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The Effect of Mental State on EPI Scores

By G. N. BIANCHI and D. M. FERGUSSON

Summary. This paper develops a structural equation model to assess the effects of mental state on EPI scores. This model is applied to results obtained from a clinical population. The findings show that: (a) the E scale is not influenced by mental state as measured by the Hamilton Anxiety Scale (HAS); (b) the N scale is influenced by HAS. An attempt to revise the N scale to produce an uncontaminated score is discussed.

Introduction

The Eysenck Personality Inventory (EPI) and the earlier Maudsley Personality Inventory (MPI) have been designed to measure two personality traits: Extraversion (E) and Neuroticism (N). These traits are seen as relatively stable and enduring characteristics. However, a number of investigators have reported that EPI (and MPI) scores are markedly influenced by short-term mental state variables. Coppen and Metcalfe (1965) compared the scores of a sample of severely depressed patients before and after recovery from depression; they found a marked decrease in N scores on recovery and a smaller but statistically significant increase in E scores. Knowles and Kreitman (1965) found in patients with anxiety states that E scores did not change but that N scores changed to a small though significant degree on recovery. Kendell and DiScipio (1968) provided depressed patients with instructions to complete the EPI in terms of their usual personality; this procedure produced shifts in E and N scores which were consistent with the findings of Coppen and Metcalfe (1965). Serra and Pollitt (1975) reported significant correlations between scores on the Beck Depression Inventory and MPI scores; they interpreted this result as indicating that the Beck Inventory measures personality. This view was strongly disputed by Snaith (1976), who argued that in clinical populations personality scores are more a measure of sickness than of personality.

This paper sets out a general path model designed to assess the effects of mental state on EPI scores; applies this model to results obtained on a clinical population and looks for a revision of the EPI which is minimally influenced by mental state variables.

A Path Model

If mental state influences EPI scores, a subject's EPI score at any point in time will be (partially) a function of mental state at that time. Consider a sample of N subjects measured on an EPI scale Y at two time intervals T1, T2, and on a measure of mental state X at T1, T2. Let the measurements at these time periods be denoted Y1, Y2 and X1, X2 respectively. Given that it is assumed that each Y score is a function of the corresponding X score, the relationship between the measures over the two time periods can be summarized by the following structural equations:

$$Y_1 = p_1X_1 + p_{e1}E_1$$
$$X_2 = p_2X_1 + p_3Y_1 + p_{e2}E_2;\ (p_3 = 0)$$
$$Y_2 = p_1X_1 + p_5X_2 + p_6Y_1 + p_{e3}E_3;\ (p_4 = 0)$$

where all variables are in standard (i.e. z) form, and the terms E1, E2, E3 represent sources of disturbance not explained by the variables in the model; the coefficients p1, . . . pe3 are the weights or path coefficients attached to the standardized variables. Notice that, while the model is written in fully recursive form, in fact it contains two over-identifying restrictions:

p3 = p4 = 0. These restrictions can be tested by obtaining the ordinary least squares estimates of the path coefficients and then testing whether p3, p4 significantly deviate from zero (Duncan, 1975).

Next, consider the test/retest correlation of Y:

$$r_{y1y2} = \frac{\Sigma Y_1 Y_2}{N}$$

This correlation can be expressed in terms of the structural equations as:

$$r_{y1y2} = p_6 + p_1 p_4 + p_3 p_5 + p_1 p_2 p_5$$

This simplifies to:

$$r_{y1y2} = p_6 + p_1 p_2 p_5$$

if $p_3 = p_4 = 0$.

The last expression has a ready interpretation: the test/retest correlation is the sum of two components; a component (p6) which represents the correlation between Y1 and Y2 independently of the contaminating effect of X1 and X2 and a component (p1p2p5) which is spuriously induced by the association between X1 and X2. The model is independent of the degree of correlation between X1 and X2 and in general, the observed test/retest correlation will be inflated if X1, X2 are positively correlated, it will be depressed if X1, X2 are negatively correlated and unbiased if X1, X2 are uncorrelated (providing the coefficients p2, p5 are positive). The above method of decomposition thus permits estimation of the true test/retest correlation independent of the contaminating effects of mental state. This true test/retest correlation can be taken as an estimate of the true variance of the test (Guildford and Fruchter, 1973).

In addition to providing a method of assessing the impact of mental state on EPI scores the model has one further feature: it indicates the conditions which must be satisfied if Y is to be uncontaminated by mental state. These conditions are that p1 and p5 be near zero and p6 be large (ideally unity). If these conditions can be fulfilled then the test Y not only is independent of mental state but also has good stability.

Methods and Results

The findings reported here are based on the results of a double-blind, between-patients trial designed to assess the effects of diazepam and doxepin on anxiety/depressive neurosis (Bianchi and Phillips, 1972). In this trial 50 patients diagnosed as suffering from anxiety/depressive neurosis were measured on the EPI and mental state variables at two points in time 21 days apart. The present report is confined to analysis of the effects of anxiety, as measured by an anxiety scale (Hamilton, 1969), on EPI scores.

Table I shows the matrix of correlations of the Hamilton Anxiety Scale (HAS) scores and the EPI scores at the two time intervals. Fig 1 shows the solved path models for both the E and N scales and Table II gives the decompositions of the test/retest correlations of E and N.

TABLE I

Correlation of Hamilton Anxiety Scale (HAS), extraversion (E) and neuroticism (N) scores at two time periods

		Time 1			Time 2		
		HAS	E	N	HAS	E	N
Time 1	HAS	1	−·14	·32	·48	−·12	·46
	E		1	−·16	−·14	·72	·02
	N			1	·24	−·04	·66
Time 2	HAS				1	−·13	·60
	E					1	−·06
	N						1

TABLE II

Decomposition of test/retest correlations for extraversion and neuroticism

	Direct	Spurious	Total
E	·720	·004	·724
N	·534	·129	·663

These results lead to the following conclusions:

1. The E scale of the EPI appears to be uncontaminated by the effects of HAS score. This can be seen from the path coefficients linking the HAS scores and the E scores in Fig 1 and from the decomposition of the

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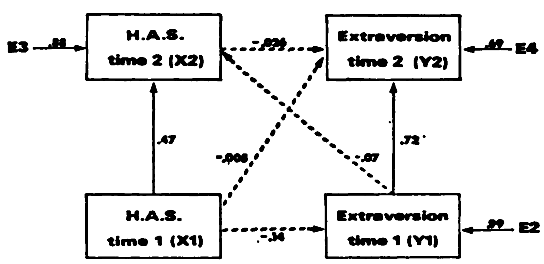
test/retest correlation in Table II. The path coefficients between HAS scores and E scores are in all cases not significantly different from zero, indicating that HAS scores have virtually no effect on E scores. The test/retest correlation of the E score when measured independently of HAS is also good (r = ·72) and differs barely at all from the overall test/retest correlation. The E scale thus satisfies the conditions discussed previously: negligible influence from mental state variables and good test/retest correlation.

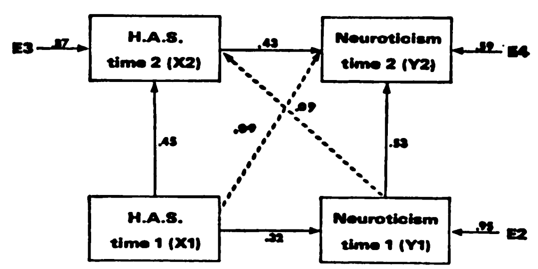
2. In contrast, the N scale appears to be heavily contaminated by the HAS score. The path coefficients between the HAS scores and the N scores are both substantial and statistically significant. Further, the test/retest correlation of N when the effects of HAS are taken into account is poor (r = ·53). These findings show that the N scale does not satisfy the conditions for independence from mental state.

3. For both models depicted in Fig 1, the over-identifying restrictions p3 = p4 = 0 appear to be satisfied. In all cases the path coefficients attached to the diagonal paths do not differ significantly from zero.



---denotes path coefficient not significantly different from zero (p>05)

FIG 1a.—Path model for E scale.



---denotes path coefficient not significantly different from zero (p>·05)

FIG 1b.—Path model for N scale.

An attempt was made to revise the N scale by producing a new scale N′ which comprised only those EPI items with low or zero correlations with HAS. This attempt was unsuccessful since the majority of N items, showed significant correlations with the HAS score. The result indicated that an attempt to modify the item content of the N scale to remove the effects of mental state would not be possible. The findings suggest that the N scale items probably measure both short-term mental state and long-term personality but that these two aspects are inextricably confounded in the item content.

Discussion

The findings lead to the following conclusions:

1. The analysis has produced little evidence to suggest that the E scale of the EPI is contaminated by the effects of short-term mental state. The E scale has good test/retest reliability and is not influenced by the subject's level of anxiety as measured by the Hamilton Anxiety Scale. It is possible, however, that other mental state variables (e.g. depression) may influence E scores.

2. There is evidence to suggest that the N scale is heavily contaminated by short-term mental state. N scale scores are quite well related to mental state, and the test/retest reliability of the N scale when measured independently of HAS score is poor.

3. It would appear that the N scale cannot be revised by removing a few contaminating items. Rather, the scale items appear to measure a diffuse combination of mental state variables and personality factors which cannot be separated mechanically. In view of this, N scores obtained on clinical samples should be approached with some caution. Perhaps the only way of minimizing the contaminating effects of mental state in these samples is by using an instructional set by advising subjects to respond in terms of their normal or usual personality as suggested by Kendell and DiScipio (1968).

In conclusion, it should be noted the present analysis rests heavily on the basic assumptions which underlie the path model: that mental

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state exerts an influence on EPI score but not *vice versa*. If it is assumed that the relationship between mental state and EPI score is reciprocal, this model does not apply and may in fact misrepresent the situation. However, it can be shown that the appropriate modifications to include a reciprocal influence between EPI and mental state will result in an under-identified model which renders the whole problem incapable of solution by the present method of analysis.

References

BIANCHI, G. N. & PHILLIPS, J. (1972) A comparative trial of doxepin and diazepam in anxiety states. *Psychopharmacologia*, **25**, 86–95.

COPPEN, A. & METCALFE, M. (1965) Effect of a depressive illness on MPI scores. *British Journal of Psychiatry*, **111**, 236–9.

DUNCAN, O. D. (1975) *Introduction to Structural Equation Models*. New York: Academic Press.

GUILDFORD, J. P. & FRUCHTER, B. (1973) *Fundamental Statistics in Psychology and Education* (5th edition). New York: McGraw-Hill.

HAMILTON, M. (1969) Diagnosis and rating of anxiety. In *Studies of Anxiety* (ed M. H. Lader). British Journal of Psychiatry Special Publication No. 3. Ashford, Kent: Headley Brothers Ltd.

KENDELL, R. E. & DISCIPIO, W. J. (1968) Eysenck Personality Inventory scores of patients with depressive illness. *British Journal of Psychiatry*, **114**, 767–70.

KNOWLES, J. B. & KREITMAN, N. (1965) The Eysenck Personality Inventory: some considerations. *British Journal of Psychiatry*, **111**, 755–9.

SERRA, A. V. & POLLITT, J. (1975) The relationship between personality and the symptoms of depressive illness. *British Journal of Psychiatry*, **127**, 211–18.

SNAITH, R. P. (1976) Personality and depressive illness. *British Journal of Psychiatry*, **128**, 101–2.

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