# THE RELATION OF NEUROTICISM AND EXTRAVERSION TO INTELLIGENCE AND EDUCATIONAL ATTAINMENT

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SUMMARY. Several recent investigators have reported studies of personality factors in educational attainment in terms of Eysenck's dimensional theory of personality. These findings have tended to show that attainment is associated with introversion and neuroticism. In the present paper seven predictions concerning the associations of neuroticism and introversion-extraversion with persistence, size of vocabulary and intelligence were derived from Eysenck's theory and subjected to investigation. Five of the predictions were verified at a statistically significant level, namely: (1) there was a positive correlation between introversion and persistence and (2) between neuroticism and size of vocabulary; (3) there was a curvilinear relation between neuroticism and score on Raven's matrices, subjects in the middle range of neuroticism doing best; (4) and (5) there was no significant correlation between either neuroticism or introversion and intelligence.

## I.—Introduction.

SEVERAL recent studies of the relation of personality factors to educational success and failure have reported findings interpreted in terms of the theory of personality advanced by H. J. Eysenck (e.g., 1952, 1957). Briefly, this theory in its present form posits four principal dimensions of personality, which are virtually independent of each other and are designated neuroticism, introversion-extraversion, psychoticism, and general intelligence. As far as educational success and failure are concerned, recent reports have shown that academic success, while obviously correlated highly with general intelligence, has also positive associations with introversion and neuroticism. The association between educational success and introversion is the more firmly established relationship and the evidence for it can be summarised briefly as follows:

A tendency for introverted university students to do well academically has been reported by Furneaux (1956) and Broadbent (1958) in England and by Bendig (1960) in the United States; and there is evidence that introversion favourably affects the attainment of school children in the Advanced Level examinations (Lynn, 1959). There is also indirect evidence supporting these findings, e.g., (1) delinquents have extraverted behavour patterns and tend to be educationally retarded (e.g., McCarthy, 1954). (2) Introverts tend to be leptomorphic in body build (i.e., to be thin in relation to their height) and leptomorphic children tend to be good readers (Eysenck, 1959a). (3) Women tend to be more introverted than men (Eysenck, 1959b) and girls do better than boys in England in the eleven plus examination (Yates and Pidgeon, 1957) and do better academically in the United States (Terman and Tyler, 1954). (4) Brain injured people tend to be extraverted (Eysenck, 1957) and brain injured children tend to be poor academic attainers in relation to their intelligence (Stephen, 1958).

The findings concerning neuroticism and attainment are less well establised. A positive correlation between neuroticism and attainment in university students was found by Furneaux (1956). Consistent with this is the finding that university students score more highly on tests of neuroticism than other young people (Lynn, 1959), which suggests that neuroticism is a factor in educational success.

On the other hand, Bendig (1960) found no association between neuroticism and attainment in American university students. There is a fairly considerable literature on the relation between anxiety and attainment which is of interest in this connection because anxiety and neuroticism are highly correlated, although anxiety is also associated with introversion. There is some evidence that anxious children tend to be good readers (Lynn, 1955; Biggs, 1959). But Sarnoff, *et al.* (1959) found no association between anxiety and attainment in the eleven plus examination and investigations in the United States frequently report negative correlations between anxiety and attainment (e.g., McCandless and Casteneda, 1956). The relation between neuroticism and attainment is evidently in considerable confusion. The English studies tend to suggest that the relationship is positive, and the American findings that it is negative. The present paper reports the results of an investigation designed to present further evidence on the question of the relation of introversion and neuroticism with academic success.

## II.—REVIEW OF THE LITERATURE.

There is considerable literature on personality characteristics associated with the dimensions of neuroticism and introversion-extraversion, for which the reader is referred to detailed reviews (Eysenck, 1947, 1952, 1957). What we attempt to do here is to outline those manifestations of neuroticism and introversion-extraversion that are likely to have an effect on educational attainment. In doing this it has been necessary at some points to accept Eysenck's (1957) postulates equating neuroticism with autonomic drive and introversion with a tendency to generate reactive inhibition slowly, since these assumptions do something to bridge the gap between studies of animal learning and educational psychology and generate hypotheses which may be of value in education.

*A.—Introversion-Extraversion.* There are four principal characteristics in which introverts differ from extraverts in a way which might be expected to have an effect on educational achievement, namely learning speed, the ratio of verbal to performance intelligence, work decrement and preferences for speed or accuracy.

(1) *Learning Speed.* Introverts appear to form conditioned responses more quickly than extraverts. This finding has been reported for classical conditioning by Franks (1957) using the conditioned eye blink response and by Eysenck (1959c) using a verbal conditioning technique. It is possible that this factor would result in introverts having greater vocabularies than extraverts, since learning the meaning of words appears to involve classical conditioning (expermental evidence for this view has been presented by Staats and Staats (1957). On the other hand, the introversion-extraversion factor does not seem to affect verbal serial learning in the memory drum type of experiment. Thus, Willett (1960) reported that stimulants (introverting drugs) do not improve learning on this type of task and that introverts show no superiority to extraverts. This finding supports the doubts Underwood (1957) has raised about whether reactive inhibition plays any part in tasks of this sort.

(2) *Intelligence.* There is evidence that neurotic introverts tend to be more intelligent than neurotic extraverts (e.g., Cattell, 1950; Eysenck, 1947), although the mean differences are small and the variances considerable. There is little evidence concerning how far this is true among normal subjects, although Broadbent (1958) found no correlation among students between introversion and intelligence as assessed by the AH4 test. It has also been shown that introverted neurotics tend to have good vocabularies in relation to their scores on Raven's matrices, while in extraverted neurotics the reverse is the case

(Himmelweit, 1946). It is possible that the high P : low V ratio which Wechsler (1944) regards as characteristic of psychopaths and the high V : P of neurotics reflects, at any rate to some extent, the same introvert-extravert dichotomy. It is suggested by Eysenck (1957) that vocabulary is acquired by conditioning and the high verbal ability of introverted neurotics is a result of their condition-ability accelerating the verbal skills ; on the other hand, the high V : low P ratio is often interpreted as reflecting deterioration or impairment on the performance skills. Which of these theories is correct could, of course, be determined by examining the actual attainments of introverts and extraverts on verbal and non-verbal intelligence, rather than the ratio between the scores. There appears to be no evidence on this question.

(3) *Work decrement.* A third group of findings shows that introverts are superior to extraverts in tasks requiring sustained work or attention. The typical finding here is that extraverts begin as efficiently as introverts, but that after a period of time they flag more quickly and show periods of inattention or a uniform work decrement (depending on the method of scoring efficiency on the task). Perhaps the leading studies on this aspect of introversion-extraversion are those reported by Broadbent (1958) using vigilance tasks, i.e., tasks in which the subject is required to give sustained attention to a visual display over a period of some two hours ; in tasks of this type extraverts begin by noticing signals correctly but their attention breaks down after a period of time. This finding has been confirmed for an auditory vigilance task using neurotic introverts and extraverts (Eysenck, 1959). It has also been found that during inverted alphabet printing at speed under massed conditions, a task requiring considerably sustained attention and effort, extraverted students begin as efficiently as introverted ones but show greater work decrement as the task proceeds (Lynn, 1960).

These findings suggest that extraverted students may be at a disadvantage in intellectual tasks where sustained effort is required. That this is so has been demonstrated by Furneaux in comparing the performance of introverted and extraverted students on the Nufferno intelligence tests ; from an analysis of the times taken on each item it appeared that the extraverts took proportionally longer on the later items in the test (an account of this study is given in Eysenck (1957)). Furneaux (1956) has also reported that extraverts devote less time to private study. It seems, probable, therefore, that the tendency of extraverts to show greater decrement in tasks where sustained concentration is required is likely adversely to affect their academic achievements ; this detrimental effect might appear in at least two ways, first in examinations, where extraverts would be expected to show a fall-off towards the end of the usual three-hour session, and secondly in preparation for examinations, where extraverts should be less capable of sustained work over long periods of time.

(4) *Accuracy and speed.* There is some evidence that introverts tackle tasks slowly and accurately whereas extraverts are quick and inaccurate. Himmelweit (1946) reported this difference comparing hysterics (neurotic extraverts) and dysthymics (neurotic introverts) on a manual tracking task, and Foulds (1951, 1952) has reported a similar result using speed and accuracy on the Porteus mazes. The findings have been partially replicated for normal introverts and extraverts by Drew, Colquhoun and Long (1958) in a study of performance in a simulated driving task, where extraverts made more mistakes as a result of inaccuracy. Furneaux (1956) has shown that students who do badly in examinations tend to be slow, but there does not appear to be any

evidence as to how far preferences for speed and accuracy in intellectual tasks are related to introversion–extraversion in normal subjects or how far relative preferences for speed or accuracy are related to educational attainment.

*B.—Neuroticism.*

(1) *Intelligence.* The large number of studies on the relation of intelligence to neuroticism show conflicting results, although there is very wide agreement that whatever association there may be is small and of little practical importance. Eysenck (1947) and Cattell (1950) in reviewing a number of sutdies conclude that most investigators have reported a slight tendency for neurotics to be more intelligent than the normal population. On the other hand, Vernon (1937) in a study of neurotic children, and Eysenck (1947), in an investigation of neurotic soldiers, found that neurotics were slightly below average in intelligence. Several studies of normal groups using anxiety questionnaires (which are highly correlated with neuroticism) report small negative correlations between anxiety and intelligence ; this appears to be true both of school children (Zweibelson, 1956) and university students (Taylor, 1956). In view of these findings it is unlikely that the superior academic attainment of university students scoring high on neuroticism can be attributed to superior intelligence.

(2) *Persistence.* There is evidence that persistence is related to educational success (e.g., Cushing, 1929 ; Ryans, 1938) and it is possible that neuroticism is related to academic success through its manifestation in persistence. This hypothesis is plausible in view of the drive properties of neuroticism, since there are several animal studies showing that amount of activity is a function of drive level. Investigations of human subjects, however, lend no support to the hypothesis ; neurotics are less persistent than normals on the leg persistence test, in which the subject has to hold his leg in the air over a chair (Eysenck, 1952 ; Thorpe and James, 1957). However, this test probably measures persistence against pain and since neurotics have greater reactivity to pain (e.g., Hall, 1953) it would be unwise to generalise from this finding to ideational persistence (i.e., persistence in intellectual tasks), although Ryans (1938) presents evidence that there is a general factor of persistence. There appears to be no direct evidence on the relation of persistence in intellectual tasks to neuroticism.

(3) *Learning Speed.* The relation of learning speed (or learning efficiency in a fixed time) to neuroticism is expressed in the Yerkes-Dodson law, which states that the optimum drive required for efficient learning is inversely related to the complexity of the task. While this law was first derived from experiments on animals, quite a large number of studies are now available for human subjects using anxiety questionnaires or threat situations as indices of drive and comparing low and high drive subjects on simple and complex tasks. By and large these studies show that highly anxious subjects are better at simple asks but are impaired on complex ones. The literature on this subject is considerable and too large to be reviewed here ; recent work has been discussed by Jensen (1958). Since neuroticism is highly associated with anxiety, it would be expected that neuroticism would impair learning on complex tasks but facilitate the learning of simple tasks.

## III.—THE HYPOTHESES.

In the investigation to be reported we have set up and subjected to experimental test several hypotheses to account for the association of introversion and neuroticism with academic success. These hypotheses are derived from the extensions to Hull's (1952) general theory of learning and behaviour which have

recently been made by Eysenck (1957), namely his postulates that introverted behaviour patterns result from a tendency to generate reactive inhibition slowly and dissipate it quickly, and that neuroticism can be identified with autonomic drive. This general theory suggests two types of way in which these personality differences might affect educational attainment, namely preferences for speed or accuracy on a task, and efficiency of learning. As far as speed-accuracy preferences are concerned, introverts would be expected to work longer and more persistently at academic tasks, partly because they are more socialised and partly because they generate inhibition less readily and hence should not give up so quickly. On the other hand, neuroticism should increase the speed with which intellectual tasks are completed, partly because its drive properties should have a direct effect on increasing speed, and partly because they should counteract the effects of fatigue. Consequently, we have taken Raven's Progressive Matrices as the task, and predicted that introverted subjects will take longer than extraverted, and neurotic subjects will be quicker than stable.

The effects of drive and reactive inhibition on learning efficiency are more complex. Reactive inhibition has an impairing effect on learning efficiency, especially under conditions of massed practice, because it tends to prevent the response from occurring. It has been shown by Franks (1957) that extraverts form conditioned eyeblink responses slowly, presumably because of their tendency to generate reactive inhibition quickly. This probably accounts for the fact that introverts are more socialised than extraverts, since they acquire conditioned anxiety reactions to social disapproval more readily. Our prediction concerning the relation of introversion to learning is as follows : we assume that vocabulary is acquired by conditioning, i.e., the formation of a stimulus-response connection between the stimulus word and its meaning (a detailed argument that this is a conditioning process is presented by Staats and Staats (1957) and an essentially similar model to account for the early stages of school learning by Peel (1956)). If this is true, introverts should have high vocabulary in relation to intelligence and extraverts a low vocabulary-intelligence ratio, and, as shown above, this deduction has been confirmed on neurotic subjects by Himmelweit (1946) using vocabulary and matrices tests. This scatter is sometimes regarded as a result of the disorganising effects of the anxiety of introverted neurotics on the performance tests and this theory yields the prediction that extraverts and introverts will score similarly on vocabulary but that introverts will do worse on performance tests. On the other hand, the conditioning theory outlined here enables us to predict that introverts and extraverts will score equally well on the performance tests but that the introverts will do better on tests of vocabulary.

On the basis of the Yerkes-Dodson law (i.e., high anxiety facilitates the learning of simple tasks but impairs the learning of complex ones) the following prediction can be made : learning the meaning of words appears to be a simple task and we shall, therefore, expect it to be facilitated by high drive. Assuming that Eysenck is correct in his postulate that neuroticism reflects drive, it follows that high neuroticism scores should be associated with good vocabulary.

In a recent study of the operation of the Yerkes-Dodson law in rats, Broadhurst (1957) has shown that for tasks of moderate complexity there is a curvilinear relation between anxiety drive and learning efficiency, such that both high and low anxiety are less effective than anixiety of moderate strength. It appears that Raven's Progressive Matrices may be regarded as a task of moderate complexity for university students and on the basis of Broadhurst's work, the prediction is made of a curvilinear relation between neuroticism and correct scores on the test.

## IV.—THE INVESTIGATION.

*Subjects* : The subjects comprised sixty male university students living in a university hall of residence accommodating seventy-nine students. Students were asked to volunteer for the testing and the first sixty to do so were taken as subjects. All students fell within the age range 18–23.

*Tests* : The following tests were given : (1) the Maudsley Personality Inventory as a measure of neuroticism and introversion-extraversion ; (2) Mill Hill Vocabulary test, scales A and B ; these scales were summed to give a total vocabulary score ; (3) Raven's Progressive Matrices, 1938 ; subjects were instructed to attempt odd numbers only because of the importance of making the test short (in view of the findings that extraverts fatigue more quickly on long intelligence tests) ; subjects were instructed to work primarily for accuracy but at the same time to work at speed.

*Results* : The means and standard deviations for the tests given are presented in Table 1. It is evident that these results support an earlier report (Lynn, 1959) that university students tend to score more neurotic and more introverted than the general population (means of general population : neuroticism=19·9 ;

TABLE 1

MEANS AND STANDARD DEVIATIONS OF TEST SCORES.

| Test | Neuroticism | Extraversion | Vocabulary | Time on Matrices | Matrices |
|---|---|---|---|---|---|
| Mean ..... | 25·17 | 22·67 | 62·67 | 534 secs. | 23·25 |
| S.D. ..... | 10·29 | 9·84 | 7·56 | 236 secs. | 4·16 |

TABLE 2

PRODUCT-MOMENT CORRELATIONS AND PARTIAL CORRELATIONS.

(* Significant at 0·05 level)

| Factors | Product-moment Correlation | Partial Correlation | Factor held Constant |
|---|---|---|---|
| Neuroticism × Extraversion | −0·32* | — | — |
| Neuroticism × Vocabulary | +0·36* | +0·30* | Extraversion |
| Neuroticism × Matrices (time) | −0·17 | −0·265* | Extraversion |
| Neuroticism × Matrices (score) | +0·07 | +0·08 | Extraversion |
| Extraversion × Vocabulary | −0·27* | −0·18 | Neuroticism |
| Extraversion × Matrices (time) | −0·23 | −0·30* | Neuroticism |
| Extraversion × Matrices (score) | −0·05 | −0·01 | Neuroticism |

introversion-extraversion=24·9). The data were first examined for a possible relation between neuroticism and introversion-extraversion, since although they are independent in normal groups they tend to be correlated in extreme groups (Eysenck, 1959), and, in fact, the product moment correlation in this sample was −·32 (i.e., students scoring neurotic tend to score introverted). In view of this finding, it was necessary to calculate the partial correlations of neuroticism and introversion-extraversion with the tests given. Table 2 presents the product-moment correlations and the partial correlations between neuroticism, introversion-extraversion and the intelligence tests.

The prediction of a curvilinear relation between neuroticism and matrices results was examined by calculating mean scores on the matrices for different levels of neuroticism and these results are shown in Fig. 1. The departure from rectilinearity was tested with eta, and is just significant at the ·05 level (chi squared=21·3, with 12 d.f.).

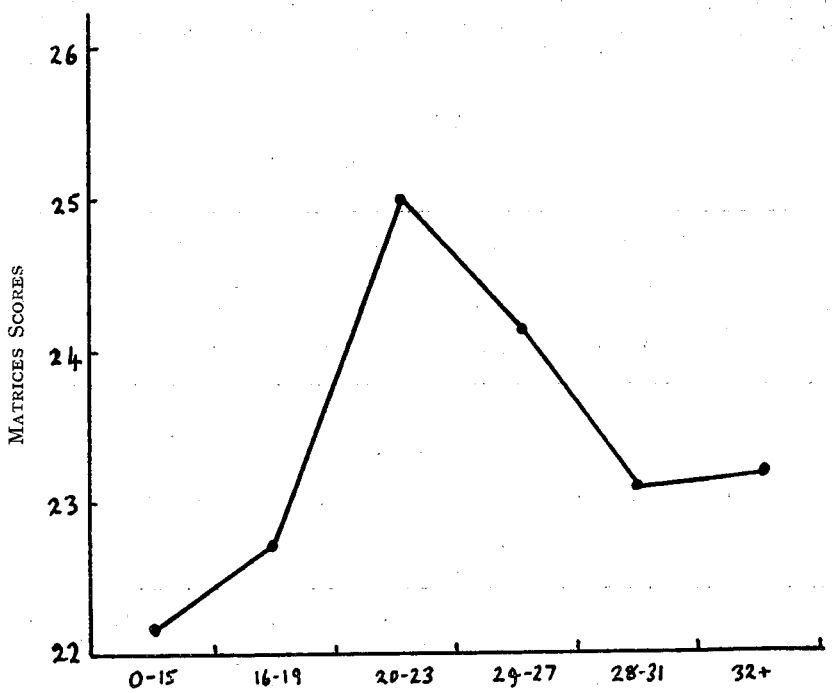


Fig. 1.—Progressive Matrices Scores at different levels of neuroticism.

## V.—Discussion of Results.

The following points of interest emerge from the results. In the first place, neither neuroticism nor extraversion has any significant correlation with intelligence as assessed by the matrices test. This finding confirms a number of previous investigations and supports the view that explanations for the associations of introversion and neuroticism with academic success must be sought elsewhere.

The prediction that introverted subjects would show more persistence in spending longer on the matrices test was confirmed at a statistically significant level. It seemed possible that introverts might simply be slower and to check this possibility the speeds of the fifteen most introverted and most extraverted subjects on the first six problems were calculated. But there was virtually no difference between the speeds of the two extreme groups at this stage of the test (mean times : extraverts=38 seconds, introverts=40 seconds). This finding supports the prediction that it is in the later stages of a task that introverts become slower than extraverts. It is not at present clear whether this is because extraverts are less socialised and anxious and hence willing to put down an answer quickly without obsessional doubts and re-checking or whether they become more fatigued and tend to give up the later problems. The fact that no association was found between introversion-extraversion and the number of problems correctly solved suggests the first interpretation of our findings. On the other hand, Eysenck (1959d) has recently published a similar study to our own but using a longer task, and reported that hysterics (extraverted neurotics) tend to give up more quickly on the last problems of the Morrisby test.

There is also a significant correlation between speed on the matrices and neuroticism, subjects scoring neurotic working faster and completing the test more quickly. This finding might be expected from the theory that neuroticism has the energizing properties of drive, although on some tasks drive has an impairing effect on performance (Taylor, 1956). In view of the many conflicting reports on the relation of drive to performance, the most important finding of the present investigation is probably that of the curvilinear relation between neuroticism and scores on the matrices. It confirms the theory that for this type of task there is a golden mean of neuroticism or anxiety, neither too little nor too much being desirable for efficient performance. It suggests that the many findings on the relationship of anxiety or neuroticism to performance, at present reported in terms of correlations, might usefully be analysed for a curvilinear relationship. Inspection of the figure suggests that for tasks like the matrices the optimum level of neuroticism is roughly about half a standard deviation above the national average. The finding that the average level of neuroticism among university students is also roughly at this point (Lynn, 1959) confirms the interpretation that this is the optimum level of neuroticism for successful academic attainment.

The partial correlations of neuroticism and extraversion with vocabulary have some bearing on the Spence-Eysenck controversy on conditioning. Spence (1956) has attributed individual differences in conditioning to differences in drive, whereas Eysenck argues that the more important variable is inhibition. There is of course no reason why both variables should not be important. The significant correlation between neuroticim and vocabulary clearly supports Spence's position, together with the assumptions that neuroticism is a measure of drive and that vocabulary is acquired through conditioning. On the other hand, extraversion is not significantly associated with vocabulary when neuroticism is partialled out and the prediction from Eysenck's theory is, therefore, not confirmed. Two comments should be made about this conclusion. In the first place, the correlation is in the direction predicted by Eysenck's theory and its failure to reach statistical significance may simply be a result of the unreliability of the measuring instruments and the small variance among the subjects in vocabulary. Secondly, Himmelweit's report of the tendency of dysthymics to have good vocabularies in relation to intelligence, while appearing to support Eysenck's theory, assumes an air of ambiguity in the light of the

present and other recent findings. It has become apparent that dysthymics score somewhat higher on neuroticism than hysterics (Eysenck, 1959b) and Himmelweit's finding that dysthymics have good vocabularies could, therefore, be due to higher neuroticism.

The present state of the evidence appears to suggest the following conclusions. The extravert is handicapped in academic work, as in other tasks requiring sustained concentration, because of his tendency to fatigue and to give up more quickly. How far differences in conditionability contribute to the association between introversion and educational success remains an open question. Neuroticism appears advantageous because of its relationship to size of vocabulary and probably to conditionability, and also because in normal groups, subjects scoring neurotic tend to be quicker. The optimum level of neuroticism for academic performance appears to be in the region of half a standard deviation above the national average.

## VI.—References.


Bendig, A. W. (1960). Extraversion, neuroticism, and student achievement in introductory psychology. *J. Educ. Res.*, 53, 263-267.

Biggs, J. B. (1959). The teaching of mathematics: II—Attitudes to arithmetic-number anxiety. *Educ. Res.*, 1, 6-21.

Broadbent, D. E. (1958). *Perception and Communication.* London: Pergamon Press.

Broadhurst, P. (1957). Emotionality and the Yerkes-Dodson Law. *J. Exp. Psychol.*, 54, 345-352.

Cattell, R. B. (1950). *Personality.* New York: McGraw-Hill.

Cushing, H. M. (1929). A perseverative tendency in pre-school children: a study of personality differences. *Arch. Psychol.*, 17, 55.

Drew, G. C., Colquhoun, W. P., and Long, H. (1958). Effect of small doses of alcohol on a skill resembling driving. *Brit. Med. J.*, ii, 993-999.

Eysenck, H. J. (1947). *Dimensions of Personality.* London: Kegan Paul.

Eysenck, H. J. (1952). *The Scientific Study of Personality.* London: Routledge and Kegan Paul.

Eysenck, H. J. (1957). *The Dynamics of Anxiety and Hysteria.* London: Routledge and Kegan Paul.

Eysenck, H. J. (1959a). The Rees-Eysenck body index and Sheldon's somatotype system. *J. Ment. Sci.*, 105, 1053-8.

Eysenck, H. J. (1959b). *Manual of the Maudsley Personality Inventory.* University of London Press.

Eysenck, H. J. (1959c). Personality and verbal conditioning. *Psychol., Reps.* 5, 570.

Eysenck, H. J. (1959d). Personality and problem solving. *Psychol. Reps.*, 5, 592.

Foulds, G. A. (1951). Temperamental differences in maze performance. *Brit. J. Psychol.*, 42, 209-17.

Foulds, G. A. (1952). Temperamental differences in maze performance. *Brit. J. Psychol.*, 43, 33-41.

Franks, C. M. (1957). Personality factors and the rate of conditioning. *Brit. J. Psychol.*, 48, 119-26.

Furneaux, W. D. (1956). *Report to Imperial College of Science and Technology.*

Hall, K. R. L. (1953). Studies of cutaneous pain: A survey of research since 1940. *Brit. J. Psychol.*, 44, 279-294.

Himmelweit, H. T. (1946). Speed and accuracy of work as related to temperament. *Brit. J. Psychol.*, 36, 132-44.

Hull, C. L. (1952). *A Behavior System.* New Haven: Yale University Press.

Jensen, A. R. (1958). Personality. *Annual Rev. Psychol.*, 9, 295-322.

Lynn, R. (1955). Personality factors in reading achievement. *Proc. Roy. Soc. Med.*, 48, 996-998.

Lynn, R. (1959). Two personalty characteristics related to academic achievement. *Brit. J. Educ. Psychol.*, 29, 213-216.

Lynn, R. (1960). Extraversion, reminiscence and satiation effects. *Brit. J. Psychol.* (to appear).

McCandless, B. R., and Cataneda, A. (1956). Anxiety in children, school achievement, and intelligence. *Child Development*, 27, 379-382.

OSGOOD, C. E. (1953). *Method and Theory in Experimental Psychology.* New York: Oxford University Press.
PEEL, E. A. (1956). *The Psychological Basis of Education.* Eeinburgh: Oliver and Boyd.
RYANS, D. G. (1938). A study of the observed relationship between persistence test results, intelligence indices, and academic success. *J. Educ. Psychol.*, 29, 573-580.
SARNOFF, I., *et al.* (1959). Test anxiety and 11+ examinations. *Brit. J. Educ. Psychol.*, 29, 9-16.
SPENCE, K. W. (1956). *Behavior Theory and Conditioning.* New Haven: Yale University Press.
STAATS, C. K., and STAATS, A. W. (1957). Meaning established by classical conditioning. *J. Exp. Psychol.*, 54, 74-80.
STEPHEN, E. (1958). Cerebral palsy and mental defect. In *Mental Deficiency*, ed. Clarke, A. M. and Clarke, A. D. B. London: Methuen.
TAYLOR, J. A. (1956). Drive theory and manifest anxiety. *Psychol. Bull.*, 53, 303-20.
TERMAN, L. M., and TYLER, L. E. (1954). Psychological sex differences. In *Manual of Child Psychology*, ed. Carmichael, L. New York: Wiley.
THORPE, J. G., and JAMES, D. P. (1957). Neuroticism in children, I—An investigation of normal and neurotic group differences. *Brit. J. Psychol.*, 48, 26-34.
TROUTON, D., and EYSENCK, H. J. (1960). The effects of drugs on behaviour. In *Handbook of Abnormal Psychology*, ed. H. J. Eysenck. Bath: Pitman Press.
UNDERWOOD, B. J. (1957). Studies of distributed practice: XVI—Some evidence on the nature of the inhibition involved in massed learning of verbal materials. *J. Exp. Psychol.*, 54, 139-143.
VERNON, P. E. (1937). A study of the norms and the validity of certain mental tests at a child guidance clinic. *Brit. J. Educ. Psychol.*, 7, 72-88.
WECHSLER, D. (1944). *The Measurement of Adult Intelligence.* Baltimore: Williams and Wilkins.
WILLETT, R. A. (1960). The effects of depressant drugs on learning and conditioning. In *Experiments in Personality*, ed. Eysenck, H. J. London: Routledge and Kegan Paul.
YATES, A., and PIDGEON, D. A. (1957). *Admission to Grammar Schools.* London: Newnes.
ZWEIBELSON, I. (1956). Test anxiety and intelligence test performance. *J. Consult. Psychol.*, 20, 479-481.

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