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SUPERFACTORS P, E AND N IN A COMPREHENSIVE FACTOR SPACE

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ABSTRACT

Browne and Howarth, in a recent study, selected 400 items from 1726 non-repeated items appearing in previous personality studies, representing twenty hypothetical factors. The resulting questionnaire was answered by 1003 subjects, and factor analysis, followed by rotation, resulted in a multiplicity of factors, many of them similar to those hypothesized. A table is given of the intercorrelations between factors, but no higher order factor analysis was carried out. The writer's system predicts that three such factors should be found in any comprehensive study of this kind, and this paper reports a factor analysis of the correlations among the Browne and Howarth factors. A very clear three-factor picture emerges, with the hypothetical psychoticism, extraversion and neuroticism factors having very much the predicted loading pattern. It is concluded that primary factor analysis without extraction of higher order factors leaves the analysis incomplete and omits what may be the most important part of the whole procedure. The results are interpreted as supporting the writer's theoretical position.

There exists a curious culture-bound difference in factor analytic practice between American and British workers, in that the Americans lay greater stress on so-called "primary" factors, while the British prefer dealing with higher order "superfactors." This difference originated with Spearman and Thurstone and is replicated in the personality field by Eysenck on the one side, Cattell and Guilford on the other. (Many other workers could of course be cited here as exemplifying this difference.) The writer has argued that so-called primaries in the personality field are often either "tautological" factors, *i.e.* are made up of logically related and semantically similar statements of essentially identical content, or else, as in the case of Cattell's 16 PF factors, may prove unreliable and often unreplicable (Eysenck, 1971; 1972). Superfactors, like P, E and N (Eysenck & Eysenck, 1969; 1976) are neither tautological, containing heterogeneous item content, and they are certainly replicable (Royce, 1973). In addition there are good causal theories relating to these superfactors, capable of being tested experimentally, which link them with experimental psychology, theoretical psychology, and even with physiology (Eysenck, 1967; 1976a). Furthermore, they mediate experimental studies which enable us to break out of the factor analytic circle (Eysenck, 1977). For all these reasons, British workers have tended to attribute considerable importance to the extraction of superfactors,

either directly from the intercorrelations among items, or by oblique rotation of primaries and consequent factor analysis of these intercorrelations (Eysenck & Eysenck, 1969).

In a recent study, Browne & Howarth (1977) have reported the results of a well-designed and completely factored study of 400 personality inventory items, carefully selected from a much larger number of items contained in the best known empirical studies in this field. They posited the existence of twenty factors, based on previous extensive analyses by many of the best-known authors in this field and used a large sample of subjects (N = 1,003) for their work. Nineteen factors were extracted, rotated and identified according to their psychological content; these factors were found to be correlated. We shall here be concerned with the Max. Obl. solution; other solutions are given in the paper but will here be disregarded.

Correlations as high as .58 and .59 are reported; the mean correlation for the whole Table is .16. (The Part. Obl. solution gives considerably smaller intercorrelations, of course, ranging up to .30, with a mean of .07.) Browne & Howarth do not report an analysis of these intercorrelations for various reasons, none of which seem entirely convincing. They argue that the communality estimates in such a small matrix would be indeterminate; yet many matrices of this size have in fact been reported in the technical literature, and factor analyzed. They argue that the mean intercorrelation in the Table is "very low"; this is natural when we consider that the correlations between primaries loading on different super factors would average zero and is hardly an argument. They look at clusters, of which they identify several; "these clusters are quite meaningful," and they seem to correspond to the super factors Eysenck has posited. Browne & Howarth refuse to so identify them, for reasons which seem inadequate. Thus their "leading cluster" is not identified as "extraversion" because there is no link to Impulsiveness from the Sociability primaries. Such a link can only be established on the basis of a proper factor analysis, not on the basis of casual inspection; as we shall see, both Sociability (loading .77) and Impulsiveness (loading .56) do in fact lie on the same factor in our analysis.

A principal components analysis was accordingly carried out on the correlations reported by Browne & Howarth, using unity in the principal diagonal, and rotated using Promax. Three factors were called for, and the results of the rotation are reported in

Table 1. This Table gives the factor names used by Browne & Howarth, and the loadings of the primaries on the three super factors, identified provisionally as N, E and P. Identification rests on two not unrelated procedures. In the first place the writer prepared a target matrix, listing the primaries which should form the high-loading and low-loading elements for each of the three factors, basing himself on previous work on these three superfactors. The predictions made (including double loadings, such as that of Social Shyness on both N and E) were overwhelmingly verified.

The second method consisted in submitting the Table to psychologists familiar with the field, and asking for identification. All gave judgments identifying the factors correctly (*i.e.* in line with the writer's hypothesis.) Neuroticism is loaded mainly on the following: Moodswings, Inferiority, (poor) Adjustment-emotionality, (lack of) Social Responsibility, Trust vs. Suspicion (sensitivity), (lack of) Persistence, Social Shyness and Hypochondria, and (lack of) relaxed composure. Extraversion is loaded mainly on the following: Sociability, Frivolity, Impulsiveness, General Activity, Social Conversation, Sex and Superego (mainly overt sexuality—see Eysenck, 1976b.) Psychoticism is loaded mainly on the following: Dominance-Leadership, Optimal Arousal (sensation seeking), Dominance-Submission, and (lack of) Superego.

Table 1.
Factor Loadings of Primaries for N, E and P.

Factor	N	E	P
Moodswings	*69*[a]	05	09
Inferiority	*66*	–27	–13
Adjustment-emotionality (Poor)	*63*	–18	05
Social Responsibility	*–62*	09	–11
Trust vs. Suspicion (Rev.)	*60*	18	29
Persistence	*–59*	–28	26
Social Shyness	*44*	–41	–27
Hypochondria	*35*	18	–04
Relaxed Composure	*–28*	08	04
Sociability	–06	*77*	–13
Frivolity	18	*71*	–33
Impulsiveness	56	*56*	16
General Activity	–09	*47*	03
Social Conversation	–20	*41*	36
Sex and Superego (overt sexuality)	12	*38*	25
Dominance-Leadership	–04	–11	*74*
Optimal Arousal-sensation seeking	21	–01	*63*
Dominance-Submission	–23	05	*53*
Superego (lack of)	41	–22	*51*

[a]Decimal points omitted.

The fit is best for N and E, somewhat less so for P; the reason presumably is that traditional inventories have always been preoccupied with N and E variables, and have not paid much attention to Psychoticism as a dimension of personality (Eysenck & Eysenck, 1976.) Consequently some of the salient aspects of this superfactor are left out of the list of primaries, and presumably also of the original 400 items. Thus P superfactor appears somewhat curtailed, and less clearly interpretable than E and N.

The names given to the primaries must of course be understood in terms of Browne and Howarth's more detailed description of these factors; the names themselves may be misleading, and sometimes indicate the wrong direction for interpretation. Thus "Trust vs. Suspicion" should be interpreted as suspicion (positive) and trust (negative); thanks are due to Professor Howarth for information on this point. Factor RC is not mentioned in the glossary of factors, but may be inferred as "Relaxed Composure" from the Table of Loadings. The factor labelled "superego" should really be labelled "lack of superego," to judge by the Table of Major Loadings; it might also be interpreted as paranoia. This is an important point as this factor loads on the superfactor here interpreted as Psychoticism; clearly the direction of the factor, to judge from the Table of Factor Loadings, is incorrectly represented by the title, and to judge by the actual items included as having high loadings, the term itself, "superego," is questionable. Given that these comments are justified it is possible to suggest that each one of the nineteen primaries has its major loading as predicted by the writer's hypothesis. It is believed that the results of this supplementary analysis of the original Browne and Howarth study have clarified the situation, and have succeeded in demonstrating that the three superfactors postulated by the writer appear quite clearly even in a study which not only did not set out to uncover them, but failed to carry out such analyses as might have supported or disproved the theory postulating them.[1]

1. The three factors are not entirely uncorrelated, as theory and previous work have shown them to be. The correlation between N and E is —.24; that between N and P is +.19, and that between E and P is —.32. It is not clear why in this particular respect the solution should differ from the more usual pattern; the answer may lie in the fact that men and women were both included in the sample, while in the original studies men and women were always separated before correlations were calculated or factor analyses carried out. The differences between the sexes (women having higher N scores, men having higher P and E scores) may be responsible for the present intercorrelations between factors. In future analyses it would seem advisable to follow the Eysencks' example and keep the sexes separate.

Identification of the factor structure can sometimes be carried even further by reference to previous studies. Thus Eysenck (1956) found that social shyness (as defined by Guilford's factor by that name) correlated equally with N (positively) and with E (negatively). Exactly the same pattern is observed in Table 1, with the Browne and Howarth factor "Social Shyness" having a loading of .44 on N and one of −.41 on E. It is predictable coincidences of this kind, superimposed on a general consideration of the make-up of the loadings for each factor, which make one confident of the correctness of the identification of the factors.

It is interesting to consider these results in the light of Browne's (Reference Note 1) original report, which was kindly supplied by Professor Howarth. Browne reported only on a varimax rotation and refused to consider oblique rotations. Conscious of possible criticisms, he wrote:

Browne's answer, of course, is no, and he feels that "one is bound to conclude that notions of coercing valuable and psychologically meaningful primary personality factors into 'higher-order' factors, is largely a fallacious procedure." (p. 184.) The results here reported, replicating as they do many other studies carried out with different presuppositions, using items selected on different principles, employing entirely different subjects, and basing themselves on theories rejected by Browne, suggest that the abandonment of higher-order factors may be a little hasty, and not entirely justified by the facts. Clearly there is replicable, predictable, psychologically meaningful information to be gained by analysing the observed correlations between primary personality factors; it would not seem reasonable to throw this away for the sake of preconceived and untested opinions.

The argument in favor of superfactors does not rest entirely on psychometric considerations such as the tautological nature of most primaries, and their unreliability and lack of replicability when not tautological, or the fact that lack of attention to their intercorrelations leaves out what may be the most important aspect of the analysis. Superfactors are psychologically superior to primaries because there are good causal theories to explain the

It may be objected that the present study, as primarily an 'extraversion' study, did not utilize 'oblique' rotation with the supposed advantage of carrying out higher-order analyses, where supposedly, this shadow, named 'extraversion', has been reported to dwell . . . . The question that must be faced here is: do we gain any additional psychological knowledge by moving further and further away from the basic data . . . through adopting personality dimensions based on 'Super Factor' theories? (p. 183.)

nature of the individual differences found (Eysenck, 1967; Eysenck & Eysenck, 1976); these theories link up observed findings with physiological causes on the one hand and with social consequences (crime, sex behaviour, psychiatric disorders, social attitudes and voting behaviour) on the other. Furthermore, these theories give rise to deductions which can be experimentally tested, both in the physiological, the experimental, and the social field (Eysenck, 1976a); such tests have proved positive in the great majority of cases.

On psychometric, theoretical, and experimental grounds, therefore, it seems that analysis of the personality sphere into primaries only is incomplete; it fails to break out of the vicious circle of purely correlational argument, and hence cannot provide the vital link with experimental and theoretical psychology which alone can lead the way to the unification of psychology which Cronbach (1957) called for so many years ago. Browne (Reference Note 1) and Browne & Howarth (1977) never even mention these powerful arguments in their criticism of "superfactors," or in relation to their expressed preference for primaries; this failure and the allied failure to pay attention to the genetic evidence (Eysenck, 1976c; Eaves & Eysenck, 1977) which strongly supports a genetic explanation of the major superfactors, renders their argument weaker than it might otherwise have been. It may be concluded that their own evidence negates their conclusions, and supports the view that superfactors are of major importance in the factor analytic study of personality.

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