ANXIETY LEVEL AND THE EFFECT OF VERBAL REINFORCEMENT COMBINATIONS ON A VERBAL-CODING TASK¹

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The purpose of this experiment was to test whether verbal learning is a function of manifest anxiety as well as verbal reinforcement combinations. High- and low-anxious groups were each divided into 3 subgroups, depending upon whether they were given both positive ("Right") and negative ("Wrong") reinforcements (RW), or only one of the two reinforcements (NW and RN). Only the interaction between the two variables was found to be significant, indicating that RN lead to faster learning in the high-anxious Ss than RW and NM, while the trend was opposite in the low-anxious Ss. The results were interpreted in terms of an inhibitory effect of the stressful motivation of verbal punishment (W) on learning in the high-anxious Ss.

The effect of verbal reinforcement combinations has been studied with respect to stimulus generalization (Buss, et al., 1954), concept learning (Buss & Buss, 1956; Buss, et al., 1956), and learning of nonsense syllables (Buchwald, 1959a, b). In these studies, *E* presented one of the following three combinations of verbal reinforcements after each of *S*'s responses: (a) "Right" for a correct response, "Wrong" for an incorrect response (abbreviated to RW); (b) Nothing for a correct response, "Wrong" for an incorrect response (NW); and (c) "Right" for a correct response, Nothing for an incorrect response (RN). It was uniformly found that acquisition is slower or stimulus generalization is low and less steep under the RN combinations than under the NW, and RW combinations. No significant difference has been reported between the latter two.

However, Watanabe (1959) found that this superiority of RW and NW to RN is dependent upon the difficulty of the task

in concept learning, since the superiority was not observed when the task was made easier. A similar result was shown by Ishibashi and Sugimura (1960) in a verbal coding task. This fact suggested that the effect of verbal reinforcement combinations is dependent upon a number of variables.

The purpose of the present experiment was to test whether the same effect is a function of the degree of manifest anxiety. It was hypothesized that as verbal punishment in RW and NW would be more stressful for the high anxious *S* than for the low anxious *S*, RW and NW would lead to slower learning than RN for the high anxious *S* in comparison with the result for the low anxious *S*.

METHOD

Subjects.—A sample of 216 second-year students of a junior high school in Nara was given the Taken General Anxiety Test (GAT) which was developed by Suzuki, et al. (1960). Based on the score distribution, 39 Ss were selected from the highest end, and similarly 39 Ss were chosen from the lowest end of the distribution. The former group was assumed to have high manifest anxiety (abbreviated to HA), and the latter group was assumed to have low manifest anxiety (LA). The obtained test mean was

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1	けえ
	わあ

FIG. 1. A sample card.

63.3 for the HA group, and 37.9 for the LA group. As the test score has a mean of 50 and an *SD* of 10 in the standardized population, both the HA and LA groups were deviated in average more than one *SD* unit from the population mean. These two groups were further divided randomly into three subgroups each ($N = 13$) based on the three verbal reinforcement combinations. Males and females were also randomly distributed among the subgroups. Table 1 indicates the mean anxiety score for each of the six subgroups. An analysis of variance of the data yielded only a significant difference between the two main anxiety groups ($F = 563$, $df = 1 \text{ \& } 72$; $P < .001$), but any other variations were not significant (F 's of less than unity) as is suggested by Table 1. Thus the three subgroups within each of the two main anxiety groups were homogeneous with respect to anxiety level.

Learning materials.—Learning materials and procedure used were similar to those of Buchwald (1959 a, b) and especially to those of Ishibashi and Sugimura (1960). A pack of 24 15×20 cm white cards was prepared, each with a one-digit number (1 through 4) written on the left side, and a pair of two-letter nonsense syllables written one above the other on the right side as shown in Fig. 1. Each of the four digits appeared together with the to-be-associated syllable which was paired with each of the other three syllables. Each syllable appeared in the upper position on half the cards on which the pair with the same digit was written. As four different syllables were used, a total of 24 cards ($4 \times 3 \times 2 = 24$) were needed². The syllables were taken from the list of 25% non-association value syllables prepared by Umemoto, et al. (1955): けえ (ke-e), らて

(ra-te), わあ (wa-a), and やた (ya-ta).

Procedure.—Each *S* was run individually. *S* was seated across a table from *E*, and the cards were presented by *E* one at a time. When a card was presented, *S* was required to select one of the paired syllables on the card which *S* thought would be associated with the digit written on the same card and to spell out the number. The cue for this selective learning was of course the number and each of the four numbers was randomly pre-assigned to one of the four response syllables.

Prior to the experiment, *S* was shown five practice cards which were similar to the experimental cards mentioned above, but the numbers and syllables were different, and then the following instructions were given³:

"This is a coding task. You will be shown a series of cards like these (showing the practice cards), one at a time. Each card has a one-digit number and two-letter syllables on it. One of the syllables on each card goes with the number on that card. The number and the corresponding syllable were randomly paired and there is no intrinsic, nor logical relationship between the two. Thus to begin with, you may have to guess and spell out the syllable which you think goes with the number, but as we go along, it will become clear to you. This is not a very difficult task. Take it easy."

After *S* fully understood the instructions with the practice cards, the experimental 24 cards were exposed one at a time for four seconds. The order of the card presentation was pre-arranged in random, and the same pack of cards were shown in cycles if *S* did not learn within the first 24 presentations. *S* was given the coding task under one of the three different reinforcement conditions until he or she attained a learning criterion of 15 successive correct responses.

RESULTS

The mean number of responses to the learning criterion excluding the criterion trials is shown for each of the six subgroups in Table 2, and an analysis of variance was conducted based on the data. The results indicate that (a) the main effect of an-

² The authors wish to thank Mr. Takeshi Sugimura for the construction of the cards.

³ The instructions and their English wordings were borrowed from Buchwald (1959a, p. 45).

xiety level is insignificant ($F < 1$, $df = 1$ & 72), and as a matter of fact, the difference between the two anxiety groups is small (55.6 for the HA Ss, and 53.6 for the LA Ss), (b) the main effect of reinforcement combinations is also insignificant ($F < 1$, $df = 2$ & 72), and again the differences are

not large (54.4, 53.2, and 56.4 for RW, NW, and NR, respectively), but (c) the interaction between the two main variables is significant ($F = 3.17$, $df = 2$ & 72; $P < .05$). This significant interaction is based on the fact that the RN treatment most favored learning for the HA groups than

TABLE 1
Mean manifest anxiety scores based on GAT for six subgroups ($N = 13$, each)

Reinforcement combination	High anxiety		Low anxiety		mean
	mean	range	mean	range	
RW	63.4	58-73	38.3	27-42	50.8
NW	63.6	59-80	37.6	24-42	50.6
RN	62.8	58-68	37.8	26-42	50.3
mean	63.3		37.9		

TABLE 2
Number of responses to criterion for six subgroups

Reinforcement combination	High anxiety		Low anxiety		mean
	mean	SD	mean	SD	
RW	61.2	28.8	47.5	23.6	54.4
NW	60.2	23.1	46.2	30.7	53.2
RN	45.6	31.3	67.3	28.8	56.4
mean	55.6		53.6		

TABLE 3
Number of error responses to criterion for six subgroups

Reinforcement combination	High anxiety		Low anxiety		mean
	mean	SD	mean	SD	
RW	21.5	12.4	13.6	8.2	17.5
NW	18.2	11.4	15.7	10.9	17.0
RN	12.1	9.6	20.8	11.4	16.4
mean	17.3		16.7		

TABLE 4
Mean IQ values for six subgroups

Reinforcement combination	High anxiety		Low anxiety		mean
	mean	SD	mean	SD	
RW	128.6	15.2	125.2	14.1	126.9
NW	126.5	16.0	123.0	10.9	124.8
RN	129.8	16.2	121.0	14.3	125.4
mean	128.3		123.1		

the NW and RW treatments but it operated in the opposite direction for the LA groups.

A similar finding was obtained in terms of error scores as shown in Table 3. An analysis of variance based on the error data yielded mostly identical results; only the interaction variance was statistically significant ($F = 3.21$, $df = 2$ & 72 ; $P < .05$).

In order to check if the obtained results could be ascribed to the possible differences in intelligence rather than in anxiety level, the mean IQ (as measured by the Tanaka B-type Intelligence Test) was computed for each of the six subgroups and the result is summarized in Table 4. Contrary to some previous studies (Matarazzo, et al., 1954; McCandless, et al., 1956), a slightly positive correlation is suggested between anxiety level and intelligence, but an analysis of variance based on the IQ scores yielded an insignificant F of 2.27 ($df = 1$ & 72 ; $P > .10$) for the main effect of anxiety level, and two other F s associated with reinforcement combinations and the interaction were less than unity. This would rule out the possibility that the present findings of the significant interaction in learning between anxiety level and reinforcement combinations could be attributed to differences in intelligence rather than in manifest anxiety.

DISCUSSION

Although the effect of verbal reinforcement combinations on learning shown by the means based on the pooled data of the two anxiety groups, was in accordance with the previous studies by Buss, Buchwald, and others in that the RW, and NW treatments lead to faster learning than the RN treatment, the differences among the three means were small and insignificant. A significant result would be obtained if the medium-anxious Ss were not excluded in the present study.

The main findings of this experiment agreed with our expectation in that RW and NW resulted in slower learning than

RN for the HA groups while the opposite result was found for the LA groups, and this was predicted since verbal punishment would be more stressful and would retard learning in the HA groups. It was already reported that stressful situations yield more inhibitory effects on performance in the HA group than in the LA group (Nishizawa, 1957; Nicholson, 1958; Katchmar, et al., 1958). Of course, the same verbal punishment would also increase the level of motivation for the LA Ss, but it would not be strong enough to have a disturbing effect on learning since their own anxiety level is low. On the other hand, this increased motivation or arousal level would facilitate discrimination learning because learning may be assumed to be an increasing function of drive level up to an optimum point (Bindra, 1959). The fact that RW most favored learning in the LA groups (at least in terms of sample means) may be due to the additional informational feedback ("Right" and "Wrong") as well as the increased level of motivation.

After the present experiment was completed, two studies were noticed which were more or less related to the present study. One of the studies reported by Brackbill and O'Hara (1958) indicated that discrimination learning was faster for the kindergarten Ss when they were rewarded with candy for correct responses, and punished with the forfeiture of candy for incorrect responses than when they were rewarded but not punished. So far, their results were in accordance with the Buss-Buchwald studies. However, considerable individual differences were found among the former group (i.e., under the RW treatment in our terminology). Five out of 22 Ss of this group were markedly slow in learning even in comparison with the latter group (i.e., under the RN treatment). A supplementary study showed high GSR reactivity for these slow learners but GSR remained relatively stable for three fast learners of the same group. The

mean IQ as measured by WISC was not significantly different between the fast and slow learners. The results were interpreted in terms of the drive theory of anxiety (Spence, 1956), which is essentially identical to our interpretation of the present data.

The second and less related study was reported by Jones (1960) who used psychiatric patients and college students as Ss. These Ss were required to associate a nonsense syllable with a number concept "four". After a single training trial, in which S's response was followed by E's saying either "Right" or "Wrong", S was tested with respect to generalization gradients without further communication between S and E. It was found that "Wrong" was significantly more often associated with the positive gradients indicative of learning of the correct responses than "Right" in the college group, but the trend was in the opposite direction in the psychiatric group. The college data evidently supported the previous findings that "Right" is a weaker reinforcer than "Wrong" (Buss & Buss, 1956; Buss, et al., 1954, 1956), but the result based on the psychiatric patients was contrary to the Buss studies since Buss and his coworkers used psychiatric patients as Ss and a later study showed a similar result with college students (Ferguson & Buss, 1959). Jones did not attempt any interpretation of his negative findings.

Of course, it is dangerous to give any definite comments on the discrepancies between Jones' study and the studies by Buss and his coworkers before examining diagnostic and other related details of the psychiatric Ss used by these investigators. However, Jones' finding seems to be in accordance with the present results if this patients were assumed to have high anxiety. Matsunaga (1957) reported that neurotic patients scored high on the Taylor Anxiety Scale in comparison with college students but schizophrenic patients were only slightly different from the latter.

A similar result was obtained by Tsushima, et al. (1960) using the Japanese adaptation of the Cattell Anxiety Test. If manifest anxiety is an effective factor in determining the relative effectiveness of reinforcement combinations as shown by the present experiment, then the discrepancies between Jones' and Buss and his coworkers' studies may be ascribed to the differences in the degree of manifest anxiety of the patients they used.

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