold Carpenter, "Comparison of performance with Headphone and Free-field Noise," Journal of Experimental Psychology, X (August, 1974), 377-380.

18. Haynes, Jack R., "Effects of White Noise and Presentation Rate on Serial Learning in Mentally Retarded Males," American Journal of Mental Deficiency, LXII (January, 1970), 574-577.

19. Hebb, Donald O., "Drives and the C.N.S. (Conceptual Nervous System)," Psychological Review, LXII (July, 1955), 243-253.

20. Jerison, Harry J., "Effects of Noise on Human Performance," Journal of Applied Psychology, XLIII (April, 1959), 96-102.

21. Kassinove, Howard, "Effects of Meaningful Auditory Stimulation on Children's Scholastic Performance," Journal of Educational Psychology, LXIII (June, 1972), 526-530.

22. Kryter, Karl D., The Effects of Noise on Man, New York, Academic Press, 1970.

23. Mandler, George and Seymour B. Sarason, "Anxiety as a Factor in Test Performance," American Psychologist, VI (August, 1951), 341-362.

24. Martens, Rainer, Diane L. Gill, and Tara Scanlan, "Competitive Trait Anxiety, Success-failure and Sex as Determinants of Motor Performance," Perceptual and Motor Skills, XLIII (December, 1976), 1199-1208.

25. McBrain, William N., "Noise, the 'Arousal Hypothesis,' and Monotous Work," Journal of Applied Psychology, XLV (October, 1961), 309-317.

26. Mech, Edmund V., "Factors Influencing Routine Performance Under Noise: I. The Influence of 'Set,'" Journal of Psychology, XXXV (July, 1953), 183-198.

27. Mednick, Martha T., "Medicated Generalization and the Incubation Effect as a Function of Manifest Anxiety," Journal of Abnormal and Social Psychology, LV (November, 1957), 315-321.

28. Mikol, Benard and M. Ray Denny, "The Effect of Music and Rhythm on Rotor Pursuit Performance," Perceptual and Motor Skills, V (March, 1955), 5-6.

29. Park, James F. and M. Carr Payne, Jr., "Effects of Noise Level and Difficulty of Task in Performing Division," Journal of Applied Psychology, LIV (December, 1963), 367-368.

30. Patterson, Cecil Holden, The Wechlser Scales: A Guide for Counselors, Springfield, Illinoise, Charles C. Thomas Publisher, 1953.

31. Rapaport, David, Merton Gill, and Roy Schafer, Diagnostic Psychological Testing, Chicago, Year Book Publishers, 1945.

32. Russell, Elbert W., "A Factor Analysis with Brain Damaged Subjects Using Criterion Measures," Journal of Counseling and Clinical Psychology, XXXIX (June, 1972), 133-139.

33. Samuel, William S., "Noise and the Shifting of Attention," Quarterly Journal of Experimental Psychology, XVI (August, 1964), 264-267.

34. Sarason, Irwin G. and Jay Milard, "Test Anxiety and Expertal Instructions and the WAIS," Journal of Educational Psychology, LIII (June, 1962), 299-302.

35. Sarason, Seymour B., "Empirical Findings and Theoretical Problems in the Use of Anxiety Scales," Psychological Bulletin, LVII (September, 1960), 403-415.

36. Schwartz, Steven, "Arousal and Recall: Effects of Noise on Two Retrieval Strategies," Journal of Experimental Psychology, CII (May, 1974), 896-898.

37. Shaw, Dale J., "Factor Analysis of the Collegiate WAIS," Journal of Consulting Psychology, XXXI (April, 1967), 217-219.

38. Sherrod, Drury R., Jaime N. Hage, Phillip L. Halpern, and Bert S. Moore, "Effects of Personal Causation and Perceived Control on Responses to an Aversive Environment," Journal of Experimental Social Psychology, XIII (January, 1977), 14-27.

39. Siegman, Aron W., "Cognative, Affective, and Psychopathological Correlates of the Taylor Manifest Anxiety Scale," Journal of Counseling Psychology, XX (April, 1956), 137-141.

40. Spence, Kenneth W., Eduard Farber, and Howard H. McFann, "The Relation of Anxiety (Drive) Level to Performance in Competitional and Non-competitional Paired-associates Learning," Journal of Experimental Psychology, LII, (May, 1956), 296-305.

41. Speilberger, Charles D., Anxiety and Behavior, New York, Academic Press, Inc., 1966.

42. Taylor, Janet A., "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, XLVIII (July, 1953), 285-290.

43. ______________, "Drive Theory and Manifest Anxiety," Psychological Bulletin, LIII (July, 1956), 303-320.

44. ______________, and Jean P. Chapman, "Anxiety and the Learning of Paired Associates," American Journal of Psychology, LXVIII (December, 1955), 671-673.

45. ______________, and Kenneth W. Spence, "The Relationship of Anxiety Level to Performance in Serial Learning," Journal of Experimental Psychology, XLIV (July, 1952), 61-64.

46. Theologus, George C., George R. Wheaton, and Edwin A. Fleishman, "Effects of Intermittent, Moderate Intensity Noise Stress on Human Performance," Journal of Applied Psychology, LIX (October, 1974), 539-547.

47. Watkins, William H. and Cecil E. Fechrer, "Acoustic Facilitation of Visual Detection," Journal of Experimental Psychology, LXX (September, 1965), 332-333.

48. Westman, Alida and Francis M. Carter, "Relationship Between Certain Personality Characteristics and Ability to Concentrate in Common Noise Situations," Perceptual and Motor Skills, XLII (June, 1976), 1259-1262.

49. Wiener, Earl L., "Multiple Channel Monitoring," Ergonomics, VII (October, 1964), 453-460.

50. Zimmerman, Irla and James M. Woo-Sam, Clinical Interpretation of the Wechsler Adult Intelligence Scale, New York, Grune and Stratton, 1973.

CHAPTER III

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This study was designed to determine the effect of low-level noise and high-level noise, of white noise and varied noise, and of high manifest anxiety and low manifest anxiety on the quantity of production of college students performing a coding task.

Eighty college students were used in this study. They first completed the Taylor Manifest Anxiety Scale. The number of anxiety responses from this group ranged from a low of two to a high of thirty. The mean number of anxiety responses was 13.6. The standard deviation for this sample was 6.5 with a slight positive skew within the distribution. For experimental purposes, the forty individuals who gave two to thirteen anxiety responses were considered low anxiety individuals, while the forty individuals who gave fourteen to thirty anxiety responses were considered high anxiety individuals.

None of the eighty subjects were able to complete the two coding sheets in the six minutes allowed for the coding task. The number of coding symbols reproduced ranged from a low of 169 to a high of 327. The mean number of reproductions for this study was 248.4 with a standard deviation of 35.9

The number of correct coding reproductions became the coding score. A three-way analysis of variance was run on the coding scores at the North Texas State University Computer Center. The results of this analysis are presented in Table I. They show that only one F is significant at below the .05 level of significance. For this reason, no further computation was necessary.

Since there were no significant interactions, only main effects were tested.

TABLE I

SUMMARY OF ANALYSIS OF VARIANCE

Groups	Sum of Squares	df	Mean Square	F	P
Anxiety (A)	145.8	1.	145.8	.115	.7355
Volume (V)	500.0	1.	500.0	.39437	.5320
Type (T)	5577.8	1.	5577.8	4.3994	.0395*
V-A	744.2	1.	744.2	.58698	.4461
T-A	145.8	1.	145.8	.115	.7355
V-T	480.2	1.	480.2	.37875	.5402
V-T-A	64.8	1.	64.8	.05111	.8218
Within	91285.6	72.	1267.85556	. . .	. .
Total	98944.2	79.	. . . . .	. . .	. .

*significant at .04

Hypothesis 1

Hypothesis 1 stated that the subjects displaying high manifest anxiety would not perform significantly better on a coding task than would subjects displaying low manifest anxiety.

Table II presents the data for the groups displaying high and low anxiety. These data indicate that the group displaying high manifest anxiety and the group displaying low manifest anxiety were different in performance at the .74 level of significance. This was not a significant difference and the null hypothesis was retained.

TABLE II

CODING SCORES FOR HIGH- AND LOW-MANIFEST-ANXIETY GROUPS

Groups	Eight-cell			Twelve-cell		
	Mean Score	n	Stan. Dev.	Mean Score	n	Stan. Dev.
High Anxiety	249.7	40	36.56	243.8	20	34.62
Low Anxiety	247.0	40	34.57	241.0	20	30.63
Difference	2.7	. .	. .	2.8	. .	. .

An attempt was made to lessen the effect of the tendency toward the mean by forming four additional cells. Those cells were formed from those coding task scores produced by the forth subjects who scored closest to the mean on the <u>Taylor Manifest Anxiety Scale</u>. For this computation, the original eight-cell study became a twelve-cell study.

Table II presents the mean coding scores and the standard deviation for the high-manifest-anxiety group and low-manifest-anxiety group in both the eight-cell and twelve-cell form. In the eight-cell form, the mean score for the high manifest anxiety group was 249.7, and the mean score for the low manifest anxiety group was 247.0. The difference between the two scores was significant at the .74 level. This difference was not significant.

The mean scores in the twelve-cell form were 243.8 for the high-manifest-anxiety group and 241.0 for the low-manifest-anxiety group. The difference between the two scores was significant at the .74 level.

Hypothesis 2

Null Hypothesis 2 stated that the subjects exposed to high-level noise would not perform significantly better on a coding task than would subjects exposed to low-level noise.

Table III presents the data for the groups exposed to different levels of noise. These data indicate that the group exposed to high-level noise and the group exposed to low-level noise were different in performance at the .53 level of significance. This difference was not significant, and the null hypothesis was retained.

Table III presents the mean coding scores and standard deviations for the group exposed to high-level noise and the group exposed to low-level noise. The mean score of the

TABLE III

MEAN CODING SCORES FOR GROUPS EXPOSED TO HIGH AND LOW-LEVEL NOISE

Group	Mean Score	n	Standard Deviation
Low-Level	250.9	40	31.8
High-Level	245.9	40	38.9
Difference	5.0	. .	. .

group exposed to low-level noise was 250.9, and the mean score for the group exposed to high-level noise was 245.9. The difference between the two scores was significant at the .53 level. This difference was not significant, and the null hypothesis was retained.

Hypothesis 3

Null Nypothesis 3 stated that the subjects exposed to varied noise would not perform significantly better on a coding task than would subjects exposed to white noise.

Table IV presents the data for the group exposed to varied noise and the group exposed to white noise. These data indicate that the group exposed to varied noise and the group exposed to white noise were different in performance at the .04 level of significance. This is a significant difference and therefore the null hypothesis was rejected.

Table IV presents the mean coding scores and standard deviations for the group exposed to varied noise and the group exposed to white noise. The mean score of the group exposed to varied noise was 256.7, and the mean score for the group exposed to white noise was 240.0. The difference between the two scores was significant at the .04 level. This is a significant difference. Therefore the null hypothesis is retained.

TABLE IV

CODING SCORES FOR GROUPS EXPOSED TO WHITE NOISE AND VARIED NOISE

Group	Mean Score	n	Standard Deviation
Varied Noise	256.7	40	39.2
White Noise	240.0	40	29.3
Difference	16.7	. .	. .

Summary

This chapter has presented the results of testing of the hypotheses of this study. Only Hypothesis 3, which stated that subjects exposed to varied noise would perform significantly better on a coding task than would subjects exposed to white noise, was retained. Because only one of the three proposed hypotheses was accepted, no further hypotheses were generated. Chapter IV will discuss the results of this study and attempt to relate them to past research.

CHAPTER IV

DISCUSSION

The present chapter consists of a comparison between what was predicted in the form of hypotheses and what was obtained in the form of results. Only hypotheses which dealt with main effects of this study will be discussed. Whenever possible, comparisons will be drawn with previous research. The following are the chapter divisions: (a) The Relationship of this Study to the Effect of Anxiety on Performance; (b) The Relationship of this Study to the Effect of Noise on Performance; and (c) The Relationship of this Study to the Effect of Varied Noise on Performance. There is a concluding section in which there is discussion of the implications of the study.

The Relationship of This Study to the Effect of Anxiety on Performance

The first variable investigated in this study was the effect of high-level anxiety and of low-level anxiety as determined by the *Taylor Manifest Anxiety Scale*. It was stated in *Hypothesis 1* that the subjects displaying high manifest anxiety would perform significantly better on a coding task than would the subjects displaying low manifest anxiety. There was no significant difference between the performance of the high-anxiety and low-anxiety groups on the performance of the coding task.

Mednick (6), Spence and Farber (11), Spence, Farber, and McFann (12), Taylor and Chapman (15), Taylor and Spence (16), and Wiener (19) performed experiments testing the motivational effect of anxiety on learning. These studies suggest that high-anxiety can reduce the time required to learn a task. Although the present study found no difference in performance between the high- and low-anxiety group on the performance of a coding task, the findings are inconclusive relative to learning a task.

Mandler and Sarason (4) and Siegman (10) found that high-anxiety adversely affected performance on the coding subtest of the Wechsler Scale. Sarason and Minard (9) and Wachtel and Blatt (17), however, found that anxiety was not a factor in determining ability to perform a coding task. The findings of this study concur with those of Sarason and Minard, and Wachtel and Blatt.

The Relationship of This Study to the Effect of Noise on Performance

The second variable investigated in this study was the effect of high-level noise and low-level noise on the performance of a coding task. It was stated in Hypothesis 2 that the subjects who were exposed to high-level noise would perform significantly better on a coding task than would subjects who were exposed to low-level noise. There was no significant difference between the performance of the group that was exposed to the high-level noise and the group exposed to low-level noise on the performance of the coding task.

Poock and Wiener (8) conducted an experiment which attempted to improve the performance of subjects on visual monitoring tasks through the introduction of noise. They found that noise did not improve the performance. Haynes (3) and Pascal (7) found that the introduction of noise did not improve the performance of mentally deficient individuals. Although these studies are not comparable with the present study, they found that noise did not improve performance.

Broadbent (1), in a review of the literature, concluded that the introduction of noise leads to active but inaccurate behavior. Thus, he would expect that those individuals in an environment of noise to produce more, but have a greater number of errors than those in a quiet environment. Although the present study exposed the subjects to two levels of noise, it is felt that the low-level noise might have the same effect as a quiet environment. If this is true, the present study does not support Broadbent's conclusion since there was no significant difference in production between the two groups.

The Relationship of This Study to the Effect of Varied Noise on Performance

The third variable investigated in this study was the effect of varied noise and white noise on the performance of a coding task. It was stated in Hypothesis 3 that the subjects exposed to varied noise will perform significantly better on a coding task than the subjects exposed to white noise. The subjects exposed to varied noise did perform significantly better on the coding task than did the subjects exposed to white noise.

Davenport (2) and Watkins and Fechrer (18) performed experiments which exposed subjects to continuous and varied noise. The studies found that the groups exposed to varied noise performed better than the groups exposed to continuous noise.

McBrain (5) suggested that varied noise will produce an improvement in performance and continuous noise will produce little effect. He hypothesized that the subject will adapt to the continuous noise but the varied noise will retain its arousal effect.

The findings of the present study concur with the findings of Davenport, Watkins and Fachrer while giving support to the conclusion of McBrain.

Implications of the Study

Several implications have been generated from the results of this study.

The low-level noise of 74db was used as a control in this study. Studies within the literature seldom state the level of noise in the control environment. It is possible than any sound at or above the threshold of hearing is enough to act as an arousal stimulus. A replication of the present study with the control group in an environment of noise which is below the threshold of hearing might lead to different conclusions concerning the arousal effect of noise.

The effect of the subjects which took part in the study might have influenced the results of the study. Subjects taking courses in other areas such as Music might have a different reaction to anxiety or noise. A replication of the present study with such a population might lead to different conclusions.

Conclusion

The arousal hypothesis has received much attention from researchers and many studies have resulted from this interest. In such research, noise has often been used to induce a state of arousal. The studies have not been consistent with each other in their findings. The present study tested the arousal effect of two levels of anxiety, two levels of noise, and two types of noise on the performance of a coding task. This study found that although neither the anxiety nor the noise level affected performance on the coding task, the varied noise did affect performance, that performance being superior to the others.

CHAPTER BIBLIOGRAPHY

1. Broadbent, D. E., "Effects of Noise on Behavior," Handbook of Noise Control, edited by Cycil M. Harris, New York, McGraw-Hill Book Company, 1957, pp/ 10-34.

2. Davenport, William G., "Vigilance and Arousal: Effects of Different Types of Background Stimulation," Journal of Psychology, LXXXII (November, 1972), 339-346.

3. Haynes, Jack R., "Effects of White Noise and Presentation Rate on Serial Learning in Mentally Retarded Males," American Journal of Mental Deficiency, LXXII (January, 1970), 574-577.

4. Mandler, George and Seymour B. Sarason, "Anxiety as a Factor in Test Performance," American Psychologist, VI (August, 1951), 341-362.

5. McBrain, William N., "Noise, the 'Arousal Hypothesis' and Monotous Work," Journal of Applied Psychology, XLV (October, 1961), 309-317.

6. Mednick, Martha T., "Medicated Generalization and the Incubation Effect as a Function of Manifest Anxiety," Journal of Abnormal and Social Psychology, LV (November, 1957), 315-321.

7. Pascal, G. R., "The Effects of Disturbing Noise on the Reaction Time of Mental Defectives," American Journal of Mental Deficiency, LIV (August, 1963), 691-699.

8. Poock, Gary K. and Earl L. Wiener, "Music and Other Auditory Backgrounds During Visual Monitoring," Journal of Industrial Engineering, XVII (June, 1966), 318-323.

9. Sarason, Irwin G. and Jay Milard, "Test Anxiety and Expertal Instructions and the WAIS," Journal of Educational Psychology, LIII (April, 1962), 299-302.

10. Siegman, Aron W., "Cognitive, Affective, and Psychopathological Correlates of the Taylor Manifest Anxiety Scale," Journal of Counseling Psychology, XX (April, 1956), 137-141.

11. Spence, Kenneth W. and K. Eduard Farber, "Conditioning and Extinction as a Function of Anxiety," Journal of Experimental Psychology, XLV (February, 1953), 116-119.

12. ______________, Irving E. Faber, and Howard H. McFann, "The Relation of Anxiety (drive) Level to Performance in Competitional and Non-competitional Paired-associates Learning," Journal of Experimental Psychology, LII (May, 1956), 296-305.

13. Taylor, Janet A., "A Personality Scale of Manifest Anxiety," Journal of Abnormal and Social Psychology, XLVIII (April, 1953), 285-290.

14. ______________, "Drive Theory and Manifest Anxiety," Psychological Bulletins, LIII (July, 1956), 303-320.

15. ______________ and Jean P. Chapman, "Anxiety and the Learning of Paired Associates," American Journal of Psychology, LXVIII (December, 1955), 671-673.

16. ______________ and Kenneth W. Spence, "The Relationship of Anxiety Level to Performance in Serial Learning," Journal of Experimental Psychology, XLIV (July, 1952), 61-64.

17. Wachtel, Paul L. and Sidney J. Blatt, "Energy Development and Achievement," Journal of Counseling Psychology, XXIX (August, 1965), 302-308.

18. Watkins, William H. and Carl E. Fechrer, "Acoustic Facilitation of Visual Detection," Journal of Experimental Psychology, LXX (September, 1965), 332-333.

19. Wiener, Earl L., "Multiple Channel Monitoring," Ergonomics, VII (October, 1964), 453-460.

APPENDIX A

Read each statement and decide whether it is true as applied to you or false as applied to you.

If a statement is true or mostly true as applied to you, put an X on the space before the statement.

If the statement is false or not usually true as applied to you, put an O on the space before the statement.

Give your own opinion of yourself. DO NOT LEAVE ANY BLANK SPACES.

NAME ____________________ CLASS AND SECTION ____________________

___ I do not tire quickly.

___ I am often sick to my stomach.

___ I am about as nervous as other people.

___ I have very few headaches.

___ I work under a great deal of strain.

___ I cannot keep my mind on one thing.

___ I worry over money and business.

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

___ I blush as often as others.

___ I have diarrhea once a month or more.

___ I worry quite a bit over possible troubles.

___ I practically never blush.

___ I am often afraid that I am going to blush.

___ I have nightmares every few nights.

___ My hands and feet are usually warm enough.

___ I sweat very easily even on cool days.

___ When embarrassed, I often break out in a sweat which is very annoying.

___ I do not often notice my heart pounding and I am seldom short of breath.

___ I feel hungry almost all the time.

___ Often my bowels don't move for several days at a time.

___ I have a great deal of stomach trouble.

___ At times I lose sleep over worry.

___ I don't like to face a difficulty or make an important decision.

___ At times I feel that I am going to crack up.

___ My sleep is restless and disturbed.

___ I often dream about things I don't like to tell other people.

___ I am easily embarrassed.

___ My feelings are hurt easier than most people.

___ I often find myself worrying about something.

___ I wish I could be as happy as others.

___ I am usually calm and not easily upset.

___ I cry easily.

___ I feel anxious about something or someone almost all of the time.

___ I am happy most of the time.

___ It makes me nervous to have to wait.

___ At times I am so restless that I cannot sit on a chair for very long.

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

___ I have often felt that I faced so many difficulties I could not overcome them.

___ At times I have been worried beyond reason about something that did not really matter.

___ I do not have as many fears as my friends.

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

___ I certainly feel useless at times.

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

___ I am the kind of person that takes things hard.

___ I am more self-conscious than most people.

___ I am a very nervous person.

___ Life is often a strain of me.

___ At times I feel that I am no good at all.

___ I am not at all confident of myself.

___ I am very confident of myself.

APPENDIX B

1	2	3	4	5	6	7	8	9
—	⊥	⊐	L	U	O	∧	X	=

SAMPLES

2	1	3	7	2	4	8	1	5	4	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3

1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3

6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7

9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	1	4	6	3	5	2	1	3	4	2	1	3	1	2	3	1	4	2	6	3	1	2	5	1

3	1	5	4	2	7	4	6	9	2	5	8	4	7	6	1	8	7	5	4	8	6	9	4	3

1	8	2	9	7	6	2	5	4	7	3	6	8	5	9	4	1	6	8	9	3	7	5	1	4

9	1	5	8	7	6	9	7	8	2	4	8	3	5	6	7	1	9	4	3	6	2	7	9	3

6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7

9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	1	3	7	2	4	8	1	5	4	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3

1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3

BIBLIOGRAPHY

Books

Anastasi, Anne, Psychological Testing, New York, Macmillan Company, 1961.

Basowitz, Hareld, Anxiety and Stress, New York, McGraw-Hill, 1955.

Broadbent, Donald E., "Effects of Noise on Behavior," Handbook of Noise Control, edited by Cyril M. Harris, New York, McGraw-Hill Book Company, 1957, pp. 10-34.

Glasser, Albert J. and Irla Lee Zimmerman, Clinical Interpretation of the Wechsler Intelligence Scale for Children, New York, Grune and Stratton, 1968.

Haber, Ralph Norman, Current Research in Motivation, New York, Holt, Rinehart and Winston, Inc., 1966.

Kryter, Karl D., The Effects of Noise on Man, New York, Academic Press, 1970.

Lindsley, Donald B., "Emotion," Handbook of Experimental Psychology, edited by S. S. Stevens, New York, Wiley, 1951, pp. 473-516.

Malmo, Robert B., "Studies of Anxiety: Some Clinical Origins of the Activation Concept," Anxiety and Behavior, edited by C. D. Spielberger, New York, Academic Press, 1966, pp. 157-177.

Patterson, Cecil Holden, The Wechsler Scales: A Guide for Counselors, Springfield, Illinois, Charles C. Thomas Publisher, 1953.

Rapaport, David, Merton Gill, and Roy Schafer, Diagnostic Psychological Testing, Chicago, Year Book Publishers, 1945.

Spielberger, Charles D., Anxiety and Behavior, New York, Academic Press, Inc., 1966.

Symonds, Percival Mallon, What Education Has to Learn from Psychology, New York, Teachers College Press, 1968.

Zimmerman, Irla, and James M. Woo-Sam, Clinical Interpretation of the Wechsler Adult Intelligence Scale, New York, Grune and Stratton, 1973.

Journals

Aita, John A., Stewart G. Armitage, Ralph M. Reitan, and Aron Rabinowitz, "The Use of Certain Psychological Tests in the Evaluation of Brain Injury," Journal of General Psychology, XXXVII (July, 1947), 25-44.

Alpert, Richard and Ralph N. Haber, "Anxiety in Academic Achievement Situations," Journal of Abnormal and Social Psychology, LXI (September, 1960), 207-215.

Angetino, Henry and Edmund Mech, "Factors Influencing Routine Performance Under Noise: An Exploratory Analysis of the Influence of Adjustment," Journal of Psychology, XL (October, 1955), 397-401.

Archer, Barbara U. and Robert R. Margolin, "Arousal Effects in Intentional Recall and Forgetting," Journal of Experimental Psychology, LXXXVI (October, 1970), 8-12.

Atlinson, John W. and George H. Litwin, "Achievement Motivation and Test Anxiety Conceived as Motivation to Approach Success and Motivation to Avoid Failure," Journal of Abnormal and Social Psychology, LX (January, 1960), 52-63.

Auble, Donald and Nancy Britton, "Anxiety as a Factor Influencing Routine Performance Under Auditory Stimuli," Journal of General Psychology, LVIII (January, 1968), 111-114.

Benignus, Vernon A., David A. Otto, and John H. Knelson, "Effect of Low-frequency Random Noise on Performance of a Numeric Monitoring Task," Perceptual and Motor Skills, XL (February, 1975), 231-239.

Broadbent, Donald E., "Noise, Paced Performance, and Vigilance Tasks," British Journal of Psychology, XLIV, 295-303.

Cohen, Jacob, "A Factor-analytically Based Rational for the Wechsler Adult Intelligence Scale," Journal of Counseling Psychology, XXI (December, 1957), 451-457.

Davenport, William G., "Vigilance and Arousal: Effects of Different Types of Background Stimulation," Journal of Psychology, LXXXII (November, 1972), 339-346.

Davis, Anthony and Charles W. Eriksen, "Some Social and Cultural Factors Determining Relationships Between Authoritarianism and Measures of Neuroticism," Journal of Counseling Psychology, XXI (April, 1957), 155-159.

Duffy, Elizabeth, "The Psychological Significance of the Concept of 'Arousal' or 'Activation,'" Psychological Review, LXIV (September, 1957), 265-275.

Frankenhaeuser, Marianne and Ulf Lundbert, "Immediate and Delayed Effects of Noise on Performance and Arousal," Biological Psychology, II (January, 1974), 127-133.

Goodstein, Leonard D., "Interrelationship Among Several Measures of Anxiety and Hostility," Journal of Consulting Psychology XVIII (February, 1954), 35-39.

Gynther, Ruth A., "The Effects of Anxiety and of Situational Stress on Communicative Efficiency," Journal of Abnormal and Social Psychology, LIV (March, 1957), 274-276.

Harcum, E. Rae and Peter M. Monti, "Cognition and 'Placebo' in Behavioral Research on Ambient Noise," Perceptual and Motor Skills, XXXVII (August, 1973), 75-99.

Harris, C. Stanley, "Effects of Intermittent and Continuous Noise on Serial Search Performance," Perceptual and Motor Skills, XXXV (October, 1972), 627-634.

Hartley, Larry R. and Arnold Carpenter, "Comparison of Performance with Headphone and Free-field Noise," Journal of Experimental Psychology, X (August, 1974), 377-380.

Haynes, Jack R., "Effects of White Noise and Presentation Rate on Serial Learning in Mentally Retarded Males," American Journal of Mental Deficiency, LXII (January, 1970), 574-577.

Hebb, Donald O., "Drives and the C.N.S. (Conceptual Nervous System)," Psychological Review, LXII (July, 1955), 243-253.

Jerison, Harry J., "Effects of Noise on Human Performance," Journal of Applied Psychology, XLIII (April, 1959), 96-102.

Kassinove, Howard, "Effects of Meaningful Auditory Stimulation on Children's Scholastic Performance," Journal of Educational Psychology, LXIII (June, 1972), 526-530.

Mandler, George and Seymour B. Sarason, "Anxiety as a Factor in Test Performance," American Psychologist, VI (August, 1951), 341-362.

Martens, Rainer, Diane L. Gill, and Tara Scanlan, "Competitive Trait Anxiety, Success-failure and Sex as Determinants of Motor Performance," Perceptual and Motor Skills, XLIII (December, 1976), 1199-1208.

McBrain, William N., "Noise, the 'Arousal Hypothesis,' and Monotonous Work," Journal of Applied Psychology, XLV (October, 1961), 309-317.

Mech, Edmund V., "Factors Influencing Routine Performance Under Noise: I. The Influence of 'Set,'" Journal of Psychology, XXXV (July, 1953), 183-198.

Mednick, Martha T., "Medicated Generalization and the Incubation Effect as a Function of Manifest Anxiety," Journal of Abnormal and Social Psychology, LV (November, 1957), 315-321.

Mikol, Benard and M. Ray Denny, "The Effect of Music and Rhythm on Rotor Pursuit Performance," Perceptual and Motor Skills, V (March, 1955), 5-6.

Oakland, James A., "WISC Coding as a Measure of Motivation," Journal of Clinical Psychology, XXV (October, 1969), 411-412.

Park, James F. and M. Carr Payne, Jr., "Effects of Noise Level and Difficulty of Task in Performing Division," Journal of Applied Psychology, LIV (December, 1963), 367-368.

Pascal, G. R., "The Effects of Disturbing Noise on the Reaction Time of Mental Defectives," American Journal of Mental Deficiency, LIV (August, 1963), 691-699.

Poock, Gary K. and Earl L. Wiener, "Music and Other Auditory Backgrounds During Visual Monitoring," Journal of Industrial Engineering, XVII (June, 1966), 318-323.

Russell, Elbert W., "A Factor Analysis with Brain Damaged Subjects Using Criterion Measures," Journal of Counseling and Clinical Psychology, XXXIX (June, 1972), 133-139.

Samuel, William S., "Noise and the Shifting of Attention," _Quarterly Journal of Experimental Psychology_, XVI (August, 1964), 264-267.

Sarason, Irwin G. and Jay Milard, "Test Anxiety and Expertal Instructions and the WAIS," _Journal of Educational Psychology_, LIII (June, 1962), 299-302.

Sarason, Seymour B., "Empirical Findings and Theoretical Problems in the Use of Anxiety Scales," _Psychological Bulletin_, LVII (September, 1960), 403-415.

Schwartz, Steven, "Arousal and Recall: Effects of Noise on Two Retrieval Strategies," _Journal of Experimental Psychology_, CII (May, 1974), 896-898.

Sahw, Dale J., "Factor Analysis of the Collegiate WAIS," _Journal of Consulting Psychology_, XXXI (April, 1967), 217-219.

Sherrod, Drury R., Jaime N. Hage, Phillip L. Halpern, and Bert S. Moore, "Effects of Personal Causation and Perceived Control on Responses to an Aversive Environment," _Journal of Experimental Social Psychology_, XIII (January, 1977), 14-27.

Siegman, Aron W., "Cognitive, Affective, and Psychopathological Correlates of the Taylor Manifest Anxiety Scale," _Journal of Counseling Psychology_, XX (April, 1956), 137-144.

Spence, Kenneth W., Eduard Farber, and Howard H. McFann, "The Relation of Anxiety (drive) Level to Performance in Competitional and Non-competitional Paired-associates Learning," _Journal of Experimental Psychology_, LII (May, 1956), 296-305.

Spence, Kenneth W. and Eduard Farber, "Conditioning and Extinction as a Function of Anxiety," _Journal of Experimental Psychology_, XLV (February, 1953), 116-119.

Spence, Kenneth W. and Janet A. Taylor, "Anxiety and Strength of the UCS as Determiners of the Amount of Eyelid Conditioning," _Journal of Experimental Psychology_, XLII (September, 1951), 183-188.

Taylor, Janet A., "A Personality Scale of Manifest Anxiety," _Journal of Abnormal and Social Psychology_, XLVIII (July, 1953), 285-290.

Taylor, Janet A., "Drive Theory and Manifest Anxiety," Psychological Bulletins, LIII (July, 1956), 303-320.

__________ and Jean P. Chapman, "Anxiety and the Learning of Paired Assoicates," American Journal of Psychology, LXVIII (December, 1955), 671-673.

__________ and Kenneth W. Spence, "The Relationship of Anxiety Level to Performance in Serial Learning," Journal of Experimental Psychology, XLIV (July, 1952), 61-64.

Theologus, George C., George R. Wheaton, and Edwin A. Fleishman, "Effects of Intermittent, Moderate Intensity Noise Stress on Human Performance," Journal of Applied Psychology, LIX (October, 1974), 539-547.

Wachtel, Paul L. and Signey J. Blatt, "Energy Development and Achievement, " Journal of Counseling Psychology, XXIX (August, 1965), 302-308.

Watkins, William H. and Cecil E. Fechrer, "Acoustic Facilitation of Visual Detection," Journal of Experimental Psychology, LXX (September, 1965), 332-33.

Westman, Alida and Francis M. Carter, "Relationship Between Certain Personality Characteristics and Ability to Concentrate in Common Noise Situations," Perceptual and Motor Skills, XLII (June, 1976), 1259-1262.

Wiener, Earl L., "Multiple Channel Monitoring," Ergonomics, VII (October, 1964), 453-460.