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EXPERIMENTALLY INDUCED DRIVE AND DIFFICULTY LEVEL IN SERIAL ROTE LEARNING

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The interaction of experimentally induced drive with task difficulty was investigated in a group of candidates for selection to an industrial training school. The performance of the experimental group and a control group, on two nonsense syllable lists of different difficulty levels, showed no evidence of interaction but a simple facilitative effect of drive on level of performance.

The separate and combined influence of drive level and difficulty level upon both serial verbal learning and paired associate learning has received considerable attention in the recent literature. Most of this work has followed that of Spence and his collaborators (see review by Jones, 1960) in selecting as the drive condition under investigation the complex of secondary drives characterized as Manifest Anxiety and measured by the Manifest Anxiety Scale. There are certain objections to the measurement of the drive component by means of questionnaires, however, and a number of studies have attempted to avoid these by selecting or contriving their experimental situations to induce different drive levels (e.g. Beam, 1955; Sarason, 1956, 1957*a*, *b*). The interaction of these experimentally induced drives with such factors as difficulty level has then been examined. The present study is a contribution to this work and is part of a series of investigations into the role of drive in performance (Eysenck & Holland, 1960; Eysenck & Maxwell, 1961; Eysenck & Willett, 1961; Eysenck, Willett & Slater, 1962).

It should be noted that the emphasis upon the interaction of the drive component, with other variables like stress and difficulty level, in such studies as these, constitutes a departure from the Hullian position upon which they are based. It was hoped that the investigation being reported would throw some light on the relative merits of the interaction-type hypothesis and the basic Hullian concepts.

SUBJECTS

A total of seventy-six young men were obtained through the apprentice training school of a large automobile manufacturing company. Seven records had to be rejected through subjects failing to complete the learning task in the time made available at the school. This point was reached after sixty trials had been completed.

APPARATUS AND PROCEDURE

Each subject was required to learn a list of nine nonsense syllables to a criterion of two successive perfect repetitions. The procedure of serial anticipation was adopted and the method of presentation was by means of an electrically driven drum

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of the type employed by Hull (1940). Each syllable was presented for 2 sec., there being 4 sec. between the removal of the last syllable and the appearance of a cue to respond with the first syllable. The subject was given instruction in the method and required to learn a practice list of nine syllables to a criterion of two correct syllable anticipations. He was told to obtain the maximum score on each trial and to reach the criterion—two successive perfect repetitions—in the minimum number of trials.

EXPERIMENTAL DESIGN

Two sets of nonsense syllables were prepared from the lists published by Glaze (1928), one (the 'difficult' list) contained no syllable whose association value was more than 7 %; the second (the 'easy' list) contained no syllable whose association value was less than 67 %. Both lists conformed to the usual rules of constructing nonsense syllable lists.

Half of the subjects (thirty-eight) were taken from the 'Short List' (about eighty, selected from 600) of candidates undergoing selection to enter the apprentice training school. The other half were taken from students already undergoing training. Instructions were identical for both groups, but the former (the 'High Drive' group) carried out the learning task under examination conditions, as one of a number of tests comprising the selection battery. There was no evidence which suggested that these subjects did not believe, as was intended, the nonsense syllable learning task to be part of this battery. The group undergoing training (the 'Low Drive' group) were familiar with the experiments and with performance tests, although none had any experience of nonsense syllable learning. They were aware that they were being used as 'guinea-pigs', and, from past experience, knew that, although they were required to follow the instructions faithfully, their performance was unconnected with any reward and unrelated to their progress in the school.

Half of each group learnt the easy list and half the difficult list. Thus, there were four subgroups: (*a*) Low Drive, Easy list—'LE'; (*b*) Low Drive, Difficult List—'LD'; (*c*) High Drive, Easy List—'HE'; (*d*) High Drive, Difficult List—'HD'. After the rejection of subjects who were unable to complete the task the number of LE was 19, that of LD was 17, that of HE 18, and that of HD was 15.

Concerning the interaction between drive level and difficulty level two main predictions are possible. The prediction from classical Hullian theory would be simply that the high drive groups would learn more efficiently, no interaction being observed (and of course that the 'difficult' list would require more trials to the criterion). The prediction from hypotheses like Spence's and also from the Yerkes–Dodson Law would be that an interaction between drive level and difficulty level would be revealed, such that 'difficulty' would impair the performance of the high drive group relatively more than the performance of the low drive group.

RESULTS

Table 1 shows the standard deviations and mean number of trials taken by each subgroup to reach the criterion.

The subgroup arrays were subjected to an analysis of variance which involved the correction for disproportionality and unequal subclasses given by Snedecor (1956). The table of corrected sums of squares is given in Table 2.

Table 1. *Mean number of trials required to reach the criterion*

LE			LD			HE			HD		
No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
19	28·84	11·69	17	40·71	9·54	18	25·22	10·23	15	33·07	10·79

Table 2. *Analysis of variance table. Number of trials required*

Source	D.F.	Sum of squares	Mean square	*F*	*P*
Between drive levels	1	515·06	515·06	4·33	< 0·05
Between difficulty levels	1	1694·83	1694·83	14·17	< 0·01
Interaction (drive × level)	1	69·90	69·90	1	N.S.
Error	65	7774·10	119·60		

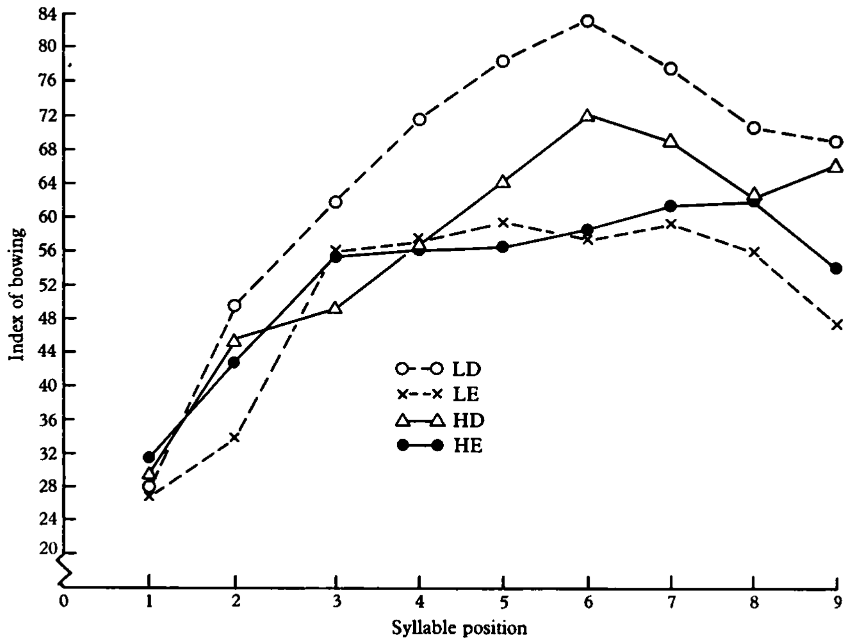

Fig. 1. Serial position effect.

It can be seen that superior performance was characteristic of the high drive group and of the 'easy' lists. No interaction between drive level and difficulty level was revealed.

Considerable speculation has centred on the distribution of errors across the item positions of rote learning tasks (the so-called 'bowed' serial position effect). However, whatever position is adopted the observation remains that the middle items of a list are relatively more difficult to learn than terminal items and we would thus expect either the greater efficiency of high drive in performance or its interaction with 'difficulty' to be particularly noticeable in the learning of these middle items relative to the terminal items.

Fig. 1. shows the distribution of errors across the items. These curves were constructed after a square root transformation had been applied to the error scores to equalize the variances of these scores across the item positions in order to obviate spurious differences in 'bowing' arising from the greater variances characteristic of the error scores of the middle items. After this transformation had been carried out, differences in 'bowing' were tested by obtaining, for each subgroup, an array of difference scores between the mean (transformed) error scores of items 1, 2, 3, 8, 9 and of items 4, 5, 6 and 7. The arrays of difference scores (multiplied by 100 to remove the decimals) so derived, constitute the indices of bowing. Table 3 shows the mean and standard deviations of these indices for the four sub-groups. All groups were reduced to fifteen to simplify computations in these calculations.

Table 3. *Indices of 'Bowing'*

LE			LD			HE			HD		
No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
15	96·47	67·33	15	145·07	45·22	15	62·80	34·61	15	99·80	42·28

These subgroup scores were also subjected to an analysis of variance, the relevant table of sums of squares being reproduced below in Table 4.

It can be seen from Table 4 that greater bowing is associated with low drive and list difficulty. There is no evidence of any interaction between these two main effects.

Table 4. *Analysis of variance table—indices of bowing*

Source	D.F.	Sum of squares	Mean square	F	P
Between drive levels	1	23,364·26	23,364·26	9·08	< 0·01
Between difficulty levels	1	27,477·22	27,477·22	10·68	< 0·01
Interaction (drive × difficulty)	1	504·48	504·48	1	N.S.
Error	56	144,021·47	2571·81		

DISCUSSION

The findings favour the classical Hullian account of the relationship between drive and performance as some simple progressive function and do not accord with those hypotheses which emphasize the interaction of drive with such variables as difficulty level. In both the case of over-all performance and of performance in the most difficult section of the task, the simpler Hullian model is adequate to account for the results without the necessity of postulating any interaction.

Quite clearly, however, these results alone cannot conclusively infirm the interaction-type hypotheses. The experimental design, here, can only arrange that different drive levels be induced in the two groups—it cannot ensure that the difference is such that an interaction with difficulty would necessarily be expected. If it were held that drive and difficulty interact at all levels, opportunity for them to do so was afforded in this investigation. If, however, it were argued that interaction occurs only within a narrow critical range of drive and difficulty values, then it is conceivable that the values obtaining in this investigation were inappropriate. To place the matter beyond doubt it would be necessary to have some independent measure of the effects of the experimental conditions (possibly a P.G.R. record), to have a wider range of drive levels and lists even more 'difficult' than the 'difficult' list employed. If, under these conditions, interaction again failed to appear, the conclusion suggested by this investigation would receive considerable support.

Summary

Two groups of subjects were formed such that the experimental situation induced a state of relatively high drive in one and of relatively low drive in the other. The 'high' drive group was selected from 'short' list candidates for entrance to the training school of a large industrial concern. The 'low' drive was selected from trainees attending the school familiar with experiments and performance tests. Half of each group was required to learn an 'easy' list and half a 'difficult' list of nonsense syllables. The interaction between drive level and difficulty level was examined and found to be negligible in both the case of performance to a criterion and over the middle items of the list. Superior performance and less marked 'bowing' of the serial position curve was associated with 'high' drive and the 'easy' list.

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