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THE EFFECTS OF DRIVE LEVEL, NON-CONTINGENT SUCCESS-FAILURE FEEDBACK, AND STIMULUS CONFLICTFULNESS ON COLOR-WORD PERFORMANCE

by

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A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Abstract

THE EFFECTS OF DRIVE LEVEL, NON-CONTINGENT SUCCESS-FAILURE FEEDBACK, AND STIMULUS CONFLICTFULNESS ON COLOR-WORD PERFORMANCE

by

SIDNEY H. HOCHMAN

Adviser: Professor William Reynolds

The purpose of the present study was to explore some of the multiple implications of the H x D theory for human performance and to refine the conceptualization that scores on the Manifest Anxiety Scale reflect susceptibility to different sources of stress.

A factorial experiment on 90 subjects determined the effects of drive level, feedback and stimulus conflictfulness on color-word performance. Analyses of time and interference scores suggest that while a H x D mechanism is inadequate, a formulation in terms of (1) boundary strength of cognitive systems and (2) sensitivity to different stressors appear promising.

The results support Saltz's theoretical formulation and suggest that a "cognitive" theory may be helpful in assessing some of the factors involved in the effects of stress on learning and performance.

To

Darlene

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CHAPTER I

INTRODUCTION

The primary impetus for a series of studies originating in the early 1950's concerned with the effects of anxiety on performance was Hull's (1943) original assumption that all momentarily operative motivational factors or drives (D) combine indiscriminately with all existing habits (H) that are aroused by the stimulus situation to produce response strength (E). More specifically, Hull assumed that the drive and habit factor combined multiplicatively as joint determiners of response strength, i.e., E=D x H. Furthermore, he assumed that this multiplicative function was indiscriminate in the case where more than one habit tendency was aroused.

Spence (1956) was the first to formally expound on the implications of these assumptions as a guide for the design and interpretations of experiments concerned with the role of motivational factors in learned performance. For example, in conditions involving acquisition of classical conditioned responses or where only one H is involved and there is no response competition, reference to the fundamental equation, E = D x H, indicates that with H constant, the performance of subjects with high D levels should exceed that of subjects with low D levels. On the other hand, with D constant, the performance of subjects with higher H levels should exceed that of subjects with the lower H levels. Where there are competing responses,

with D constant, the theory would predict the occurrence of the response having the greatest magnitude of H and hence of E. In cases where the correct H is dominant, the greater the dominance of the correct H, the more the performance of subjects with high D should exceed that of subjects with low D. In the case where an incorrect H is dominant, the greater the dominance of the incorrect H, the more the performance of the low D subjects should exceed the performance of the high D subjects. Thus, if the strengths of the competing, incorrect responses are greater in relation to the correct one, the effects of an increase in drive level are expected to be deleterious to performance. However, if the correct habit is dominant, i.e., its strength is greater in relation to the competing, incorrect habit, the effects of an increase in drive level are expected to be beneficial to performance. These implications have received experimental support in studies involving classical conditioning (Spence, 1958; Taylor, 1951), instrumental conditioning (Penney & Croskery, 1962; Penney & McCann, 1962), paired-associates learning (Spence, 1956), finger maze performance (Matarazzo, Ulett, & Saslow, 1955), serial learning (Montague, 1953; Taylor & Spence, 1952), discrimination learning (Stevenson & Iscoe, 1956), motor learning (Castaneda, Palermo, & McCandless, 1956; Palermo, Castaneda, & McCandless, 1956).

Hull's assumption about the interaction of drive level and relative habit strength was based on infrahuman subjects in which drive or motivational states were varied by depriving the animal of selected primary needs, such as food and water. The later attempts to apply the theory to human subjects involved the assumption that anxiety and stress constitute operationally definable drives and can effect performance in learning situations. The most frequently used measure of anxiety has been the Taylor Manifest Anxiety Scale (Taylor, 1953).

Taylor conceived and developed the Manifest Anxiety Scale (MAS) as an operational measure of the general motivational (drive) level of human subjects. The scale was constructed in the form of a questionnaire type personality inventory. To obtain a convenient and objective device for rating subjects, a series of items judged by clinical psychologists to describe both the physiological reactions reported by individuals suffering from anxiety reactions and the accompanying reports of psychological reactions, such as, worry, self-doubt, anxiety, were chosen from the Minnesota Multiphasic Inventory (MMPI). It was assumed that the degree to which an individual admitted to characteristically exhibiting

manifest symptoms of anxiety, as described by items on the scale, would be related to the magnitutde of his emotional responsiveness and, therefore, to the level of D. When D is varied in terms of MAS scores, subjects having high scores on the scale would be expected to exhibit superior performance relative to subjects scoring low on the scale under conditions where the correct response is dominant. With the reverse situation, where incorrect responses are dominant, the performance of highly anxious subjects would be predicted to be inferior to low anxiety subjects (Spence & Spence, 1966).

The assumption underlying the use of the MAS as a measure of D is that scores on the scale are in some manner related to emotional responsiveness, which, in turn, contributes to drive level. There are two alternative possibilities concerning the conditions under which emotional responses of highly anxious subjects tends to be greater than that of the subjects scoring low in any and all types of experimental situations, due perhaps to the former tending to be chronically more anxious and emotionally aroused. The second possibility is that highly anxious subjects differ from the lower scorers primarily in their lower threshold for emotional arousal in response to

situations perceived as having some degree of threat. According to the first possibility, differences between anxious and nonanxious groups should be found whether or not there is any threat in the situation. In the case of the second possibility, differences would be expected in the performance of high and low anxiety groups only in those situations in which some threat is present (Taylor,1966).

Spence (1956) distinguished a simple task from a complex task on the basis of the number of response alternatives involved. In a simple task, a single response tendency is elicited, while in a complex task, more than one response is involved. Considering this distinction, a major requisite for testing drive theory is a knowledge of the response hierarchy. In fact, the presence or absence of dominant incorrect responses defines the conditions under which Spence's theory is able to predict inferior or superior performance of highly anxious subjects relative to the performance of the lower scoring subjects.

Within this context of the Hull-Spence theory, the present study attempts to explore the implications of the $E = D \times H$ theory in a situation where the order of dominance of correct and incorrect responses is known, and thus permits derivations about the effects of drive (MAS) level on performance.

The Stroop Color-Word Test (Stroop, 1935), a test in which the order of dominance of correct and incorrect responses is well documented by empirical research, has now been in existence for 35 years. The test is generally administered by presenting the subject with three cards in a fixed order. A warm-up task is first introduced by presentation of the first of these cards (the W card) containing a series of 100 color-words printed in black ink, which the S is to read as rapidly as possible. On the second card (the C card), each color-word is replaced by patches of colored ink printed in the color denoted by the word they replaced. Subjects are instructed to name the colors as rapidly as they can. Response competition is introduced by presentation of the third card (the CW card), which also contains the color-words, but this time they are printed in conflicting colors, e.g., the word "red" might be printed in blue ink, "green" in red ink, etc. Subjects are instructed to name the colors and ignore the words.

There is no standard version of the Stroop test in terms of either the exact materials used, the administration, or the scoring of the test. The Stroop test has the distinction of possessing one of the most reliably demonstrable phenomena in experimental psychology. Jensen and Rohwer (1966) cite over 60 studies supporting the basic finding that speed

of reading the colors in which words are printed is impeded when the words themselves are the names of colors incongruent with the colors of the ink. The series of tasks has proved discriminative in studies of cognitive styles (Broverman & Lazarus, 1958; Broverman, 1960), of developmental trends (Comalli, Wapner, & Werner, 1962; Schiller, 1966), and in Ss under primitivizing drugs vs placebo conditions (Wapner & Krus, 1960).

Most interpretations of the Stroop phenomenon have been couched in terms of response interference - an interference effect due to response competition between habits of unequal strenght, the stronger habit (word reading) having to be inhibited in favor of the weaker (color naming). The fact that the habit strength of word reading is dominant over that of color naming is indicated not only by the C-W difference, but also by Stroop's (1935) finding that reading the words on the CW card suffers no appreciable interference from incongruous colors and is practically as easy as reading the words on card W. Stroop found an average increase of 5.6 percent in time for reading the words on CW as compared with W. On the other hand, there was a 74.3 percent increase in color naming time on CW as compared with C.

This finding has led several investigators (Bakan & Alperson, 1967; Dalrymple-Alford & Budayr, 1966; Hochman, 1967, 1969; Klein, 1964; Schiller, 1966) to attempt to vary the strength of the incorrect competing response relative to the correct response by varying the relationship between color and text. Word meanings that implicate the colors should be more interfering than simply meaningful but unrelated words; words referring directly to color should be more interfering than connotatively related words; greatest of all should be the interference of words that are themselves the names of the printed color names. These predictions have received experimental support, as has the prediction of an interaction of color-word conflict with age and reading abilities (Schiller, 1966). Translated into Hullian terms, these results mean that the habit strength of word reading is greater than the habit strength of color naming. The Hull-Spence theory would therefore predict that, since response strength is a multiplicative function of drive and habit strength, where the correct response (naming the color) has a lower habit strength than the competing response (reading the color word), high drive would be detrimental to performance.

What predictions would be made of the effects of

non-contingent success and failure feedback on Stroop color-word performance? Since failure and success, if effective, would presumably increase the Ss drive level, it would be predicted that performance would be affected in the same way after either success or failure and that their effects would interact in the same fashion as anxiety. In studies investigating the effects of failure on performance, when the Ss are told they have performed poorly or whey they are required to attempt very difficult tasks in which they believe they are performing poorly, highly anxious Ss show disruption in their performance while low anxious Ss are less affected. Several studies (Gordon & Berlyne, 1954; Katchmer, Ross, & Andrews, 1958; Lucas,1952; Sarason, 1957) have found an interaction between anxiety level and failure - the performance of highly anxious Ss uniformly being inferior under failure as compared to the nonfailure condition, while the performance of low scoring anxiety Ss experiencing failure varying from being inferior to slightly superior to the parallel nonfailure groups.

A recent theory (Saltz, 1970) suggests that we have misread the relationship between manifest anxiety and learning. Saltz proposed that Ss who score as high

anxious on the MAS are those who show disrupted behavior under failure-induced stress, but not necessarily under pain-induced stress, while Ss who score as low anxious are those who show disruption under pain-induced stress, but not necessarily under failure. Persons scoring high on the MAS are not necessarily more susceptible to stress than persons low on the scale. They are susceptible to different stressors. Instead of referring to persons as high and low anxious, Saltz prefers to refer to failure-disrupted and pain-disrupted persons, respectively.

The present experiment was developed to attempt to refine this conceptualization and to test predictions from Hull-Spence theory on the combined effects of drive level, non-contingent success-failure feedback, and stimulus conflictfulness. The rationale for the experiment is summarized as follows:

1. Score differences on the manifest anxiety scale reflect differences in drive level. Subjects with high scores have a higher drive level (D) than subjects with significantly lower scores.
2. Anxiety is a predisposition toward increased drive, and stress must be introduced into the immediate situation to increase the difference between high drive and low drive subjects than when compared under neutral conditions.

3. Success or failure feedback should increase Ss drive level. Changes in performance after such feedback should be in the same direction.
4. An increase in drive, via MAS score, induced success or failure report, will result in an increase in reaction potential ($E = D \times H$).
5. Nonsense syllables should provoke less interference with the color-naming response than words that are themselves the names of the printed color names since the degree of response competition is assumed to be greater in the latter case.
6. Where the stimulus situation gives rise to more than one response, the effects of increased drive are expected to depend on the strength of the correct response relative to other competing incorrect responses.

The major hypotheses of the present study are as follows:

1. Highly anxious Ss should do better on simple tasks than low anxious subjects, whereas in a complex task, with the dominant response incorrect, highly anxious subjects should perform poorer than their low anxious counterparts.

2. (a) Feedback, positive or negative, is conceived as an external, stressful aspect of the experimental situation, and is thus expected to elicit emotionality. (b) Assuming emotionality to be motivational in nature, feedback is expected to interact with anxiety and stimulus conflictfulness in accordance with the $E = D \times H$ formula.

CHAPTER II

Method

Subjects

The Ss were selected from introductory psychology classes on the basis of extreme scores on the Taylor Manifest Anxiety Scale. (See Appendix A) All were naive with respect to the experimental task and were unaware of the reason for their selection as Ss. The anxious group consisted of 45 female Ss whose scores fell in the upper 15% of the distribution, while the nonanxious group was composed of 45 female Ss falling in the lower 15%. The raw scores for the nonanxious group ranged from 2-12 and for the anxious Ss from 28-39. Each group was further subdivided into a no feedback, positive feedback and negative feedback group of 15 Ss each, individuals being alternately assigned to the subgroups as they appeared to be tested.

Procedure

The performance materials (See Appendix B) consisted of three 9 x 12 cards was presented in the same sequence to all Ss.

The Color Card (Card A) was made up of 80 colored rectangular patches, approximately .15" x .50", of red, green or blue ink. These patches were randomly ordered, ten lines with eight items to a line, with the restriction that no color could follow itself.

The Low Conflict Card (Card B) cosisted of three nonsense stimulus items (DAP, FON, LAR) printed in red, green or blue ink. There were 80 items on the card with the order of the ink colors identical to the order of colors on Card A.

The High Conflict Card (Card C) consisted of the words red, blue and green, printed in conflicting colors of red, blue and green ink. There were 80 such items and the order of the ink colors were identical to the order of the ink colors on Card B and the order of colors on Card A.

Each S was tested individually in one experimental session. Each card was placed on an easel approximately 12 inches away from the S. The instructions for Card A were as follows:

> For this part of the experiment I will give you a page with a series of color patches on it. You are to name the colors from left to right after I tell you to begin. Do not pause at the end of the lines; work through the entire page. I will be timing you so remember to work for speed as well as accuracy. If you make a mistake, please correct it before going on. When you reach the end of the page, say the word "Stop". Do you have any questions?

The instructions for Cards B and C were:

> On this page you will find a series of words which are printed in different colors. Your task is to ignore the words and name the colors in which the words are printed. If, for example, the word, "DAP" ("BLUE")is printed in red, and "FON" ("GREEN") is printed in blue, you would say "red, blue" and so on. Again, do not pause at the end of lines; name all the colors on the page before stopping. If you make a mistake, please correct it before going on. Remember, I will be timing you so work for speed as well as accuracy. When you finish the page, say the word "Stop". Do you have any questions?

While these instructions were given to all Ss, the Ss in the positive and negative feedback groups, before being presented with Cards B and C were told additionally that:

> On these cards (B and C) your performance is to be compared with a normative sample who had already taken this test. If you are performing as well as or better than the norm, a blue light will flash periodically while you are taking the test. However, if your performance is poor or falls below the norm, a red light will flash. I hope this feedback will help you with the task. Do you have any questions?

Regardless of the Ss actual performance on Cards B and C, all Ss in the positive feedback group received the blue light, while those Ss in the negative feedback group received the red light. The lights (25w,125v) were positioned to the immediate right of the cards and were clearly visible to all Ss. Midway through the second line, and once on every line through line ten, a light was flashed. At the end of the experiment, all stress Ss were told of the deception, assured that their performance had been adequate, and cautioned not to discuss the nature of the experiment with others. Responses to all cards were tape recorded.

The experimental design, a 3 x 2 x 3 factorial with repeated measures on one factor, consisted of three levels of feedback, two levels of anxiety, and three levels of stimulus conflictfulness.

Three dependent measures were used: (a) total time to complete the individual cards (recorded with a stopwatch to the nearest 10th of a second); (b) an interference score

(Card B - Card A; Card C - Card A) analoguous to the formula suggested by Jensen (1965) to represent the "purest" interference formula of the 16 proposed formulas he studied; and (c) total errors for the individual cards.

CHAPTER III

RESULTS

Time

The means and standard deviations of the time scores for the high and low anxiety groups under each of the three feedback conditions for each level of stimulus conflictfulness were computed and are presented in Table 1. The differences among the means were initially analyzed using an analysis of variance for three factors with repeated measures on one factor. The results of the analysis of variance are shown in Table 2. It can be seen from the table that significant differences appear for Cards (F = 2022.07, df = 2,168; $p < .01$), for the Feedback x Cards interaction (F = 5.7, df = 4,168; $p < .01$), and for the Feedback x Anxiety x Cards interaction (F = 6.86, df = 4,168, $p < .01$). Figure 1 presents the mean time scores as a function of anxiety level, feedback conditions, and conflict level. The pattern suggests that the performance of the high anxious group on the high conflict card in the negative feedback condition to be the major factor resulting in the significant interaction. The fact that tyhe three factor interaction is significant makes the meaning and interpretation of the other significant differences ambiguous.

TABLE 1. -- Means and standard deviations of the time scores for the high and low anxiety groups under each of the three feedback conditions for each level of stimulus conflictfulness.

		High Anxiety Card			Low Anxiety Card		
		A	B	C	A	B	C
No-Feedback	$\bar{X}$	44.19	47.82	77.66	44.19	48.95	83.30
	sd	5.13	5.76	8.78	6.55	6.28	9.08
Positive Feedback	$\bar{X}$	42.35	50.42	77.83	43.27	51.03	81.56
	sd	6.31	5.96	9.21	5.86	6.95	8.48
Negative Feedback	$\bar{X}$	45.45	56.04	90.53	42.68	52.91	79.58
	sd	5.67	6.48	7.68	5.33	6.03	8.93

TABLE 2. -- Analysis of variance of the time scores

Source	SS	df	MS	F
Total	89021.29	269		
SS between	11959.47	89		
Feedback (A)	730.02	2	365.01	2.96
Anxiety (B)	19.20	1	19.20	.15
A x B	873.85	2	436.92	3.55
SS error bet.	10336.39	84	123.05	
SS within	77061.82	180		
Cards (C)	73151.05	2	36575.52	2022.07*
A x C	374.71	4	93.67	5.17*
B x C	.46	2	.23	.01
A x B x C	496.97	4	124.24	6.86*
SS error within	3038.80	168	18.08	

*$p < .01$

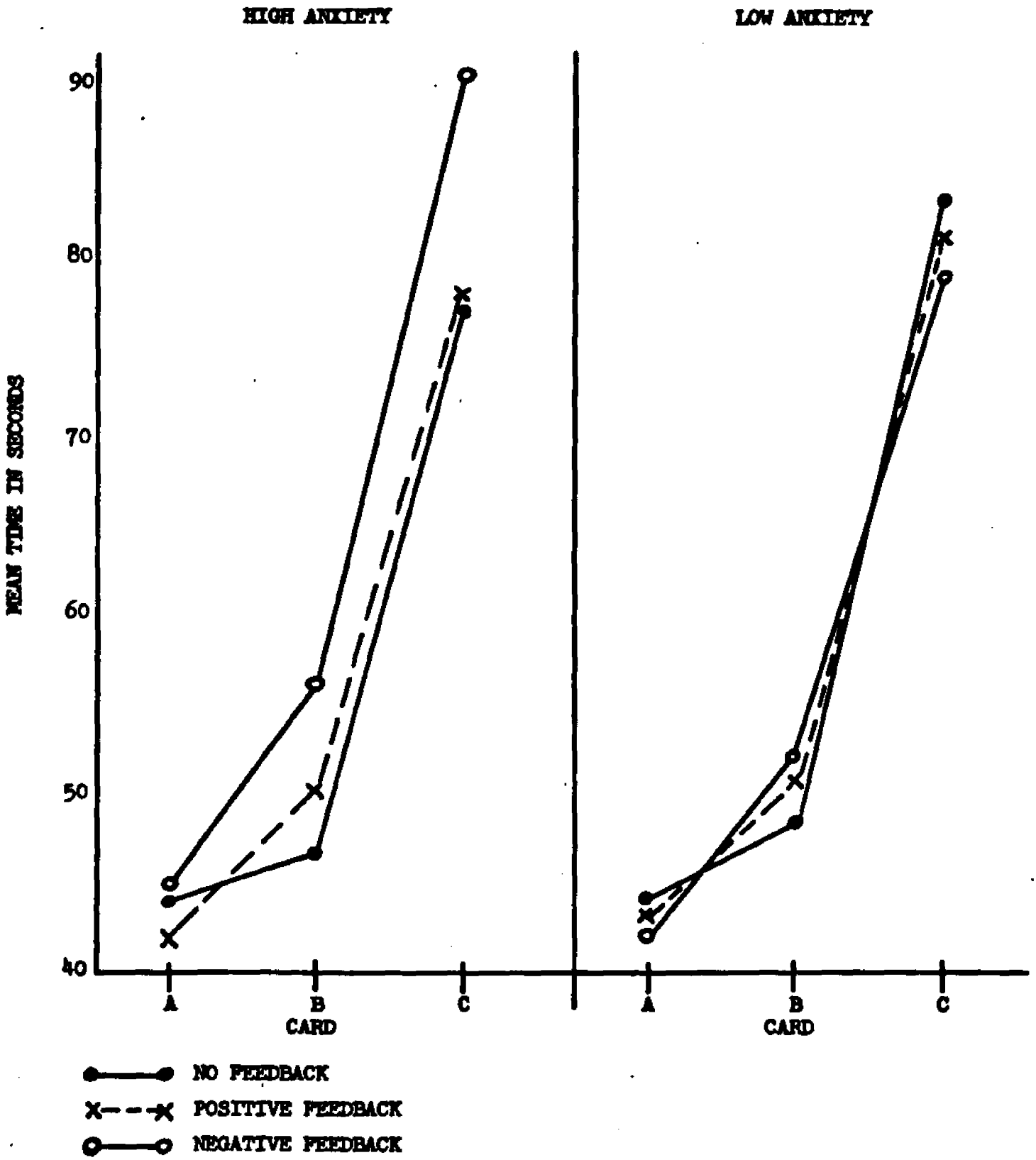


Figure 1.-- Mean time as a function of anxiety, feedback, and level of conflict.

In an attempt to provide for an unambiguous interpretation of the data eight two-factor analyses of variance were performed. Three two-factor analysis of variance were performed for each level of feedback (Appendix C, Tables 1, 2, 3). Significant differences appeared for the main effect of Cards ($F = 958.21$, $df = 2.56$, $p < .01$ in the no-feedback condition; $F = 508.07$, $df = 2.56$, $p < .01$ in the positive feedback condition, and $F = 744.46$, $df = 2.56$, $p < .01$ in the negative feedback condition). Also, in the no-feedback and negative feedback conditions, the Anxiety x Cards interactions were significant ($F = 10.05$, $df = 2.56$, $p < .01$ - no-feedback; $F = 9.06$, $df = 2.56$, $p < .01$ - negative feedback). Figures 2 and 3 portray these interactions graphically. A Newman-Keuls test (Winer, 1962) of ordered means indicated that all time differences across all feedback conditions were significant for the high and low anxiety groups. Most noteworthy is the significant difference on Card C under the negative feedback condition for the high vs. the low anxiety groups.

Analyses of variance were then performed for each of the three levels of stimulus conflictfulness (Appendix C, Tables 4, 5, 6). The two-way analysis of variance for Card A revealed no significant differences. There was, however, a significant difference for Feedback on Card B ($F = 6.79$, $df = 2.84$, $p < .01$). A Newman-Keuls test revealed that the negative - positive feedback conditions, and the negative-no-feedback

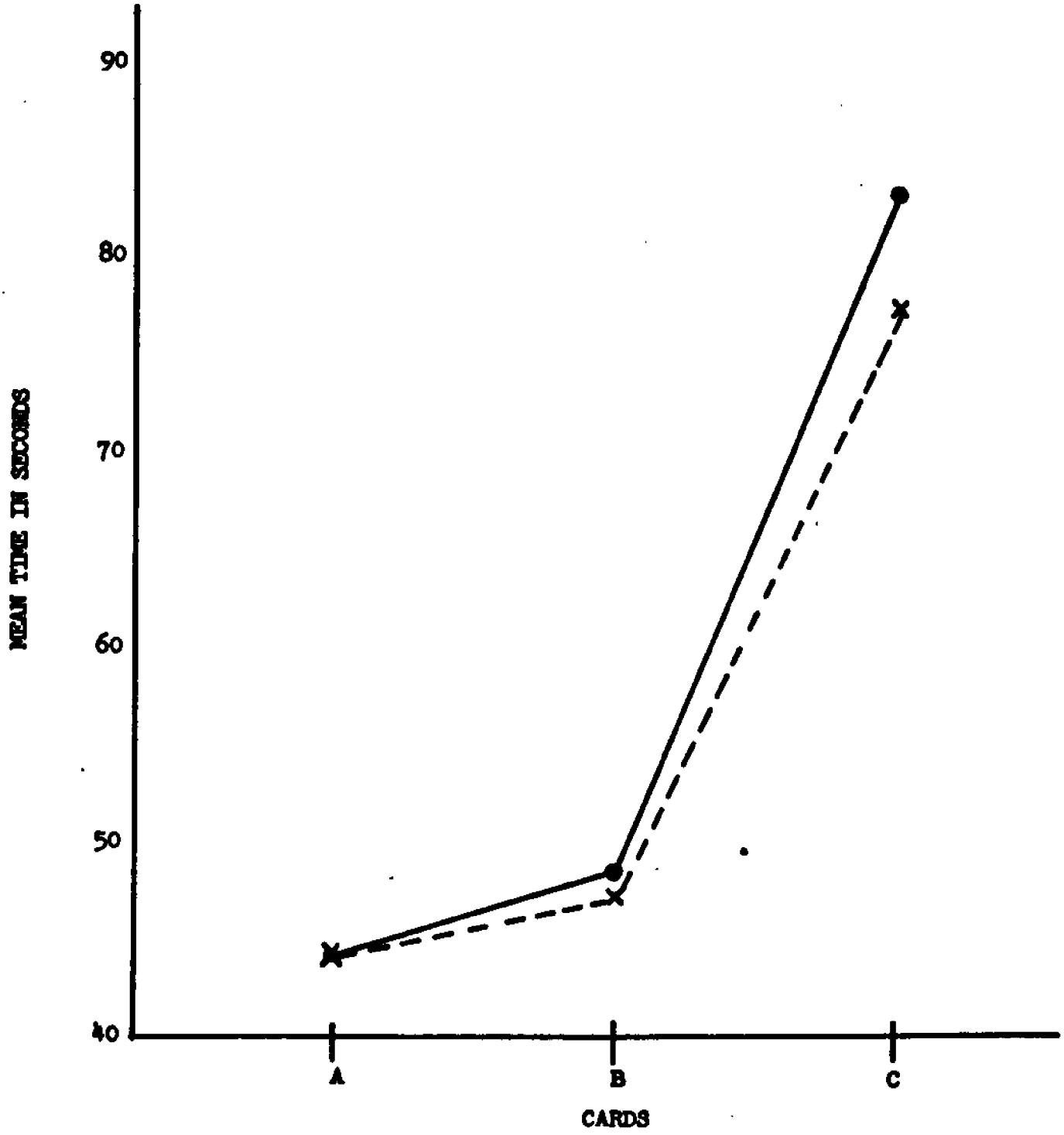


Figure 2.-- Mean time as a function of cards and anxiety (no-feedba

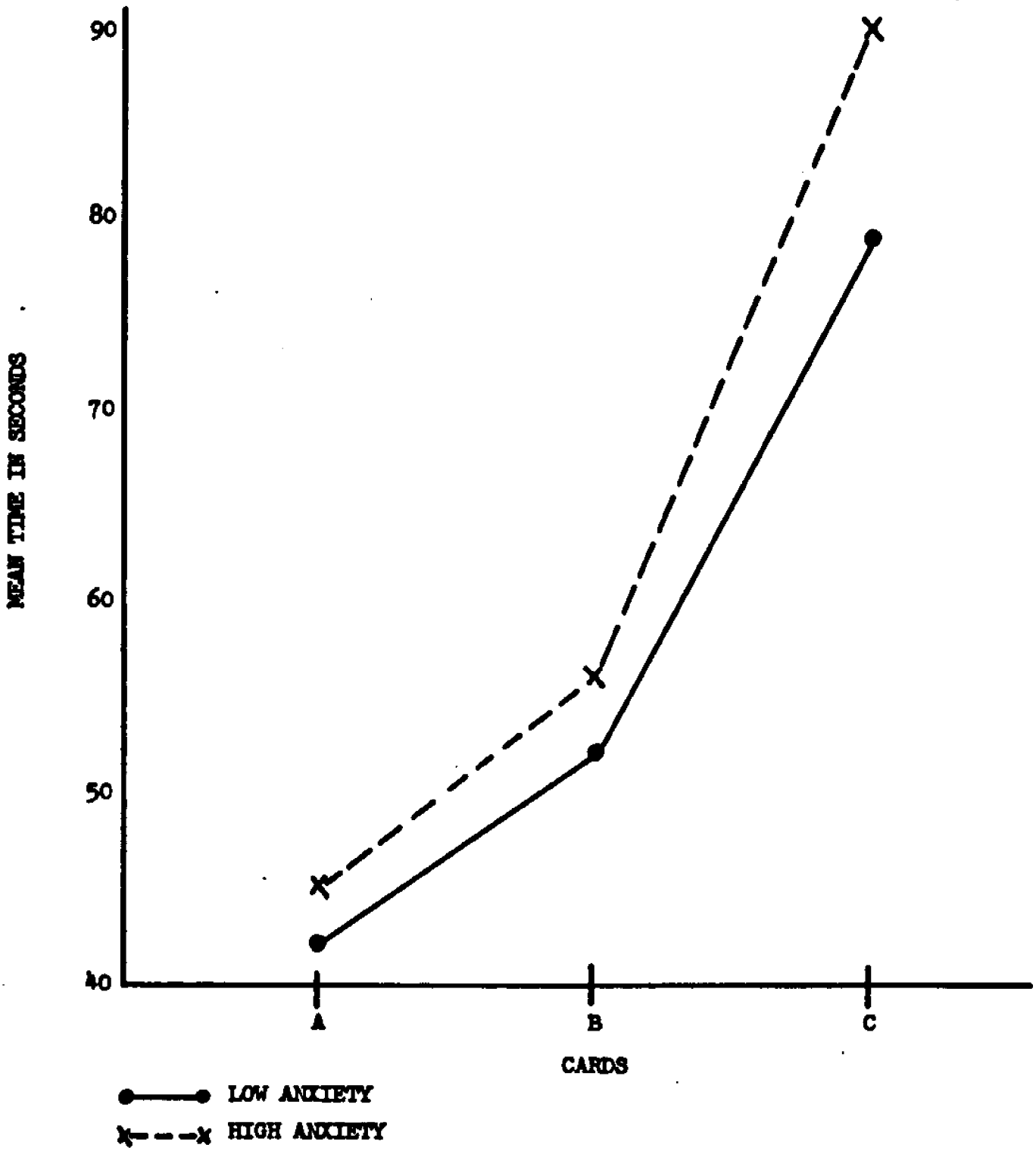


Figure 3.-- Mean time as a function of cards and anxiety (negative feedback).

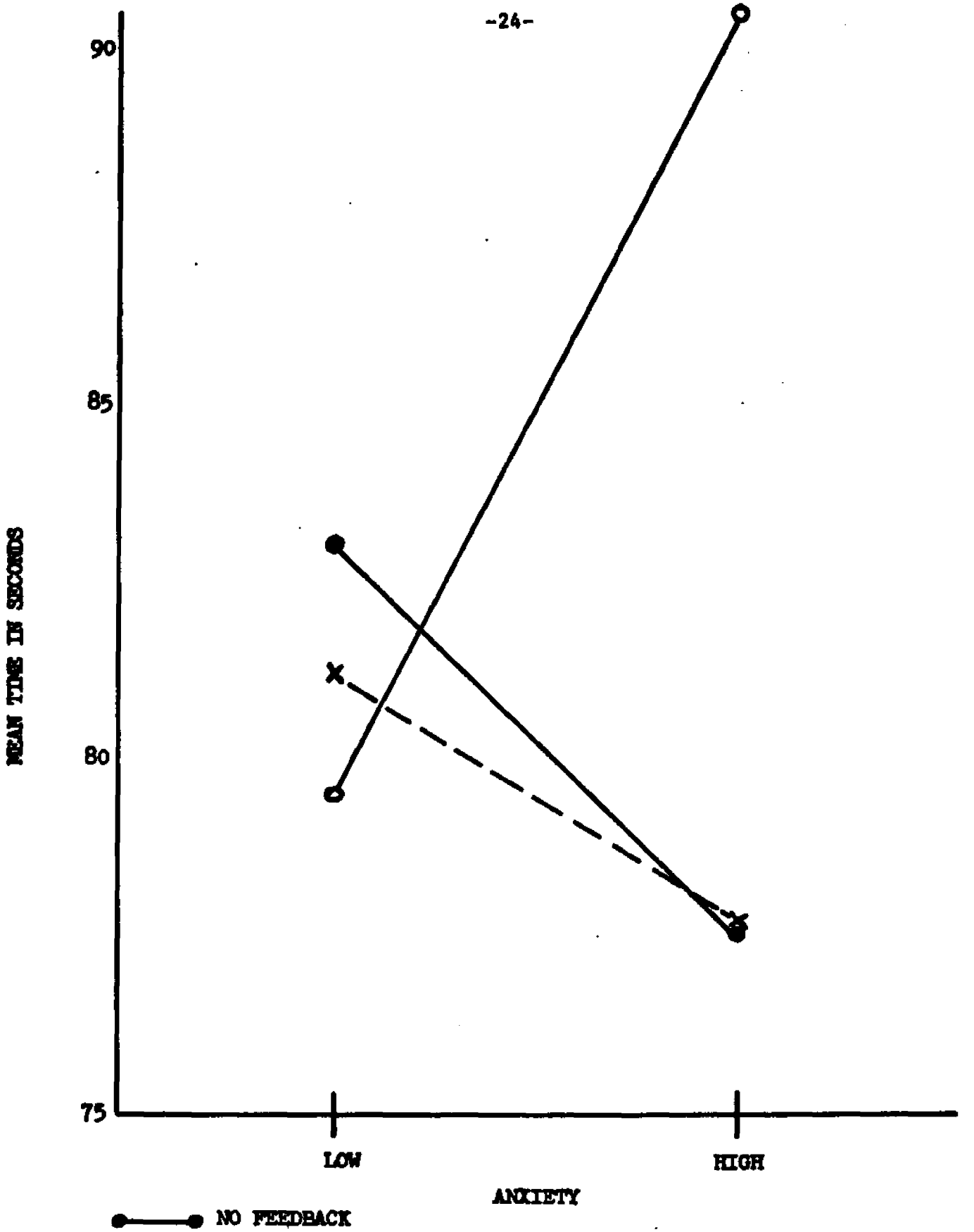


Figure 4.-- Mean time as a function of anxiety and feedback (Card C

conditions differed significantly from each other, but there was no significant difference between the positive-no-feedback conditions. On Card C, the interaction between Anxiety x Feedback was significant ($F = 7.61$, $df = 2.84$, $p < .01$). This interaction is presented graphically in Figure 4. A Newman-Keuls test revealed no significant differences for the low anxious groups under the different feedback conditions. However, for the high anxious groups, significant differences appeared between the negative-positive feedback conditions, as well as the negative-no-feedback conditions, while the positive-no-feedback conditions did not differ significantly from each other.

Finally, analyses of variance were performed for each level of anxiety (Appendix C, Tables 7,8). For the low anxiety groups, the only significant difference appeared for Cards ($F = 1028.55$, $df = 2.86$, $p < .01$). ANewman-Keuls test revealed that all differences were significantly different from each other. For the high anxiety groups, significant differences appeared for Feedback ($F = 6.81$, $df = 2.42$, $p < .01$), Cards ($F = 2443.46$, $df = 2.86$, $p < .01$). Figure 5 presents this interaction graphically. A Newman-Keuls test for differences under the different feedback conditions revealed all combinations to be significantly different from each other.

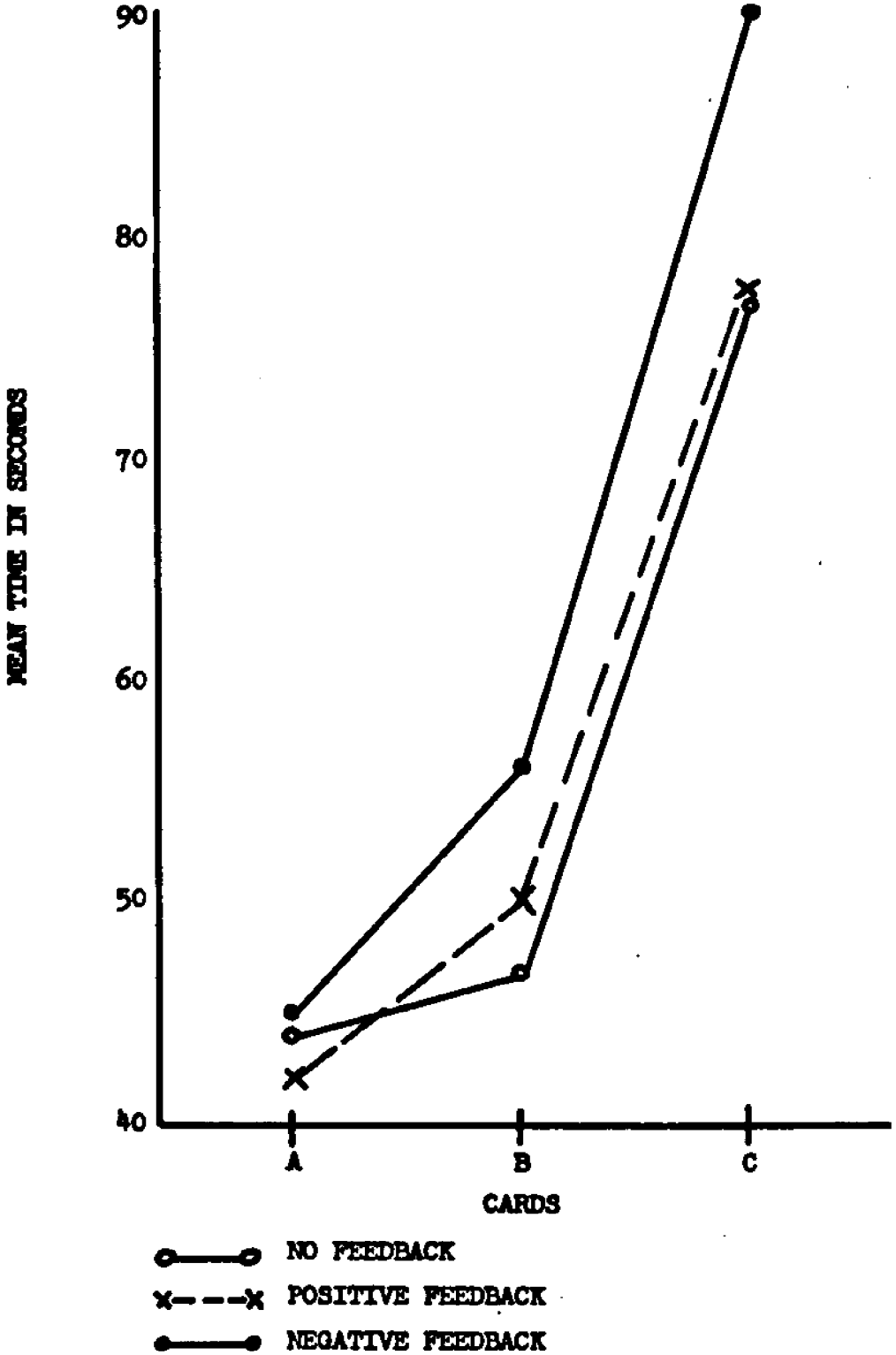


Figure 5.-- Mean time as a function of feedback and cards for the high anxious groups.

The Newman-Keuls test for differences for Cards revealed only significant differences on Card C for the negative-positive and the negative-no-feedback conditions.

Interference

The interference scores chosen in this study were (a) Card B - Card A and (b) Card C - Card A. These scores, analogous to Jensen's (1965) CW-C formula, represents the "purest" interference scores found in a factor analysis of 16 proposed formulas.

The means and standard deviations of the interference scores for the high and low anxiety groups under each of the three feedback conditions for each level of stimulus conflictfulness were computed and are presented in Table 3. The differences among the means were initially analyzed using an analysis of variance for three factors with repeated measures on one factor. The results of the analysis of variance are shown in Table 4. It can be seen from the table that significant differences appear for Feedback ($F = 9.34$, $df = 2.84$, $p < .01$), Cards ($F = 2075.00$, $df = 1.84$, $p < .01$), Feedback x Anxiety ($F = 4.82$, $df = 2.84$, $p < .01$), and the Feedback x Anxiety x Cards interaction ($F = 8.44$, $df = 2.84$, $p < .01$). Figure 6 presents the interference scores as a function of anxiety level, feedback conditions, and conflict level. Here again, as in the case of the time scores, the performance of the high anxious group in the negative feedback condition seems to be the major factor resulting in the

TABLE 3. -- Means and standard deviations of the interference scores for the high and low anxiety groups under each level of the three feedback conditions for each level of stimulus conflictfulness.

		High Anxiety			
		CARDS			
		B-A	C-A	B-A	C-A
No-Feedback	$\bar{X}$	3.62	33.46	4.76	39.11
	sd	3.83	5.46	2.25	4.80
Positive Feedback	$\bar{X}$	8.07	35.49	7.77	38.29
	sd	3.85	9.91	4.21	6.53
Negative Feedback	$\bar{X}$	10.59	45.08	10.23	36.90
	sd	2.60	5.52	3.92	8.14

TABLE 4. -- Analysis of variance of the interference scores

Source	SS	df	MS	F
Total	49568.28	179		
SS between	5457.64	89		
Feedback (A)	907.55	2	453.77	9.34*
Anxiety (B)	.69	1	.69	.01
A x B	468.95	2	234.47	4.82*
SS error bet.	4080.44	84	48.57	
SS within	44110.64	90		
Cards (C)	41995.55	1	41995.55	2075.00*
A x C	73.19	2	36.59	1.80
B x C	.04	1	.04	.002
A x B x C	341.78	2	170.89	8.44*
SS error within	1700.05	84	20.23	

* $p < .01$

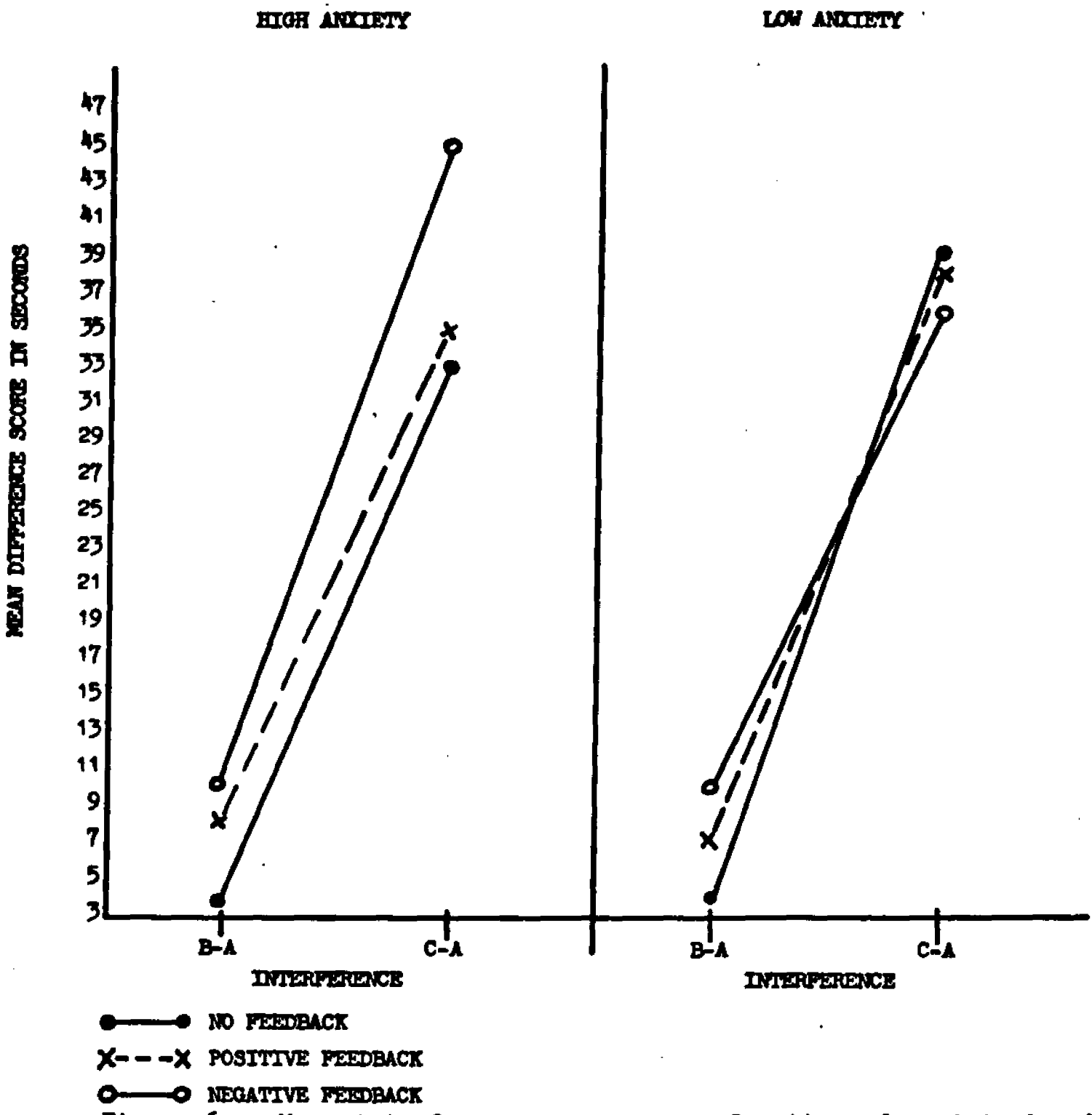


Figure 6.-- Mean interference scores as a function of anxiety level feedback, and level of conflict.

significant interaction. The fact that the three factor interaction is significant makes the meaning and interpretation of the other significant differences ambiguous. In attempting to provide for a more meaningful interpretation, two two-factor analyses of variance were performed. The interference scores for Card B - Card A are presented in Table 9 (Appendix C). The only significant difference which appears is for Feedback ($F = 22.00$, $df = 2.84$, $p < .01$). A Newman-Keuls test revealed that all feedback conditions were significantly different from each other. The interference scores for Card C - Card A appear in Table 10 (Appendix C). Examination of the table reveals a significant Anxiety x Feedback interaction ($F = 7.20$, $df = 2.84$, $p < .01$). This interaction is graphically presented in Figure 7. The Newman-Keuls test reveals no significant differences for feedback conditions in the low anxiety groups, nor in the positive-no-feedback condition for the high anxiety groups. However, quite noteworthy, are the significant differences in the high anxiety condition for the negative-positive and negative-no-feedback conditions. Of further interest, in the comparison between means across feedback conditions, a significant difference exists between the high and the low anxiety groups only in the negative feedback condition.

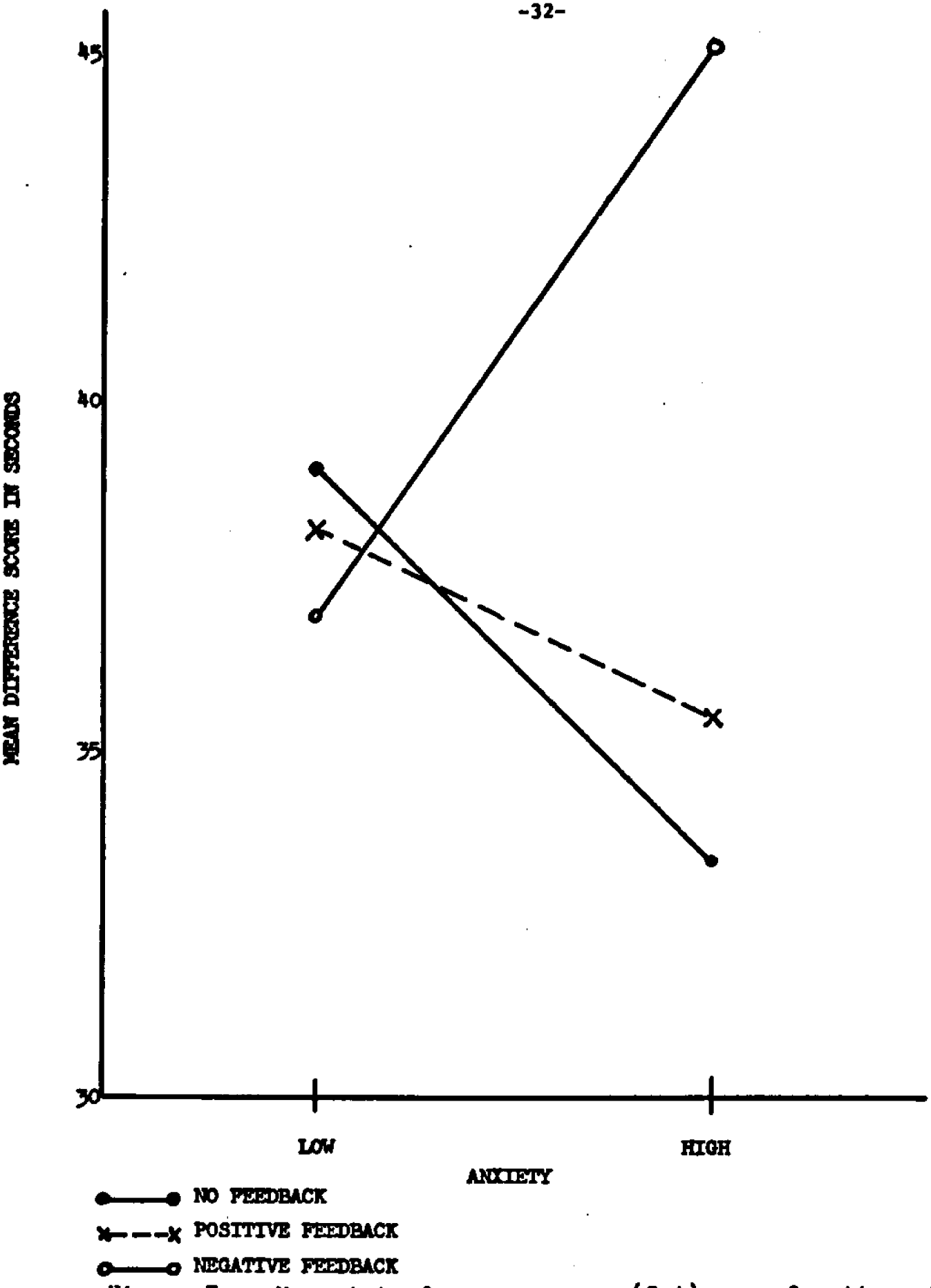


Figure 7.-- Mean interference scores (C-A) as a function of anxiety and feedback.

Errors

Number of errors made by each subject were gathered from Ss tape recorded performance. The means and standard deviations of the error scores for the high and low anxiety groups under each of the three feedback conditions for each level of stimulus conflictfulness are presented in Table 5. The differences among the means were analyzed using an analysis of variance for three factors with repeated measures on one factor. The results of the analysis of variance are shown in Table 6. It can be seen from the table that the only significant difference appears for Cards ($F = 87.96$, $df = 2,168$, $p < .01$). In a comparison of means across conditions, the means for Cards A, B, and C were 1.11, 1.11, and 4.67, respectively. Obviously, the significance is due to the conflict generated by Card C. While an analysis of errors, analyogous to a classification system originated by Rand, et al., (1963) was contemplated, the paucity of errors and the insensitivity of this measure in the present study led this investigator to abandon this idea.

TABLE 5. -- Means and standard deviations of the error scores for the high and low anxiety groups under each of the three feedback conditions for each level of stimulus conflictfulness.

		High Anxiety CARD			Low Anxiety CARD		
		A	B	C	A	B	C
No Feedback	$\bar{X}$	1.13	1.07	4.40	1.60	1.13	5.27
	sd	1.21	1.06	3.28	1.02	1.09	3.37
Positive Feedback	$\bar{X}$	.80	1.00	3.67	1.27	1.07	4.07
	sd	.66	.82	3.61	1.65	1.12	2.13
Negative Feedback	$\bar{X}$	1.27	1.47	5.40	.93	1.27	4.87
	sd	1.12	1.66	3.98	.39	1.18	3.11

TABLE 6. -- Analysis of variance of error scores

Source	SS	df	MS	F
Total	1984.24	269		
SS between	574.90	89		
Feedback (A)	15.78	2	7.89	1.20
Anxiety (B)	1.33	1	1.33	.20
A x B	8.58	2	4.29	.65
SS error bet.	549.20	84	6.53	
SS within	1509.33	180		
Cards (C)	711.85	2	355.92	87.96*
A x C	14.23	4	3.55	.87
B x C	.91	2	.45	.11
A x B x C	2.59	4	.64	.16
SS error within	679.73	168	4.04	

* $p < .01$

Chapter IV

DISCUSSION

The purpose of this paper was to explore some of the multiple implications of the D x H theory for human performance and to determine the extent to which they are supported by the data. Further, the present experiment sought to explore the effect of a different source of stress - namely, the results of non-contingent positive feedback on performance.

Psychologists have used the term stress in a number of ways. Among them, the following situations have been considered stressful: (a) telling a subject that he has performed poorly; (b) forcing a subject to respond at such a fast rate that he is likely to make many errors; and (c) telling a subject that a difficult task which he is performing is a measure of intelligence.

Within the Hull-Spence framework, the effects of an increase in drive will depend on how complex the situation is - where the correct response stands in relation to competing responses. If the correct response is alone or stands higher than its competitors from the start, a high level of drive should facilitate performance. If, on the other hand, the correct response is initially in competition with erroneous responses of comparable strength or overshadowed by them,

a high level of drive will be detrimental to performance. Also, high-drive subject may differ from low-drive subject in having a higher prevailing level of anxiety most of the time regardless of the environmental conditions. Or, high-drive subjects may be subjects whose level of drive receives a larger increment when they are exposed to threat. Finally, Hull assumed that drives produce distinctive stimuli (S_D) - in some cases, such distinctive stimuli, arising from stress or anxiety, may elicit responses which interfere with performance on an experimental task.

The emphasis in conceptualizing the data over the years has been on stress as a drive state and on stress as producing distinctive stimuli which may become associated with distinctive responses. Saltz (1970, 1971) takes the position that we have been misreading the data on the relationship between manifest anxiety and learning and that a consideration of different set of variables are needed. More specifically, (a) the boundary strength of the cognitive system is the most sensitive to stress - i.e., in situations involving the competition between cognitive systems, stress permits the disruption of the weaker systems and (b) the extremes of the Manifest Anxiety Scale appear to isolate people who are sensitive to different sources of stress. Persons with low MAS scores tend to show marked deterioration

in performance under conditions of pain as stress, while high anxious persons are less affected. On the other hand, high anxious persons react poorly under conditions of failure or threat of failure, while low-anxious persons are less affected by this stressor.

Saltz's (1970) review examines the empirical data and explanations on stress during conditioning, stress produced by pain, and stress produced by failure that have been in the forefront for many years and offers a new context and conceptualization which relate these findings to a new and broader set of variables.

The conditioned eyelid response is a defensive reaction to a noxious stimulus. Low anxious subjects perform poorly in the eyelid conditioning task because their performance is disrupted by the noxious stimulation provided by the unconditioned stimulus, the puff of air to the eye. If the eyelid conditioning of the low anxious subjects is due to the disruptive effects of pain, one could expect this effect to vanish in conditioning studies involving a nutritive unconditioned stimulus. This is precisely what was found when a study investigated the relationship between anxiety and salivary conditioning (Bindra, Paterson, & Strzelecki,1955). Anxiety was unrelated to rate of conditioning.

According to Hull-Spence theory, electric shock activates the anxiety state in high anxious subjects. Therefore, shock during the learning of material involving massive interference should produce disruption for high anxious subjects as compared to their low anxious counterparts; on the other hand, shock during the learning of material in which the correct response is dominant should lead to superior learning for high anxious subjects compared to low anxious subjects. Contrary to this expectation, several studies (Besch, 1959; Chiles, 1958; Deese, Lazarus, & Keenan, 1953; Lee, 1961; Lazarus, Deese, and Hamilton, 1954) are consistent in showing that pain produces poorer learning in low anxious than in high anxious subjects, and that this is true for material involving massive interference as for material in which the correct response is dominant. The stress produced by failure studies (Lucas, 1952; Saltz & Hoehn, 1957; Sarason, 1956,1957; Taylor, 1958) leads to systematic disruption in the performance of high anxious subjects while low anxious subjects are less affected.

In the light of the above, let us look at the major hypotheses of the present study. Based upon the rationale that (1) score differences on the MAS reflect differences in drive level and (2) nonsense syllables should provoke less interference with the color-naming response than words that are themselves the names of the printed color names,

Hypothesis 1 predicted that highly anxious subjects, whereas in a complex task, with the dominant response incorrect, highly anxious subects should perform poorer than their low anxious counterparts. This hypothesis received no support at all. In the no-feedback condition, there was no significant differences between the performance of the high anxious as compared to the low anxious subjects on Cards A, B, or C for all dependent measures. However, with time as the dependent measure, significant differences appeared for cards for the high anxious as well as for the low anxious groups - strongly supporting the second hypothesis.

The rationale that (1) an increase in drive or (2) stress must be introduced into the situation to differentially effect the performance on simple versus complex tasks for the high and low anxious subjects led to Hypothesis 2 - namely, that feedback, positive or negative, is conceived as an external, stressful aspect of the experimental situation, and (a) is expected to elicit emotionality, and (b) assuming emotionality to be motivational in nature, where the stimulus situation gives rise to more than one response, the effects of increased drive are expected to depend on the strength of the correct response relative to other competing incorrect responses. This hypothesis received only partial support

from the data. With time and interference scores as the dependent measures, the significant differences that appear for feedback and for the interactions of anxiety x feedback seem to indicate that negative feedback is quite different a stressor than is the no-feedback and positive feedback conditions. While the no-feedback, positive feedback, and negative feedback conditions appear to have no differential effect on the performance of the low anxiety groups, the various feedback conditions effect the high anxiety groups quite differently. The low anxiety subjects respond to the no-feedback, positive feedback, and negative feedback conditions with increased effort, which, in turn, permits efficient functioning in the simple and complex situations. However, for the highly anxious subjects, positive feedback seems to produce a modulated increase in drive that permits efficient functioning both in the simple and complex situations, while negative feedback produces an increase in effort which causes a deterioration in performance only on the complex task.

The assumptions concerning (1) Cards A, B, and C reflecting differential task complexities; (2) anxiety being a predisposition toward increased drive and stress introduction necessary for the induction of drive; and (3) the effects of increased drive depending upon the strength of

the correct response relative to other competing responses seem to be generally supported by the data. However, serious questions arise concerning (1) the conception of positive feedback as a source of stress and (2) the MAS as a measure of difference in drive level.

Positive feedback seems to produce a feeling of well being which leads to increased effort and efficient performance on the part of all subjects. Regardless of the anxiety level of the subjects, positive feedback does not impair performance.

Regarding the MAS, there were several reasons which prompted its use. As Spielberger (1966) points out, the content validity, the concurrent validity, and the construct validity have been empirically demonstrated. Besides being used in more studies than any other anxiety measure, the MAS fit into the theoretical framework of the present experiment quite well. However, in observing and questioning the subjects, during and after the experiment, in many cases the subjects (1) were quite surprised to learn their score on the MAS - believing the opposite to be true of their "manifest" anxiety, and (2) were not so muc upset as they were amused at their difficulty in responding to Card C. This may very well suggest that the conflict produced by Card C may reflect attitudinal processes which are only minimally related to shifts in emotionality. It was only on Card C in the negative feedback

condition for the high anxiety subjects that performance was significantly impaired. This would support Morris & Liebert's (1969) proposal that in measuring "anxiety" we make a distinction between cognitive and physiological-affective anxiety components. In the former, the subject is concerned with his performance, while in the latter, concern is centered on his autonomic reactions which occur in response to the stress situation. This corresponds quite well with Eriksen & Davids' (1955) study where they note that high anxious subjects on the MAS tend to be psychasthenics on the MMPI, while low anxious subjects tend to be hysterics.

In beginning the present study, the outcome, in my mind, had been completely anticipated. However, the results of the present study, even with the addition that in some cases stress may elicit responses which interfere with performance, seem quite difficult to fit into the Hullian position that stress acts as a drive in the H x D formulation. Where a subject's performance is facilitated in situations that might otherwise produce impairment, the distinctive stimuli can always be invoked to explain the data. This is unfortunate, since one cannot predict beforehand whether competing responses will be elicited.

Saltz's conceptualization that (a) the boundary strength of the cognitive systems is the most sensitive to stress and (b) the extremes of the MAS appear to isolate people who are sensitive to different stressors, appear to explain the results of the present study quite well. The high anxiety subjects are sensitive to failure and their performance is expected to deteriorate where the boundary strength of the cognitive systems is most sensitive to stress - i.e., word-reading versus color-naming in the complex situation under the negative feedback condition.

Very much in line with this conceptualization are the results of several studies (Agnew & Agnew, 1963; Tecce & Happ, 1964) that have demonstrated high drive conditions to facilitate color-word performance. In these studies, drive level was manipulated by shock and threat of shock.

Moreover, Saltz suggests that subjects who develop strong boundaries for cognitive systems are less likely to have these systems disrupted by stress than are subjects whose boundaries are weaker. Using a field independence measure as an index of boundary strength and a group form of the Stroop color-word test as a measure of strength of cognitive systems, Hochman (1971) reported that field independent subjects are less susceptible to stimulus competition than field dependent subjects.

A related study (Breskin, Gorman, & Hochman, 1970) reported that the restriction of attention characteristic of rigid, compulsive personality styles facilitates performance on the Stroop color-word test.

The present experiment was not intended as a test of the general theory that D and H multiply. Rather, it was designed to evaluate how well the theory applies to a specific situation. One may argue that the interpretation has slipped from a Hull-Spence to a cognitive orientation. This is quite intentional. Ideas change to fit the findings. Hopefully, they will continue to do so. Saltz's theory and approach appear promising and may very well help in assessing some of the factors involved in the effects of stress on learning and performance.

While the issues are certainly far from any clear resolution, I feel it is quite appropriate to close by quoting Cohen (1967): "stress is one of those peculiar terms which is understood by everyone when used in a very general context but understood by few men when an operational definition is desired which is sufficiently specific to enable the precise testing of certain relationships".

APPENDIX A

MANIFEST ANXIETY SCALE

AND ANSWER KEY

INSTRUCTIONS:
Reach each question carefully. Answer YES if you think it is true about you. Answer NO if you do not think it is true about you.

_____ 1. I do not tire quickly.

_____ 2. I am often sick to my stomach.

_____ 3. I have very few headaches.

_____ 4. I am about as nervous as other people.

_____ 5. I work under a great deal of strain.

_____ 6. I cannot keep my mind on one thing.

_____ 7. I worry over money and business.

_____ 8. I frequently notice my hand shakes when I try to do something.

_____ 9. I blush as often as others.

_____10. I have diarrhea ("the runs") once a month or more.

_____11. I worry quite a bit over possible troubles.

_____12. I practically never blush.

_____13. I am often afraid that I am going to blush.

_____14. I have nightmares every few nights.

_____15. My hands and feet are usually warm enough.

_____16. I sweat very easily even on cool days.

_____17. When embarrassed I often break out in a sweat which is very annoying.

_____18. I do not often notice my heart pounding and I am seldom short of breath.

_____19. I feel hungry almost all the time.

_____20. Often my bowels don't move for several days at a time.

_____21. I have a great deal of stomach trouble.

_____22. At times I lose sleep over worry.

_____23. My sleep is restless and disturbed.

_____24. I often dream about things I don't like to tell

_____25. I am easily embarrassed.

_____26. My feelings are hurt easier than most people.

_____27. I often find myself worrying about something.

_____28. I wish I could be as happy as others.

_____29. I am usually calm and not easily upset.

_____30. I cry easily.

_____31. I feel anxious about something or someone almost all of the time.

_____32. I am happy most of the time.

_____33. It makes me nervous to have to wait.

_____34. At times I am so restless that I cannot sit in a chair for very long.

_____35. Sometimes I become so excited that I find it hard to get to sleep.

_____36. I have often felt that I faced so many difficulties I could not overcome them.

_____37. At times I have been worried beyond reason about something that really did not matter.

_____38. I do not have as many fears as my friends.

_____39. I have been afraid of things or people that I know could not hurt me.

_____40. I certainly feel useless at times.

_____41. I find it hard to keep my mind on a task or job.

_____42. I am more self-conscious than most people.

_____43. I am the kind of person who takes things hard.

_____44. I am a very nervous person.

_____45. Life is often a strain for me.

_____46. At times I think I am no good at all.

_____47. I am not at all confident of myself.

_____48. At times I feel that I am going to crack up.

_____49. I don't like to face a difficulty or make an important decision.

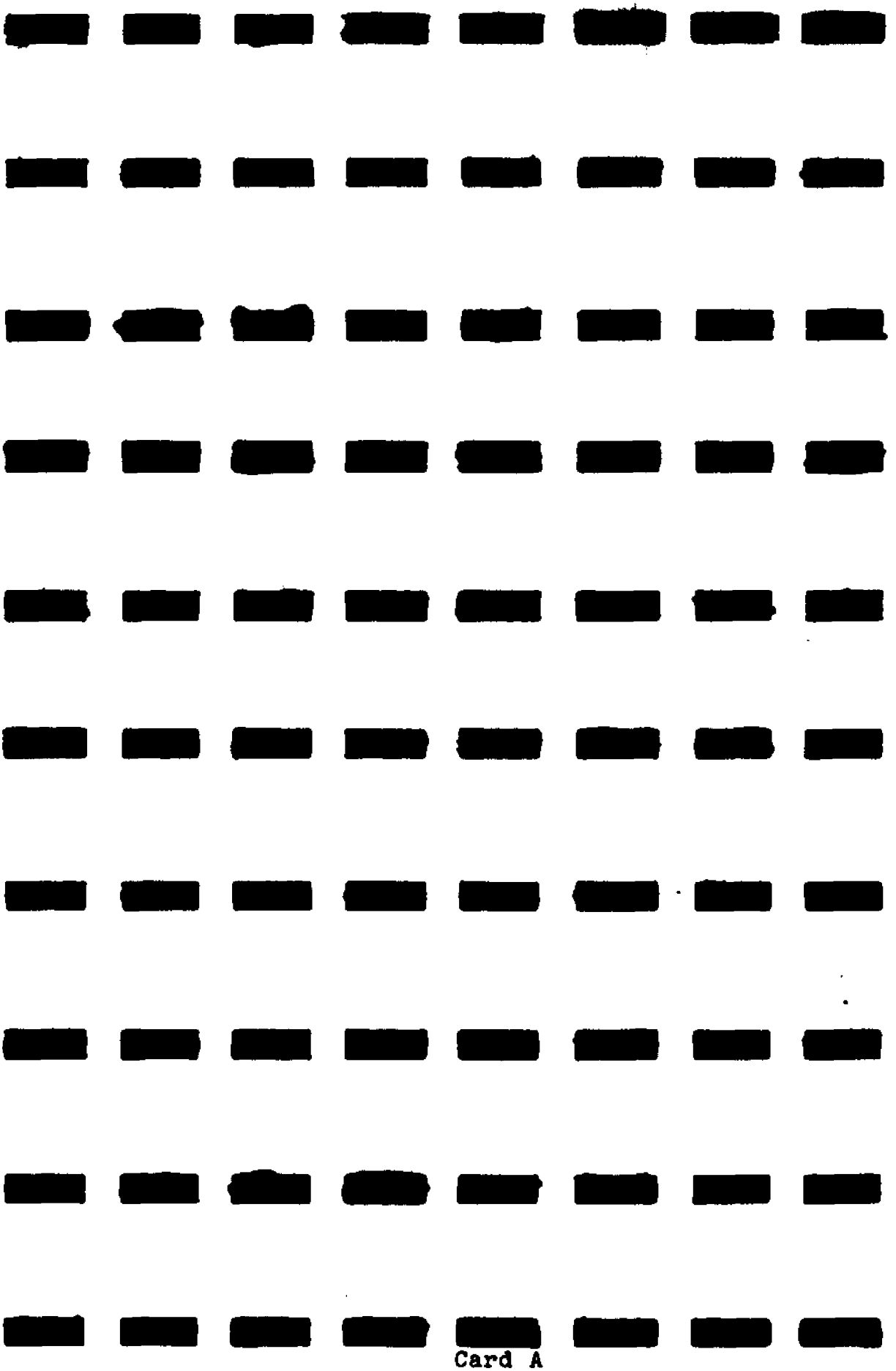
_____50. I am very confident of myself.

MAS ANSWER KEY

ITEM	KEY	ITEM	KEY
1	No	26	Yes
2	Yes	27	Yes
3	No	28	Yes
4	NO	29	No
5	Yes	30	Yes
6	Yes	31	Yes
7	Yes	32	No
8	Yes	33	Yes
9	No	34	Yes
10	Yes	35	Yes
11	Yes	36	Yes
12	No	37	Yes
13	Yes	38	No
14	Yes	39	Yes
15	No	40	Yes
16	Yes	41	Yes
17	Yes	42	Yes
18	NO	43	Yes
19	Yes	44	Yes
20	Yes	45	Yes
21	Yes	46	Yes
22	Yes	47	Yes
23	Yes	48	Yes
24	Yes	49	Yes
25	Yes	50	No

APPENDIX B

PERFORMANCE MATERIALS - CARDS A, B, C



Card A

DAP LAR FON LAR DAP LAR DAP FON

DAP LAR FON DAP FON LAR FON DAP

LAR DAP FON DAP FON LAR DAP LAR

DAP FON LAR FON LAR FON LAR FON

LAR DAP LAR DAP FON DAP LAR DAP

FON DAP LAR DAP FON DAP FON LAR

FON LAR DAP LAR FON DAP FON LAR

FON DAP FON DAP LAR DAP LAR FON

DAP LAR DAP LAR FON DAP FON LAR

DAP FON LAR DAP FON LAR FON LAR

Card B

RED BLUE GREEN BLUE RED BLUE RED GREEN

RED BLUE GREEN RED GREEN BLUE GREEN RED

BLUE RED GREEN RED GREEN BLUE RED BLUE

RED GREEN BLUE GREEN BLUE GREEN BLUE GREEN

BLUE RED BLUE RED GREEN RED BLUE RED

GREEN RED BLUE RED GREEN RED GREEN BLUE

GREEN BLUE RED BLUE GREEN RED GREEN BLUE

GREEN RED GREEN RED BLUE RED BLUE GREEN

RED BLUE. RED BLUE GREEN RED GREEN BLUE

RED GREEN BLUE RED GREEN BLUE GREEN BLUE

APPENDIX C

STATISTICAL TESTS

TABLE 1. -- Analysis of variance of Anxiety x Cards - No-feedback

Source	SS	df	MS	F
Total	28406.59	89		
SS between	3821.87	29		
Anxiety (A)	114.92	1	114.92	.86
SS error bet.	3706.95	28	132.39	
SS within	24584.72	60		
Cards (B)	23645.58	2	11822.79	958.21 *
A x B	248.20	2	124.10	10.05 *
SS error within	690.95	56	12.33	

* $p < .01$

TABLE 2. -- Analysis of variance of Anxiety x Cards - Positive Feedback

Source	SS	df	MS	F
Total	27455.21	89		
SS between	3535.38	29		
Anxiety (A)	69.16	1	69.16	.55
SS error between	3466.20	28	123.79	
SS within	23919.82	60		
Cards (B)	22628.59	2	11314.29	508.07 *
A x B	44.16	2	22.08	.99
SS error within	1247.06	56	22.26	

* $p < .01$

TABLE 3. -- Analysis of variance of Anxiety x Cards - Negative Feedback

Source	SS	df	MS	F
Total	32428.87	89		
SS between	3872.19	29		
Anxiety (A)	708.96	1	708.96	6.27
SS error between	3163.22	28	112.97	
SS within	28556.68	60		
Cards (B)	27252.50	2	13626.25	774.46 *
A x B	318.88	2	159.44	9.06 *
SS error within	985.29	56	17.59	

* $p < .01$

TABLE 4. -- Analysis of variance of Anxiety x Feedback - Card A

Source	SS	df	MS	F
Total	3157.13	89		
Anxiety (A)	8.52	1	8.52	.23
Feedback (B)	35.16	2	17.58	.48
A x B	55.50	2	27.75	.76
Error	3057.93	84	36.40	

TABLE 5. -- Analysis of variance of Anxiety x Feedback - Card B

Source	SS	df	MS	F
Total	4168.29	89		
Anxiety (A)	4.80	1	4.80	.11
Feedback (B)	565.60	2	282.80	6.79 *
A x B	81.28	2	40.64	.97
Error	3516.60	84	41.86	

* $p < .01$

TABLE 6. -- Analysis of variance of Anxiety x Feedback - Card C

Source	SS	df	MS	F
Total	8544.80	89		
Anxiety (A)	6.10	1	6.10	.07
Feedback (B)	504.88	2	252.44	3.11
A x B	1233.15	2	616.57	7.61 *
Error	6800.65	84	80.46	

* $p < .01$

TABLE 7. -- Analysis of variance of Feedback x Cards - Low Anxiety

Source	SS	df	MS	F
Total	43805.74	134		
SS between	5422.52	44		
Feedback (A)	3.97	2	1.98	.01
SS error between	5426.50	42	129.20	
SS within	38383.22	92		
Cards (B)	36618.71	2	18309.35	1028.55 *
A x B	233.60	4	58.40	3.27
SS error within	1530.89	86	17.80	

* $p < .01$

TABLE 8. -- Analysis of variance of Feedback x Cards - High Anxiety

Source	SS	df	MS	F
Total	45200.62	134		
SS between	6513.02	44		
Feedback (A)	1595.17	2	797.58	6.81 *
SS error between	4917.84	42	117.09	
SS within	38687.31	92		
Cards (B)	36527.87	2	18263.93	2443.46 *
A x B	2237.98	4	559.49	74.85 *
SS error within	642.81	86	7.47	

* $p < .01$

TABLE 9. -- Analysis of variance of Interference scores - (Card B - Card A)

Source	SS	df	MS	F
Total	1720.06	89		
Anxiety (A)	.49	1	.49	.03
Feedback (B)	587.43	2	293.71	22.00 *
A x B	10.92	2	5.46	.40
Error	1121.20	84	13.34	

* $p < .01$

TABLE 10. -- Analysis of variance of Interference scores - (Card C - Card A)

Source	SS	df	MS	F
Total	5855.66	89		
Anxiety (A)	.18	1	.18	.003
Feedback (B)	393.30	2	196.65	3.54
A x B	799.87	2	399.93	7.20 *
Error	4662.29	84	55.50	

* $p < .01$

REFERENCES

REFERENCES

Agnew, N. and Agnew, M. Drive level effects on tasks of narrow and broad attention. Quarterly Journal of Experimental Psychology, 1963, 15, 58-62.

Bakan, P. and Alperson, B. Pronounceability, attensity, and interference in the color-word test. American Journal of Psychology, 1967, 80, 416-420.

Besch, N.F. Paired-associate learning as a function of anxiety level and shock. Journal of Personality, 1959, 27, 115-123.

Bindra, D., Paterson, A.L., and Strzelecki, J. On the relation between anxiety and conditioning. Canadian Journal of Psychology, 1955, 9, 1-6.

Breskin, S., Gorman, B.S., and Hochman, S.H. Nonverbal rigidity and perseveration. Journal of Psychology, 1970, 75, 239-242.

Broverman, D.M. Dimensions of cognitive style. Journal of Personality, 1960, 28, 168-185.

Broverman, D.M. and Lazarus, R.S. Individual differences in task performance under conditions of cognitive interference. Journal of Personality, 1958, 26,94-105.

Castaneda, A., Palermo, D.S. and McCandless, B.R. Complex learning and performance as a function of anxiety in children and task difficulty. Child Development, 1956, 27, 327-332.

Chiles, W.D. Effects of shock-induced stress on verbal performance. Journal of Experimental Psychology, 1958, 56, 159-166.

Cohen, S.I. Central nervous system functioning in altered sensory environments. In M.H. Appley and R. Trumbell (Eds.), Psychological Stress. New York: Appleton-Century-Crofts, 1967.

Comalli, P.E. Jr., Wapner, S., and Werner, H. Interference effects of Stroop color-word test in childhood, adulthood, and aging. Journal of Genetic Psychology, 1962, 100, 47-53.

Dalrymple-Alford, E.C. and Budayr, B. Examination of some aspects of the Stroop color-word test. Perceptual and Motor Skills, 1966, 23, 1211-1214.

Deese, J., Lazarus, R.S., and Keenan, J. Anxiety, anxiety reduction, and stress in learning, Journal of Experimental Psychology, 1953, 46, 55-60.

Eriksen, C.W. and Davids, A. The meaning and clinical validity of the Taylor anxiety scale and the hysteria-psychasthenia scales from the MMPI. Journal of Abnormal and Social Psychology, 1955, 50, 135-137.

Gordon, W.M. and Berlyne, D.E. Drive-level and flexibility in paired associate nonsense-syllable learning. Quarterly Journal of Experimental Psychology, 1954, 6, 181-185.

Hochman, S.H. The effects of stress on Stroop color-word performance. Psychonomic Science, 1967, 9, 475-476.

Hochman, S.H. Stress and response competition in children's color-word performance. Perceptual and Motor Skills, 1969, 28, 115-118.

Hochman, S.H. Field independence and Stroop color-word performance. Perceptual and Motor Skills, 1971, 33, (3),(in press).

Hull, C.L. Principles of behavior. New York: Appleton-Century-Crofts, 1943.

Jensen, A.R. Scoring the Stroop test. Acta Psychologica, 1965, 24, 398-408.

Jensen, A.R. and Rohwer, W.D., Jr. The Stroop color-word test: a review. Acta Psychologica, 1966, 25, 36-93.

Katchmar, L.T., Rose, S., and Andrews, T.G. Effects of stress and anxiety on performance of a complex verbal-coding task. Journal of Experimental Psychology, 1958, 55, 559-564.

Klein, G.S. Semantic power measured through the interference of words with color-naming. American Journal of Psychology, 1964, 77, 576-588.

Lazarus, R.S., Deese, J., and Hamilton, R. Anxiety and stress in learning: the role of intraserial duplication. Journal of Experimental Psychology, 1954, 47, 111-114.

Lee, L.C. The effects of anxiety level and shock on a paired-associate verbal task. Journal of Experimental Psychology, 1961, 61, 213-217.

Lucas, J.D. The interactive effects of anxiety, failure, and interserial duplication. American Journal of Psychology, 1952, 65, 59-66.

Matarazzo, J.D. Ulett, G.A., and Saslow, G. Human maze performance as a function of increasing levels of anxiety. Journal of Genetic Psychology, 1955, 53, 79-96.

Montague, E.K. The role of anxiety in serial rote learning. Journal of Experimental Psychology, 1953, 45, 91-96.

Morris, L.W. and Liebert, R.M. Effects of anxiety on timed and untimed intelligence tests: another look. Journal of Consulting and Clinical Psychology, 1969, 33, 240-244.

Palermo, D.S., Castaneda, A., and McCandless, B.R. The relationship of anxiety in children to performance in a complex learning task. Child Development, 1956, 27, 333-337.

Penney, R.K. and Croskery, J. Instrumental avoidance conditioning of anxious and nonanxious children. Journal of Comparative and Physiological Psychology, 1962, 55, 847-849.

Penney, R.K. and McCann, B. The instrumental escape conditioning of anxious and nonanxious children. Journal of Abnormal and Social Psychology, 1962, 65, 351-354.

Rand, G., Wapner, S., Werner, H., and McFarland, J.H. Age differences in performance on the Stroop color-word test. Journal of Personality, 1963, 31, 534-558.

Saltz, E. Manifest anxiety: have we misread the data? Psychological Review, 1970, 77, 568-573.

Saltz, E. The cognitive bases of human learning. Homewood, Ill.: Dorsey Press, 1971.

Sarason, I.G. Effect of anxiety, motivational instructions, and failure on serial learning. Journal of Experimental Psychology, 1956, 51, 253-260.

Sarason, I.G. The effects of anxiety and two kinds of failure on serial learning. Journal of Personality, 1957, 25, 383-392.

Schiller, P.H. Developmental study of color-word interference. Journal of Experimental Psychology, 1966, 72, 105-108.

Spence, K.W. Behavior theory and conditioning. New Haven: Yale University Press, 1956.

Spence, K.W. A theory of emotionally based drive (D) and its relation to performance in simple learning situations. American Psychologist, 1958, 13, 131-141.

Spence, K.W., Farber, I.E., and McFann, H.H. The relation of anxiety (drive) level to performance in competitional and noncompetitional paired-associates learning. Journal of Experimental Psychology, 1956, 52, 296-305.

Spence, J.T. and Spence, K.W. The motivational components of manifest anxiety: drive and drive stimuli. In C.D. Spielberger (Ed.), Anxiety and behavior, New York: Academic Press, 1966.

Spielberger, C.D. The effects of anxiety on complex learning and academic achievement. In C.D. Spielberger (Ed.), Anxiety and behavior. New York: Academic Press, 1966.

Stevenson, H.W. and Iscoe, I. Anxiety and discriminative learning. American Journal of Psychology, 1956, 69, 113-114.

Stroop, J.R. Studies of interference in serial verbal reactions. Journal of Experimental Psychology, 1935, 18, 643-662.

Taylor, J.A. The relationship of anxiety to the conditioned eyelid response. Journal of Experimental Psychology. 1951, 41, 81-92.

Taylor, J.A. Drive theory and manifest anxiety. Psychological Bulletin, 1956, 53, 303-320.

Taylor, J.A. A personality scale of manifest anxiety. Journal of Abnormal and Social Psychology, 1953, 48, 285-290.

Taylor, J.A. The effects of anxiety level and psychological stress on verbal learning. Journal of Abnormal and Social Psychology, 1958, 57, 55-60.

Taylor, J.A. and Spence, K.W. The relationship of anxiety level to performance in serial learning. Journal of Experimental Psychology, 1952, 44, 61-64.

Tecce, J.J. and Happ, S.J. Effects of shock-arousal on a card-sorting test of color-word interferences. Perceptual and Motor Skills, 1964, 19, 905-906.

Wapner, S. and Krus, D.M. Effects of lysergic acid diethylamide, and differences between normals and schizophrenics on the Stroop color-word test. Journal of Neuropsychiatry, 1960, 2, 76-81.

Winer, B.J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.