THE INFLUENCE OF MANIFEST ANXIETY ON PROACTIVE INTERFERENCE

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John Mark Reisman

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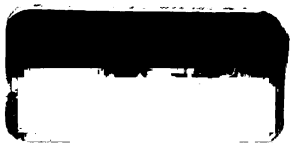

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By

John Mark Reisman

AN ABSTRACT

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

MASTER OF ARTS

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John M. Reisman

ABSTRACT

A series of experiments by Spence (6, 7) and Taylor (8) occured at the turn of mid-century that added new vigor to experimentation in the area of anxiety. The prime stimulants were a simple paper and pencil test largely culled from the Minnesota Multiphasic Personality Inventory, The Taylor Scale of Manifest Anxiety (9), and a prediction and interpertation of results on the basis of Hullian theory (2). Soon, however, findings appeared which were at variance with theoretical expectations. To explain these discrepencies, a number of factors were cited of which the task irrelevant responses or interference produced by manifest anxiety assumed a paramount role (3, 4, 5). The verification of this factor... the interference produced by manifest anxiety... was the object of this experiment. Accordingly, the following hypothesis was proposed:

> In a motor performance situation, high anxious subjects will manifest more proactive interference than low anxious subjects.

The Taylor Scale of Manifest Anxiety was administered to 290 students taking the introductory psychology course at Michigan State University. From the upper and lower 20% of scores obtained on this test, 64 students were selected to serve as subjects. They consisted of 32 who represented the low anxiety group and 32 who represented high anxiety. These students

were required to sort an ordinary deck of playing cards according to definite experimental directions on a board divided into quadrants each of which represented a different suit. The measure of performance employed was the time required to accomplish this task on each trial from the signal "GO" until the last card was sorted on the board. This was continued for fifteen trials after which the board was rotated ninety degrees. Three additional trials employing the same procedure as before followed on the rotated board. Proactive interference was the increment in time required to sort the cards between the fifteenth trial and each of the three subsequent trials.

No significant differences were found between anxiety groups in learning to sort the cards. A significant sex difference was found on the first trial of interference: males manifesting more proactive interference than females. No significant sex differences were found on the second and third interference trials but significant differences were found between the anxiety groups: the high anxiety group manifesting more proactive interference than the low anxious. The hypothesis of the experiment was considered partially confirmed. It was concluded that in a motor performance situation, high anxious subjects will manifest more prolonged proactive interference than low anxious subjects.

An interpertation of these results along strict Hullian lines was virtually impossible. A more eclectic interpertation was advanced which considered the results on the

first interference trial to be due to the prepotent influence of normative factors such as sex differences. However, on the second and third trials, the high anxiety group, which is more susceptible to experiencing failure (1), recruited their anxiety causing this factor to be prepotent. The result of this recruitment was manifested by the significantly greater increment in time to sort the cards on these trials for the high anxiety group. Results of this experiment stress the importance of further research in this area.

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The author wishes to express with pleasure his sincere appreciation to Dr. M. Ray Denny under whose enthusiastic, zestful, and capable leadership this study was conceived, conducted, and completed.

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The author dedicates this recently completed thesis to his recently acquired wife, Margo.

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INTRODUCTION

At the turn of the mid-century, something other than corn began to come out of Iowa. A series of experiments by Spence, Taylor, and Rosenbaum (20, 24, 25, 26, 27, 28) signaled a new line of attack on the problem of anxiety. That the issue had been considered before was fairly evident from a survey of the literature. Mowrer (18, 19) had demonstrated that learning could occur from the reduction of anxiety and conceived of it as the conditioned form of the pain reaction which had the function of motivating and reinforcing behavior. Farber (4) showed that under certain conditions the reduction of anxiety could cause a response to be extinguished more readily. Meanwhile, Malmo and Amsel (15) noted that, in humans, irrelevant responses were produced by anxiety that interfered with the relevant responses in serial rote learning. About a year later, Schiff, Dougan, and Welch (21) reported that a significantly positive correlation of .52 was obtained between the conditioned psychogalvanic skin response and the clinical diagnosis of anxiety. Empirical data was certainly being gathered but in a somewhat helter-skelter fashion. Two major factors in the studies from Iowa combined to give impetus and direction to this area.

A formula extracted from Hull (11) provided a theoretical basis for these investigations. This was the now-famous:

$$_{S}E_{R} = f\,(_{S}H_{R}) \times f\,(D)$$

Translated into English, it stated that the reaction potential equalled the product of functions of the habit strength and total drive. To put it more simply: the probability of a response occuring is the product of a function of habit strength multiplied by a function of the strength of drive. Since anxiety was considered an acquired drive (1), it would follow logically from the formula that differences in learning should obtain between individuals who differed in their levels of anxiety.

The second factor was the construction of a convenient paper and pencil test that could be used to obtain a sample of "high" and "low" anxious individuals. This was devised by Taylor (28). It originally consisted of 65 items from the Minnesota Multiphasic Personality Inventory which workers in the field of abnormal psychology had agreed to be highly discriminatory. The beauty of the Scale was that it was easy to score, easy to administer, and it seemed to work. Later refinements of Taylor's Scale of Manifest Anxiety yielded a test consisting of fifty anxiety items, most of the F, K, and L Scales from the M.M.P.I., and 67 fillers making a grand total of 225 True-False questions. This version has been used by a number of investigators (9, 10, 13, 14, 16, 17, 20, 25, 30) and a recent study by Kendall (12) discloses that it is sufficiently valid for experimental purposes.

This manifest anxiety which Taylor's Scale purports to measure may be defined as those complaints of fatigue, worry, nervousness, digestive upsets, etc. which are assumed to be

accompaniments of an internal emotional state. They are directly observable. This is distinguished from clinical anxiety, which is inferred from the appearance of the "defensive" reactions. Anxiety is inferred in the case of a person who projects, over-compensates, day-dreams, rationalizes, etc. That a functional relationship exists between these two states was the object of a study by Rosenbaum (20). He found that clinical anxiety like manifest or experimental anxiety is coincident with a greater degree of stimulus generalization, though with the former, conditions of threat (shock) were necessary to elicit this similarity.

All in all a mountain of data has been industriously gathered to show that differences exist between those who are assumed to be highly anxious and those who are assumed to be low anxious. High anxious subjects with reference to their low anxious brethern have been found to condition more readily (24, 25, 27), extinguish more slowly (24), generalize more frequently (20), produce more associations to verbal stimuli (2), have a reduced sensitivity to flicker (6), be less discriminative in a conditioning situation (9), and react more quickly (28). So far so good, but now for the flies in the ointment.

No significant differences between high and low anxiety groups are reported by Lazarus, et al (13) in learning lists of nonsense syllables of marked intra-list similarity; by Westrope (30) in performance on the Digit Symbol test of the Wechsler Bellevue; by Hughes, et al (10) in serial learning.

And of more interest are the completely contradictory results reported by Montague (17). He found that in learning three lists of nonsense syllables that varied in their associative value, his low anxious subjects did better on the list of low associative value while his high anxious subjects were better on the list of high associative value. In a similar vein, Farber and Spence (5) saw their high anxiety subjects make significantly more errors and take more trials to the criterion of mastery on a ten-choice stylus maze than their low anxiety fellows.

There have been many suggestions made to explain these discrepancies which, when taken together, only serve to indicate how complex the problem really is. Hughes, et al (10) conclude that the differences in learning between extreme anxiety groups are apparently a function of the intratrial temporal interval used. Farber and Spence (5) note that whether an increase in D (anxiety) will benefit or impede performance depends, to an important extent, upon the complexity of the task involved. Graff (7) offers the factor of personality variables or generalized habit patterns adopted by the subjects for dealing with anxiety. Spence and Farber (26) offer a generalized habit strength in differential conditioning so that, in this situation, anxiety differences play a relatively less important role than in simple conditioning. Deese, et al (3) suggest that differences between high and low anxious groups seem to be due in part to a decrement in performance on the part of

the low anxious subjects. Lucas (14), Montague (17), and Malmo and Amsel (15) suggest that anxiety produces interfering responses. While Sarason, et al (21) assume that anxiety strengthens task relevant responses in low anxious subjects but task irrelevant responses in the high anxious.

A disturbing note might be sounded by raising the question as to how extreme are these extremely high and low anxious groups. In most of these studies the subjects used were students in introductory psychology courses. The extremely high and low were usually those who obtained scores in the upper and lower 20% on the Taylor Scale administered. How extreme this is or whether it is extreme at all, no one really knows.

McKnelly (16) has made an interesting observation: most of the studies where significant differences have been found favoring the high anxiety group in learning involved responses which are compatible with the anxiety-induced response tendencies. Eyelid blinking is a response usually associated with fear and so it might be anticipated that the highly anxious would more readily condition with it than those who are less anxious. Thus, anxiety, per se, and not anxiety the drive state, may be more useful in interperting the data. In view of all that has been said, it might be best to walk softly and carry a big question mark.

Though it is generally assumed that anxiety produces interfering responses, a survey of the literature revealed no experiment that directly tested this assumption. Accordingly the following hypothesis was proposed:

In a motor performance situation, high anxious subjects will manifest more proactive interference than low anxious subjects.

The motor performance situation consisted of sorting an ordinary deck of playing cards, according to experimental directions, upon a board divided into quadrants each of which represented a different suit. After this had been done for fifteen trials, the board was rotated ninety degrees and three additional trials were conducted.

A high anxious subject is one who scored in the upper 20% on Taylor's Scale of Manifest Anxiety.

A low anxious subject is one who scored in the lower 20% on Taylor's Scale of Manifest Anxiety.

Proactive interference was measured by the increment in seconds to sort the cards between the fifteenth trial and each of the three subsequent trials of the experiment.

SELECTION OF SUBJECTS

Since the Taylor Scale of Manifest Anxiety has been primarily employed in selecting subjects in this area, it was decided that this tried and true instrument would be used in this study in the interests of comparability of data. The Scale was administered to 290 students at Michigan State University enrolled in the Spring session of the introductory psychology course. Of this number, 190 were males and 100 were females. They were given the following instructions:

> Read the directions on the answer sheet and fill in the blanks requested. When you are through with that, read the directions on the first page of your test booklet, and begin the test. There are 225 True-False questions. You should be able to finish them in less than an hour. Your answers to these questions are confidential. Do not show your paper to anyone but the examiner. Do not discuss the questions with your neighbor. If you have any questions, raise your hand, and I'll be glad to answer them. Work rapidly. You may leave as soon as you're finished. I wish to emphasize that this test is confidential and will count in no way on your academic record.

When the first student arose to hand in his test (usually about 35 minutes after the test began), the following announcement was made:

> Let me have your attention for a few moments. Some of you may be selected for an experiment that will last approximately half-an-hour. It will be conducted individually. Write on the back of your answer sheet any three hours of the week that you have available to participate in the experiment. Do this when you have finished the test.

None of the 290 students failed to comply with the instructions.

These tests were then scored twice manually using scoring keys employed by McKnelly (16) and Rosenbaum (20). Criteria for rejecting subjects on the basis of responses on the F, K,and L Scales were identical with those employed in the two studies just cited. According to Hathaway and McKinley (8), the F Scale is designed to detect carelessness or poor comprehension of items, the K Scale is designed to detect falsification of responses to give an impression of normalcy, while the L Scale is designed to detect lying. Twelve or more positive responses to the sixty-three items on the F Scale, twenty-four or more to the thirty items on the K Scale, or seven or more to the fifteen items on the L Scale resulted in that individual being rejected. On this basis, 28 persons were rejected of whom 17 were males and 11 were females.

For the 262 remaining subjects, anxiety scores were computed from that scale of fifty items. As in Taylor's original study (28), a positively skewed distribution was obtained. The range of this distribution was from 2 - 39 with the lower 20% (low anxious group) obtaining scores ranging from 2 - 10 and the upper 20% (high anxious group) obtaining scores ranging from 24 - 39. This is in very close agreement with the distribution of McKnelly (16). His range was from 1 - 38 with the lower 20% obtaining scores ranging from 1 - 11 while the upper 20% ranged from 24 - 38.

The upper and lower 20%'s represented a pool of 104 students from which 64 were selected to serve as subjects in the

experiment. This number was considered sufficient to reveal any significant differences between groups. The low anxiety pool consisted of 41 males and 12 females while the high anxiety pool was composed of 27 males and 24 females. An effort was made to have a proportional representation of the sexes in the experimental groups: the low anxiety group comprised 9 females and 23 males; the high anxiety group was composed of 16 females and 16 males. Age differences between the two groups were negligible: the average age of the high anxiety group was twenty; the average age of the low anxiety group was twenty-one.

In luring the wary student to serve as a subject, the following inducement was given verbally either in person or over the phone:

> You have been selected to participate in an experiment. It will be conducted individually and will last about half-an-hour. You'll probably find it very interesting and it would certainly be appreciated if you could make it. I've scheduled you for (time) at (place). Can you make it? Thank you very much.

PROCEDURE

A sound-proof, windowless, research room in the Psychology Building at Michigan State University served as the site for the experiment. On a table inside this room, a twenty-two inch square board divided into quadrants was placed. Each quadrant was plainly marked by a symbol of one of the suits found in an ordinary deck of playing cards. The subject stood before this board and held the usual pack of playing cards (thirteen in each suit) in his hand. Behind him was a chair in which he might sit between trials. On his left and out of his line of vision sat the experimenter holding a stopwatch. The design of the board was:

CLUBS	DIAMONDS
HEARTS	SPADES

Each subject was given the following instructions:

> Note where the compartment for each suit is located. Sort the cards by suit as follows: at the signal 'GO' turn over the top card of the deck and toss it face up into its appropriate compartment. Continue until all the cards have been sorted by suit. You are to work as fast as possible and to correct any errors that occur. Do you understand? GO!

This was the fore-task. Its purpose was to provide a useable measure by which the two experimental groups could each be sub-divided into two smaller groups. The reason for this sub-division was that a counter-balancing design was deemed advisable. In turn, this was due to the possibility

that the increase in time which was expected to result after the board was rotated might be attributed to some inherent difficulty of one pattern over another and not to proactive interference. Such a design served as a check on this factor. Accordingly, two card sorting patterns for each of the two experimental groups were composed. For simplicity's sake, they were termed "A" and "B". As can be seen, the pattern that was learned in A was the interference pattern in B and the pattern that was learned in B was the interference pattern in A. An equal number of the high anxious subjects performed

A		B	
SPADES	HEARTS	HEARTS	CLUBS
DIAMONDS	CLUBS	SPADES	DIAMONDS
HEARTS	CLUBS	SPADES	HEARTS
SPADES	DIAMONDS	DIAMONDS	CLUBS

on Pattern A as on Pattern B; the same condition held true for the low anxious. Eight males and eight females in the high anxious group performed on Pattern A and the same numbers performed on Pattern B; in the low anxious group, eleven males and five females performed on Pattern A while twelve males and four females performed on Pattern B.

A running-matching technique was employed. For the first 50% of subjects used, arbitrary placement in the patterns occured. Means for the fore-task were then calculated and, thereafter, subjects were placed in patterns so as to keep these means approximately equal. An interval of 45 seconds followed the fore-task during which the experimenter shuffled the cards,

recorded the time that had been required for sorting from "GO" until the last card had been placed in its appropriate compartment, and rotated the board to the desired pattern. The subject rested. Then the following instructions were given:

> Note where the compartment for each suit is located. Sort the cards by suit as follows: at the signal 'GO', turn over the top card of the deck and toss it face up, regardless of suit into the upper left quadrant. Note the suit of that card, locate its corresponding compartment, and toss the next card face up into it. The suit of this last card determines where the next card should be tossed. For example, if the first card thrown into the upper left quadrant is 'clubs', then the next card goes into the 'clubs' compartment, and if that is a 'diamond', the next card is thrown into the 'diamond' compartment, and so forth. If a card is the same suit as the compartment in which it lies, the next card is thrown into that same compartment. This is continued until a new suit turns up. You are to work as fast as possible and to correct any errors that occur. Do you understand? GO!

Fifteen trials followed. During these trials, the experimenter called the subject's attention to any mistakes that were unnoticed. These mistakes were rectified as they occured. Timing began from the starting signal "GO" until all cards had been sorted. There was an inter-trial interval of 45 seconds in which the subject rested while the experimenter recorded data to the nearest second and shuffled the cards. Upon the completion of these trials, a pencil and mimeographed sheet were handed the subject. This sheet contained two questions:

1. How do you feel you compare with others who have tried to sort these cards?

   Please make a check mark where you feel you stand.

Poorest	Not as well as most	Average	Better than most	Best

2. How hard do you feel you tried (compared with the others) to get the lowest time as quickly as possible?

Tried less than all the rest	Tried less than most	Average	Tried harder than most	Tried harder than all the rest

A study by Graff (7) had revealed that his high anxious subjects felt they had done worse than others in solving anagrams, though they believed they had expended the greatest effort. It was decided to utilize questions similar to his as an adjunct to this experiment in an effort to replicate those findings.

After the questions had been answered, the board was rotated ninety degrees, and these instructions given:

> Just continue to sort the cards as you were doing before, starting in the upper left quadrant. Do you understand? GO!

Three interference trials followed under the same experimental conditions as the previous fifteen. Upon their completion, a pencil and mimeographed sheet were handed the subject. The sheet contained these two questions:

1. How do you feel you compare with others as to the effects of rotating the sorting board?

Affected me the least	Affected me less than most	Average	Affected me more than most	Affected me most

2. How hard do you feel you tried (within your own abilities) to get the lowest card sorting time as quickly as possible?

Made no extra effort	Tried somewhat	Tried to a moderate degree	Tried more than usual	Tried as hard as I was able

When these questions were answered, the subject was thanked for his cooperation and dismissed. The average time for the entire experiment was approximately thirty-five minutes.

RESULTS

The four questions aimed at tapping the feelings of the subjects were introduced as a side-issue and shall now be quickly pushed out the back door. There were no significant differences between high and low anxiety groups on these four questions. Individuals in both groups felt (at least, they so indicated) they had done average in sorting the cards and average in being affected by the rotation of the board. Individuals in both groups felt they had tried harder than most and more than they usually tried to get the lowest card sorting time as quickly as possible. A probable explanation for this discrepency with Graff's results may lie in the fact that he employed a three category system whereas this study utilized five. Of perhaps more importance is that he lacked an Average category, instead, terming the mid-point of his continuum "Same". It may very well be that though people are quick to take refuge in an average category, they are somewhat loath to identify themselves with everyone else.

Analysis of variance was conducted for the last four trials of learning. Interest was primarily focused on whether significant differences would be obtained between the two sorting patterns. An inspection of Table I shows how closely the means agree. Therefore, it was considered permissable to combine the A and B sub-groups of the high and low anxious and proceed from there. Now analysis of variance on trial 15 produced an F ratio of 3.9 for subjects. Although none of the other F ratios computed for the other three trials even approached significance, this one was significant at the 5% level of confidence.

TABLE I

AVERAGE SORTING TIMES BY PATTERNS

Trials (15 learning & 3 interference)	Mean Time in Seconds A (N = 32)	B (N = 32)
1.	103	106
2.	87	81
3.	80	75
4.	72	67
5.	67	66
6.	61	62
7.	60	58
8.	58	57
9.	58	56
10.	55	56
11.	54	54
12.	53	54
13.	51	53
14.	51	53
15.	51	52
1.	68	67
2.	60	59
3.	57	55

On the 15th trial, the low anxiety group took an average of 54 seconds to sort the cards while the high anxious were able

to perform the same task in an average of 49 seconds. Such a difference could readily have been predicted from Hullian theory and, more specifically, from the formula quoted from it in the Introduction. If card sorting is assumed to be a simple task, then the high anxiety group due to their increased drive (D) should learn it faster. However, so omnipotent are the applications of Hull's formula that the diametrically opposite results could also have been derived. If card sorting is assumed to be a complex task, then the high anxiety group due to the interfering responses elicited by their anxiety should take longer to complete the trials. An inspection of Table II should help to clarify the issue.

As can be seen, a trend exists favoring the performance of the high anxious group. On all learning trials but three, when the times for the two groups were the same, the high anxious subjects performed faster. But only three of these differences tended toward significance and two of these three were significant at only the 20% level of confidence. When the total time taken for sorting the cards on all fifteen learning trials is used as a measure, it is found that the low anxiety group performed the task in an average of 976 seconds while the high anxiety group required an average of 936 seconds. This difference of forty seconds is not significant. The high variabilities in the two groups... the standard deviation for the low anxious was 188.8 while the standard deviation for the high anxious was 190.0... resulted in a t ratio of .84. Thus, there was no significant difference between the two groups in learning to sort the cards.

TABLE II

AVERAGE SORTING TIMES BY ANXIETY GROUPS

Trials	Mean Times in Seconds: Low Anxiety (N = 32)	High Anxiety (N = 32)	t Ratios
Fore-task	67	69	.68
1.	110	104	.66
2.	88	81	.92
3.	78	77	.18
4.	72	67	1.29
5.	65	65	0.00
6.	62	62	0.00
7.	60	59	.35
8.	58	56	.78
9.	58	56	.60
10.	57	54	1.31
11.	55	53	1.05
12.	54	53	.69
13.	52	52	0.00
14.	53	51	.96
15.	54	49	2.06*
1.	69	66	.69
2.	59	60	.21
3.	55	57	.80

* Significant at the 5% level of confidence

Looking again at Table II and delving for the moment in the realm of conjecture, it will be seen that though the mean times for the high anxiety group steadily declined, those of the low anxious began to increase on the last two trials. On trial 13, the times for the two groups were the same but while the high anxious continued to decrease, the low anxious then began to rise. During the experiment many of the subjects commented that they wished to reduce their time for sorting to less than a minute. It may be that the low anxious group having attained their level of aspiration fell prey to boredom and lack of interest. After all, sorting cards, even under the peculiar conditions of the experiment, is not the most intriguing past-time. But perhaps the high anxious group having attained the goal now shifted their levels of aspiration. Whether shifting levels of aspiration is a propensity of the highly anxious should be a matter for scientific investigation.

Attention is now directed to the three interference trials. Proactive interference was defined as the increment in seconds to sort the cards between the fifteenth trial and each of the three subsequent trials. An examination of Table III will prove illuminating. As can be seen, the difference between groups on the first trial, though in the predicted direction, was not significant. However, on the second and third trials the high anxiety group manifested significantly more interference than the low anxious.

Since the low anxious group experienced an upswing in performance on the fifteenth trial while the high anxious

TABLE III

ESTIMATES OF PROACTIVE INTERFERENCE

Trials	Mean Increments in Seconds Low Anxiety (N = 32)	High Anxiety (N = 32)	t Ratios
1'.	15	17	.56
2'.	5	11	3.00*
3'.	1	8	4.32*

* Significant at better than the 1% level of confidence

continued to improve, it was decided that a more conservative estimate of proactive interference should be made. This was accomplished by considering the average of the 14th and 15th learning trials as the base from which to measure proactive interference. This average for the low anxiety group was 53 seconds; for the high anxiety group, it was 50 seconds. Inspection of Table IV will clarify this point.

TABLE IV

REVISED ESTIMATES OF PROACTIVE INTERFERENCE

Trials	Mean Increments in Seconds Low Anxiety	High Anxiety	t Ratios
1'.	16	16	0.00
2'.	6	10	2.18#
3'.	2	7	3.10*

Significant at better than the 5% level of confidence

* Significant at better than the 1% level of confidence

Even with this more conservative estimate, on the second interference trial, the high anxious group had an average increment of ten seconds while the average increment for the low anxious group was six seconds; a difference significant at better than the 5% level of confidence. On the third interference trial, there was an average increment of seven seconds for the high anxious but two seconds for the low anxious; this difference was significant at better than the 1% level of confidence. Thus, the hypothesis of this experiment may be considered confirmed. In a motor performance situation, high anxious subjects do manifest more proactive interference than low anxious subjects.

But there is a problem here. The differences between the groups on the first interference trial were not significant. It then might be more accurate to state that proactive interference is more prolonged with the high anxious group than with the low anxious. Some explanation is certainly in order. Schneiderman (22) puts forth the view that anxiety primarily results from experiencing social failure. This is neither the time nor place to become embroiled in such an issue. The important thing is that most people would agree that anxiety can result from social failures. Recalling Graff's study (7), we note that the highly anxious are more subject to experiencing failure than the low anxious. It would be anticipated then that in a situation where failure might be experienced, the more anxious would be more susceptible to such feelings. The most likely situation in this experiment where such an event might occur is just after the first interference trial.

Little imagination is required to picture the naive, highly anxious subject reducing his time to sort the cards during the learning trials. Then, with just a little rotation of the board, all sorts of difficulties are encountered. Failure is experienced and anxiety is recruited, producing the task irrelevant responses manifested on the next two trials. On the first interference trial, interference effects were primarily due to the intrusion of the old habit with that to be acquired. On the second and third interference trials, interference effects for the high anxious were heightened by the task irrelevant responses produced by their anxiety.

Support for the contention that different factors were prepotent on the first, in contrast to the second and third, interference trial may be gathered from an examination of Table V.

TABLE V

PROACTIVE INTERFERENCE ESTIMATES BY SEXES

Trials	Mean Increments in Seconds			
	Low Anxiety		High Anxiety	
	Males (N = 23)	Females (N = 9)	Males (N = 16)	Females (N = 16)
1'.	17	12	20	13
2'.	6	6	11	10
3'.	2	0	8	7

A sex difference is clearly indicated on the first interference trial which sweeps across the anxiety categories. The average

increment on this trial for the thirty-nine males employed in the experiment was 18 seconds; the average increment for the twenty-five females was 12 seconds. A t ratio of 2.20 computed for this difference indicates that it is significant at better than the 5% level of confidence. There was no significant difference between the sexes in the learning trials. Note also that on the second and third interference trials, the increments become differentiated according to the anxiety categories, and not with respect to sex. It becomes quite feasible, therefore, to explicate the results on the basis of anxiety effects becoming operative after the first trial of interference.

SUMMARY AND CONCLUSIONS

The problem investigated in this experiment was the influence of manifest anxiety upon proactive interference. It was hypothesized that in a motor performance situation, high anxious individuals will manifest more proactive interference than low anxious individuals. Sixty-four subjects were selected from the upper and lower 20% of scores on a Taylor Scale of Manifest Anxiety administered to 290 students enrolled in an introductory psychology course at Michigan State University. These subjects then sorted cards according to experimental directions upon a board divided into quadrants each of which represented a suit. After fifteen trials, the board was rotated ninety degrees and three interference trials followed.

Two questions aimed at revealing subjects' feelings concerning the merit of their performance and the effort which it entailed were given at the end of the learning trials and at the conclusion of the experiment. No significant differences were found between groups on these questions or in learning to sort the cards. A sex difference significant at better than the 5% level of confidence was found for the amount of proactive interference manifested on the first interference trial. There were no significant differences between anxiety groups on this trial. Differences significant at better than the 1% level of confidence were found between anxiety groups

in the amount of interference manifested during the second and third interference trials. There were no significant sex differences on these trials.

The following conclusions are made:

a. The experimental hypothesis is considered partially confirmed. In a motor performance situation, high anxious subjects will manifest more prolonged proactive interference than low anxious subjects.

b. In a motor performance situation, males will initially manifest more proactive interference than females.

An explanation of the experimental results was presented along non-Hullian lines utilizing, instead, a more eclectic interpertation of anxiety. The need for further investigation in this area was indicated.

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APPENDIX

FIGURE I

ANALYSIS OF VARIANCE LEARNING TRIAL 12

Source	Sum of Squares	Degrees of Freedom	Estimate of Variance
Patterns	32	1	32
Subjects	32	1	32
Interaction	128	1	128
Within Sets	3475	60	57.92
Total	3667	63	

FIGURE 2

ANALYSIS OF VARIANCE LEARNING TRIAL 13

Source	Sum of Squares	Degrees of Freedom	Estimate of Variance
Patterns	64	1	64
Subjects	0	1	0
Interaction	176	1	176
Within Sets	4275	60	71.25
Total	4515	63	

FIGURE 3

ANALYSIS OF VARIANCE LEARNING TRIAL 14

Source	Sum of Squares	Degrees of Freedom	Estimate of Variance
Patterns	64	1	64
Subjects	64	1	64
Interaction	16	1	16
Within Sets	4217	60	70.28
Total	4361	63	

FIGURE 4

ANALYSIS OF VARIANCE LEARNING TRIAL 15

Source	Sum of Squares	Degrees of Freedom	Estimate of Variance
Patterns	32	1	32
Subjects*	288	1	288 *
Interaction	96	1	96
Within Sets	4435	60	73.92
Total	4851	63	

* Significant at the 5% level of confidence