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THE EFFECT OF DRIVE ON PERFORMANCE AND REMINISCENCE IN A COMPLEX TRACING TASK

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An experiment is reported in which high-drive and low-drive groups equated for intelligence were given a complex tracing task. Under conditions of spaced practice the low-drive group performed significantly better than the high-drive group, and similar differences were observed under conditions of massed practice. A rest pause of 10 min was interpolated in the performance of the groups tested under conditions of massed practice, and reminiscence was found to be greater for the low-drive groups than for the high-drive groups. Significant post-rest decline of performance under massed conditions was observed only for the groups having long pre-rest massed practice and not for those having short pre-rest massed practice.

One of the features of reminiscence and some of the phenomena attending it is the degree of task specificity observed (Eysenck, 1965). In a series of studies (Eysenck & Maxwell, 1961; Eysenck & Willett, 1961; Willett & Eysenck, 1962; Feldman, 1964) the writer and his colleagues have tested Kimble's (1950) hypothesis derived from Hullian theory, that in pursuit rotor learning high drive would lead to *better performance* and *greater reminiscence* than low drive; the results have verified the prediction in so far as it concerns reminiscence, but have failed to support the prediction regarding differences in performance. The present investigation was undertaken in an attempt to study the effects of drive on performance and reminiscence when a complex tracing task was substituted for the pursuit rotor. The task in question was chosen because it seemed possible to make predictions regarding the effects of drive on performance on the basis of Easterbrook's (1959) restatement of the Yerkes–Dodson Law in terms of cue utilization. He has proposed that 'the number of cues utilized in any situation tends to become smaller with increase in emotion', and that, in some tasks, 'proficiency demands the use of a wide range of cues, and drive is disorganizing or emotional'. The task chosen requires such use of a wide range of cues, and the prediction would therefore be made that high drive should lead to a decline in score. A preliminary study had supported this prediction (Eysenck & Willett, 1962).

A prediction about reminiscence is much more difficult to make because of the uncertain state of theory in regard to this concept. Eysenck (1965) has argued for a three-factor theory of reminiscence according to which the difference between pre-rest and post-rest performance on a task involving learning, such as pursuit rotor tracking or complex tracing as in this case, depends primarily on consolidation and not, as Hull and Kimble have argued, on the dissipation of reactive inhibition. If we assume that the amount of consolidation that takes place is a direct function of the amount of learning that has taken place during the pre-rest period, and if we assume that learning is impaired by high drive, then it would seem to follow that reminiscence should be greater in the low-drive than in the high-drive group. The assumption that high drive impairs learning as well as performance requires experimental support, of course, and may therefore be listed as a third prediction to be tested in the experiment itself.

METHOD

Subjects

The subjects were industrial apprentices aged 16–18, all male. The low-drive group were given the test under conditions such that the results were known by them not to affect their status in the company or their employment prospects. The high-drive group were given the test in a selection situation, and in such a manner that they were convinced that the results would affect their prospects of being taken on by the company, although in actual fact this was not so. Details about this method of producing differences in drive, and evidence regarding its effectiveness have been given elsewhere (Eysenck, 1964). All candidates were given a verbal intelligence test (N.I.I.P. Group Test 33), and high- and low-drive groups were equated within narrow limits on the scores of this test, so that no significant differences were found between main groups or subgroups. Such matching was considered necessary because correlations of between 0·4 and 0·5 were found between intelligence and performance in the various groups included in the experiment.*

Test

The test used was the Ammons (1955, 1960) version of the Pathways Test. There are twenty sheets to this test, each one of them having printed on it the numbers from 1 to 30 in a random arrangement, with a number 1 in the centre of the page. The subject has to trace these with a pencil, starting from the 1, and going on to the numbers in sequentional order; the score is the highest number reached in one minute. The twenty sheets were stapled together in random order so that each subject had a different sequence of sheets randomly arranged.

Experimental design

There were three conditions: *A*, *B* and *C*. In condition *A* there were 15 min massed practice, followed by a 10 min rest pause and 5 min of massed post-rest practice. In condition *B* there were 5 min massed practice followed by a 10 min rest pause, followed by 15 min of massed post-rest practice. Condition *C* was one of spaced practice, each 1 min trial being followed by 1 min of rest (Ammons, 1960, has shown that 1 min rest pauses were not inferior to 2½ or 5 min rest pauses). During the rest periods in all conditions subjects were prevented from looking at test pages. The number of subjects in the high drive groups (*A*, *B*, *C* in order) was 71, 75 and 67; and in the low drive groups 86, 80 and 81.

RESULTS

Fig. 1 shows the results for condition *C*: the high-drive group scored well below the low-drive group at all points. There was also a greater improvement in performance for the low-drive group than for the high-drive group, suggesting that high drive on this task does interfere with learning. Analysis of variance (Table 1) confirmed the significance of the difference between drives ($P < 0{\cdot}001$); differences between trials were also significant ($P < 0{\cdot}001$), while the interaction between drives and trials is

* In previous work (e.g. Eysenck, 1964), groups were not matched for intelligence and this point has at times been criticized. There are several reasons why such a matching was not considered necessary. (1) Many of the tasks used, such as pursuit rotor learning, are not correlated with intelligence so that matching would be unnecessary. (2) For the great majority of tasks higher performance was predicted, and found, for the high-drive group; elimination of the less intelligent from this group to equate it with the low-drive group would have enhanced the predicted effect, but there seemed to be no need for this to be done as the results were already significant enough. (3) Even where prediction favours the low-drive group, and where the test in question correlates quite highly with intelligence, as in the test used in this paper, correction for intelligence makes surprisingly little difference to the outcome as will be seen by comparing the results here reported, where intelligence was controlled, with those of the Eysenck & Willett (1962) study where it was not controlled. On the whole, criticisms of the studies reported in Eysenck (1964) on the grounds that intelligence was not controlled would not seem to be well taken, with the possible exception of the experiments relating to digit span, pages 137–142.

significant ($P < 0{\cdot}05$). As trials are not independent of each other the conservative test was applied in reaching these values (Greenhouse & Geisser, 1959), and in all other analyses in this paper.

Table 1. *Analysis of variance for condition C, spaced practice*

Source	D.F.	Sum of squares	Mean squares	*F*	*P*
Between drives	1	5857·26	5857·26	54·13	< 0·001
Between trials	19	2824·75	148·67	10·83	< 0·001
Drives x trials	19	1158·15	60·95	4·44	< 0·05
Subjects within drives	145	15689·13	108·20	—	—
Residual	2755	37821·60	13·73	—	—
Total	2939	63350·89	—	—	—

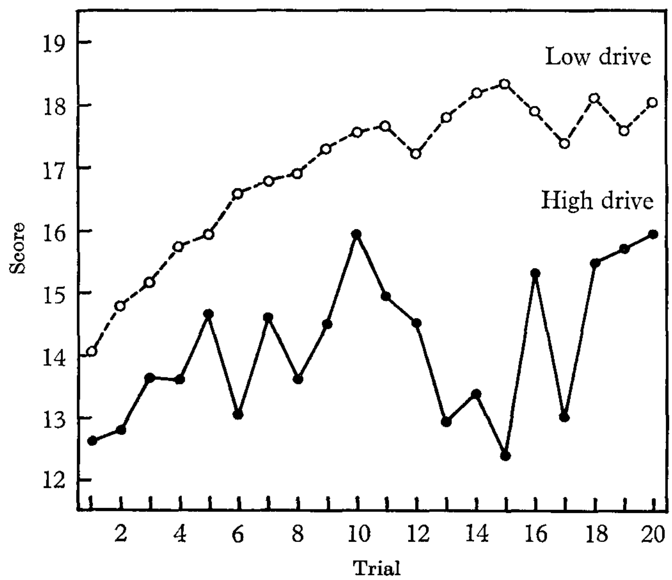

Fig. 1. Scores of high drive and low-drive groups for twenty spaced practice trials.

Fig. 2 shows the results of condition *A*: again the low-drive group was superior at all points to the high-drive group and, as predicted, it showed a greater reminiscence score. Analysis of variance of pre-rest scores showed the difference between drives to be significant ($P < 0{\cdot}01$), while no significance attached to trial differences; there was thus no evidence of learning under conditions of massed practice. During post-rest trials the difference between drives is very much more significant than before ($P < 0{\cdot}001$) and the difference between trials achieved significance ($P < 0{\cdot}05$), performance declining as is usual during post-rest practice under massed conditions.

Fig. 3 shows results for condition B: here too the low-drive group was superior at all points to the high-drive group, and reminiscence was greater for the low-drive than for the high-drive group. Analysis of variance showed level of performance during pre-rest to be significantly different ($P < 0{\cdot}05$), with no significance attaching to the trials or interaction terms; there was again no evidence of improvement under conditions of massed practice. Post-rest performance shows a difference between drives significant ($P < 0{\cdot}001$), with no significance attaching to the trials or interaction terms.

The results of analysis of variance on the four reminiscence scores are given in Table 2 (*b*); Table 2 (*a*) gives the mean reminiscence values of the four groups. Long

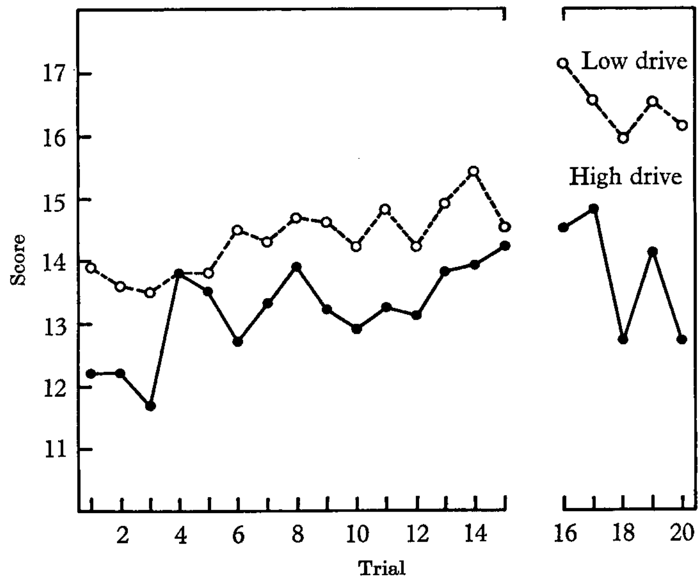

Fig. 2

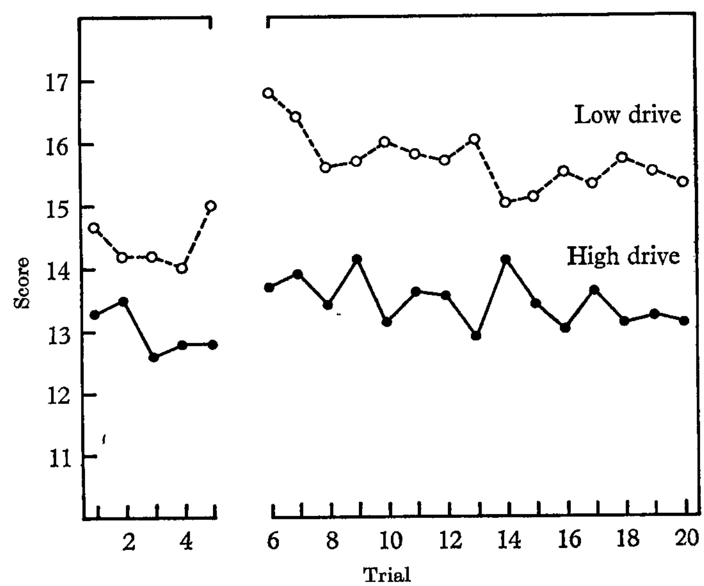

Fig. 3

Figs. 2 and 3. Scores of high- and low-drive groups during trials preceding and following a 10 min rest pause.

pre-rest resulted in slightly higher reminiscence, but this difference was non-significant. Low drive resulted in significantly greater reminiscence than high drive. The interaction was non-significant.

Table 2

(*a*) Mean reminiscence scores

	Drive		
Pre-rest	High	Low	
Long	0·282	2·570	1·535
Short	0·960	1·738	1·361
	0·630	2·169	

(*b*) Analysis of variance of reminiscence scores.

Source	D.F.	Sum of squares	Mean squares	*F*	*P*
Between drives	1	183·78	183·87	6·1516	< 0·05
Between length pre-rest	1	2·35	2·35	—	
Drives × pre-rest	1	43·14	43·14	1·4433	N.S.
Residual	308	9205·82	29·89		
Total	311	9435·18			

Discussion

The results of the experiment seem to be in good accord with prediction. High drive impairs performance under all conditions, i.e. whether spaced or massed (Eysenck & Willett, 1962); high drive impairs learning as evidenced by the spaced condition of practice; and high drive, possibly in consequence of this interference with learning, produces significantly less reminiscence. In all these features results differ from those reported on the pursuit rotor, thus demonstrating again the importance of task specificity.

One or two other features of the results may be worthy of comment. Ammons (1947) has postulated the existence of permanent work decrement as a function of length of pre-rest practice, and when we compare groups *A* and *B* on trials 16 and 6 respectively with group *C*, it will be seen that there is evidence for such a permanent decrement in group *A* but not in group *B*. This effect would be explained by Kimble (1950) and Ammons (1960) in terms of conditioned inhibition, but of course our data throw no light on the actual mechanism responsible for the effect. In any case, the decrement is not statistically significant.

The post-rest decline in performance under conditions of massed practice has been explained by Eysenck (1965) as possibly being due to the on-going and interfering effects of consolidation. If this hypothesis were true then we would expect greater interference effect in group *A* than in group *B* because group *A* had been practising for a longer time and would therefore have more material to consolidate, thus producing greater interference. As we have noted before, this difference is in fact found, decrement being significant under post-rest only for group *A* and not for group *B*.

We have argued that in terms of our theory the lower reminiscence scores for the high-drive group are the effect of less learning going on during the pre-rest massed practice period. It might be argued that what has happened is an interference with practice during this period which results in lower performance and, therefore, inevitably in less learning. Eysenck & Thompson (1966) have shown, however, that interference with practice does not necessarily produce differences in learning; in their work an interfering task produced decrement of performance on the pursuit rotor but the effects of this distracting task were completely eliminated by the rest period, so that, in fact, the groups showed no difference in learning. This suggests, even when allowance is made for the difference in task, that drive affects learning directly rather than through interference with performance.

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REFERENCES

AMMONS, C. H. (1955). Tasks for the study of perceptual learning and performance variables. *Percept. mot. Skills* **5**, 11–14.

AMMONS, C. H. (1960). Temporary and permanent inhibitory effects associated with acquisition of a simple perceptual-motor skill. *J. gen. Psychol.* **62**, 223–45.

AMMONS, R. B. (1947). Acquisition of motor skill. I. Quantitative analysis and theoretical formulation. *Psychol. Rev.* **54**, 263–81.

EASTERBROOK, J. A. (1959). The effect of emotion on cue utilisation and the organisation of behaviour. *Psychol. Rev.* **66**, 183–201.

EYSENCK, H. J. (ed.) (1964). *Experiments in Motivation.* Oxford: Pergamon.

EYSENCK, H. J. (1965). A three-factor theory of reminiscence, *Brit. J. Psychol.* **56**, 163–82.

EYSENCK, H. J. & MAXWELL, A. E. (1961). Reminiscence as a function of drive. *Brit. J. Psychol.* **52**, 43–52.

EYSENCK, H. J. & THOMPSON, W. (1966). The effects of distraction on pursuit rotor learning, performance and reminiscence. *Brit. J. Psychol.* **57**, 99–106.

EYSENCK, H. J. & WILLETT, R. A. (1961). The measurement of motivation through the use of objective indices. *J. ment. Sci.* **107**, 961–8.

EYSENCK, H. J. & WILLETT, R. A. (1962). Cue utilization as a function of drive: an experimental study. *Percept. mot. Skills,* **15**, 229–30.

FELDMAN, M. P. (1964). Pursuit rotor performance and reminiscence as a function of drive level. In *Experiments in Motivation,* ed. H. J. Eysenck. Oxford: Pergamon.

GREENHOUSE, S. W. & GEISSER, S. (1959). On method in the analysis of profile data. *Psychometrika* **24**, 95–112.

KIMBLE, G. A. (1950). Evidence for the role of motivation in determining the amount of reminiscence in pursuit rotor learning. *J. exp. Psychol.* **40**, 240–53.

WILLETT, R. A. & EYSENCK, H. J. (1962). An experimental study of human motivation. *Life Sci.* **1**, 119–27.

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