

Primary Trait Measurement of the 21 Components of the P-E-N System

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This paper describes the construction of a 21-scale inventory, with 20 items to each scale, to analyse the finer structure of the P, E and N superfactors which constitute the major dimensions of personality. Preliminary factor analyses based on small samples of 150 males and 81 females are followed by multidimensional scaling analyses and factor analyses of a larger sample of 1019 males and 580 females. There is considerable agreement between the multidimensional scaling and factor analyses, and the results for males and females. Clusters of scales clearly define E and N, with the cluster defining P being rather looser. Some scales do not relate to P, E or N, and are outside the field covered by the three superfactors. On the whole, the scales behave very much as predicted by theory, and the relative standing of males and females on the scales is also as predicted, i. e. women are higher on N scales, males on P scales.

There is now good agreement that personality description (taxonomy) is best viewed as *hierarchical* (Eysenck, 1947), in the sense that a large number of *primary traits* form the lowest level of measurement, while at the second-order level (superfactor level, type level) we have dimensions of personality based on the factor analysis of the intercorrelations between primary traits (Eysenck and Eysenck, 1985). There is good agreement that E (extraversion) and N (neuroticism) are the most basic dimensions, with P (psychoticism) a plausible candidate for the third position (Eysenck, 1991).

Different authors stress the measurement of primary factors (Cattell, and Dreger, 1977) or the measurement of dimensions (Eysenck, 1947), but clearly both in combination provide more true variance than either alone. In 1975 Eysenck and Wilson published a set of 21 trait inventories, 7 each for P, E and N, in an attempt to furnish research workers with a clear set of markers at the primary trait level. It is the purpose of this paper to give some psychometric information on these 21 traits, their reliabilities and intercorrelations, to enable readers to evaluate the scales. Each consisted of 30 questions, and a scoring system was provided.

While the principle of a trait-hierarchy is clear enough, there are several problems arising in practice. Two in particular are sometimes worrisome. (1) What appears to be a primary trait (e. g. impulsivity, sensation seeking) may break down into several sub-traits with only relatively small correlations between them (Eysenck, 1983). These concepts thus seem to form an intermediary class of traits between

primary and second-order factors, and are sometimes difficult to accommodate. (2) Some traits fail to correlate with and define just one dimension; thus impulsiveness and sensation seeking correlate with P, E and N, at different levels, and the different sub-traits of impulsiveness or sensation seeking may show different patterns of correlations (Eysenck, 1983). Problems of this kind are not insoluble, and seem simply to represent facets of reality, but they should be kept in mind in interpreting large-scale factor analyses. What does seem clear, from a meta-analysis of trait studies, is that there are three major superfactors which closely resemble P, E and N (Royce and Powell, 1983). Figs. 1, 2 and 3 show, in rough diagrammatic form, the traits whose intercorrelations define these three superfactors.

Preliminary Studies

As a preliminary, 150 male and 81 female Ss filled in the questionnaires, and the results were correlated and factor analysed, using Promax rotation of 3 factors. Also determined were Cronbach alpha reliabilities, and mean scores for male and females. Table 1 shows the major findings. Reliabilities as measured by Cronbach alpha are clearly adequate for most scales, with values between .70 and .85. (Retest data on smaller groups average around .80) Scores for the 7 scales making up P, E and N were totalled for each superfactor, and the 3 resulting

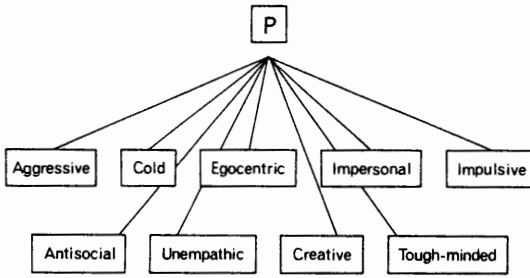


Figure 1. Traits contributing to psychoticism factor.

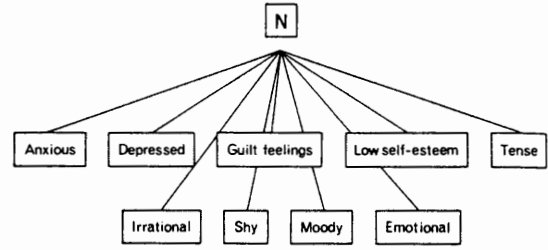


Figure 3. Traits contributing to neuroticism factor.

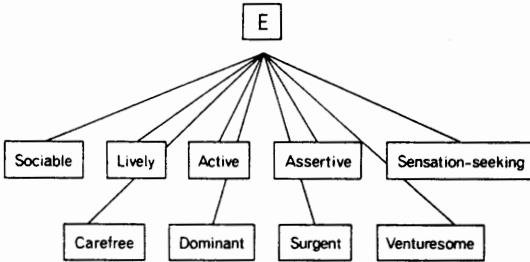


Figure 2. Traits contributing to extraversion factor.

scores correlated; none of the correlations was significant either for the males or the females.

The findings on the whole support expectations. There are three uncorrelated factors; scales are reliable on the whole; sex differences are as expected - women feel inferior, depressed, anxious, and dependent, which agrees with the higher N of women often observed in the literature. Men are more risk-taking, irresponsible, sensation seeking, and mascu-

line (!), all in agreement with the usual higher P score of men. In addition men are less sociable, but more active, less expressive, but more aggressive. The terms used to characterize each trait do not necessarily give a very clear picture of the trait measured, and the actual questions used should always be consulted.

It was decided that the large number of items was inconvenient and would be unacceptable to most potential subjects, so each scale was reduced from 30 items to 20 by calculating item-scale correlations and eliminating items with the lowest item-scale correlations. Occasionally items with reasonable item-scale correlations were eliminated if the item had higher correlations with scales other than the one for which it was being scored. We thus have a new set of scales of 20 items each, copies of which can be obtained from Dr. Jackson directly; it is this new set of scales that will form the major object of this report.

Table 1. Factor analysis of 21, 30-item scales for sample of 150 males and 81 females.

Scales:	E	N	P	Alpha	Means and S.D.	
					Males (150)	Females (81)
1. Active - Inactive	.75	-.09	-.03	.77	31 ± 8.6	34 ± 8.5
2. Sociable - Unsoc.	.71	-.14	.11	.81	33 ± 9.6	35 ± 8.1
3. Expressive - Inhibited	.54	.31	.16	.72	24 ± 8.1	26 ± 8.1
4. Assertive - Unass.	.72	-.38	.05	.74	33 ± 8.3	33 ± 6.3
5. Ambitious - Unamb.	.66	.15	-.34	.78	28 ± 9.2	28 ± 8.6
6. Dogmatic - Undog.	.45	.45	.07	.61	23 ± 6.6	23 ± 6.8
7. Aggressive - Unaggr.	.42	.42	.33	.76	21 ± 8.5	20 ± 8.6
(8) Inferior - Self-worth	-.33	.83	.00	.84	11 ± 8.1	16 ± 10.1
(9) Depressed - Happy	-.17	.84	.14	.88	10 ± 8.8	12 ± 10.6
10. Anxious - Calm	-.04	.89	-.09	.82	14 ± 8.3	18 ± 9.4
11. Dependent - Autonomous	-.24	.85	.15	.78	10 ± 8.8	12 ± 8.2
12. Hypochondriacal - Healthy	.15	.83	-.08	.84	8 ± 7.4	8 ± 6.0
13. Guilt - Guilt freedom	.08	.85	-.02	.85	12 ± 8.6	12 ± 9.3
14. Obsessive - Casual	.19	.65	-.33	.78	18 ± 8.5	19 ± 8.3
15. Risk-taking - Careful	.26	.00	.71	.70	28 ± 7.9	26 ± 6.5
16. Impulsive - Controlled	.15	.32	.57	.74	25 ± 8.6	25 ± 7.7
17. Irresponsible - Responsible	-.09	.28	.77	.70	23 ± 7.7	21 ± 7.4
18. Manipulative - Empathic	.24	.00	.48	.69	24 ± 8.0	23 ± 6.5
19. Sensation Seek. - Unadventurous	.37	.13	.62	.78	31 ± 8.8	28 ± 8.2
20. Masculine - Feminine	-.09	-.15	.49	.71	27 ± 7.3	20 ± 6.7
21. Practical - Impractical	.12	-.10	.26	.74	21 ± 8.3	23 ± 8.0

Elimination of the worst 10 items from each scale has not lowered the alpha reliabilities of the scales, but has raised it from an average of .73 to an average of .77. Sex differences were again very similar to those obtained from the 30 item scale; a factor analysis was done using direct oblimin rotation, where the maximum simple structure position was at $\Delta = 0.50$, with an overall hyperplane count of 14. The male solution was compared with the female solution, and great similarity was found. Using the Kaiser factor similarity coefficient, the mean solution cosine was 0.81, values for $N = .97$, for $P = .80$, and for $E = .85$. Corresponding values for the Tucker Congruence Coefficient were .96, .72, and .58. Bearing in mind the small number of subjects, particularly female subjects, the model is acceptable. Overall, the only major difference from the analysis given in Table 1 is the position of aggressiveness, which now has its main loading on psychoticism, rather than on extraversion; this agrees well with prediction (Eysenck & Wilson, 1975). However, as before, aggressiveness also has a significant loading on N , as before, as well as on E . This is a trait that has always complicated the factorial picture by correlating positively with all three superfactors.

Later studies added a Lie Scale from the E.P.I. (Eysenck & Eysenck, 1964), and administered the final scales to large samples of males and females.

These will be discussed in more detail in the next section; here we will only compare scores of 982 males and 542 females, to see to what extent the results of our small sample, 30 item inventories can be replicated. Table 2 shows the results. (Note that some of the scales have been renamed to make them more acceptable, but without changing their nature.)

In Table 2, crosses have been put beside items showing the greatest differences in terms of the SDs of the two distributions; in view of the large numbers involved several others would also reach significance, but the differences are too small to be of interest. The differences are very similar to those noted before on another sample; males are high on P , females on N . In addition to the 21 trait scales and sums of the P , E and N superfactors, we have also a record for each person of items left without a decision; it is clear that women find greater difficulty in coming to a decision on a number of items.

So much for a brief summary of hitherto unpublished work. In the next section we will turn to a factorial study using a much larger sample than in our preliminary analysis. It has been our experience that factorial results to be properly replicable require samples of at least 500 males and 500 females, and even larger samples are preferable in principle. Only in this way can fairly definitive results be obtained.

Table 2. Means and SDs of 21, 20-item scales, P,E. and N, and "Can't decide" scale for 982 males and 542 females.

	Males (N = 982)	Total Group S.Ds.	Females (N = 542)	
Active - Inactive	27.06	7.39	26.41	
Sociable - Unsociable	26.94	8.18	26.37	
Expressive - Inhibited	16.93	6.28	18.71	x
Assertive - Submissive	24.66	7.31	21.97	x
Ambitious - Unambitious	22.36	7.97	20.81	
Dogmatic - Flexible	14.98	5.71	14.03	
Aggressive - Peaceful	13.95	6.70	12.03	x
Inferiority - Self Esteem	8.49	8.47	12.70	x
Unhappy - Happy	7.35	8.34	9.67	x
Anxious - Calm	9.40	8.45	14.11	x
Dependent - Autonomous	7.83	6.51	10.00	x
Hypochondriacal - Healthy	3.42	4.53	4.52	x
Guilt - Guilt Free	7.33	7.04	8.86	
Obsessive - Casual	12.55	6.56	13.08	
Risk-taking - Careful	21.31	6.91	19.95	x
Impulsive - Controlled	18.23	7.58	20.15	
Irresponsible - Responsible	17.04	7.16	17.43	
Manipulative - Empathic	17.87	6.59	14.95	x
Sensation seeking - Unadventurous	22.87	7.80	19.07	x
Tough-minded - Tender-minded	24.56	7.70	13.67	x
Practical - Reflective	20.15	7.44	18.70	
E	20.98	7.08	20.05	
N	8.05	7.13	10.42	x
P	20.29	7.31	17.70	x
Can't decide	25.99	34.53	33.11	x

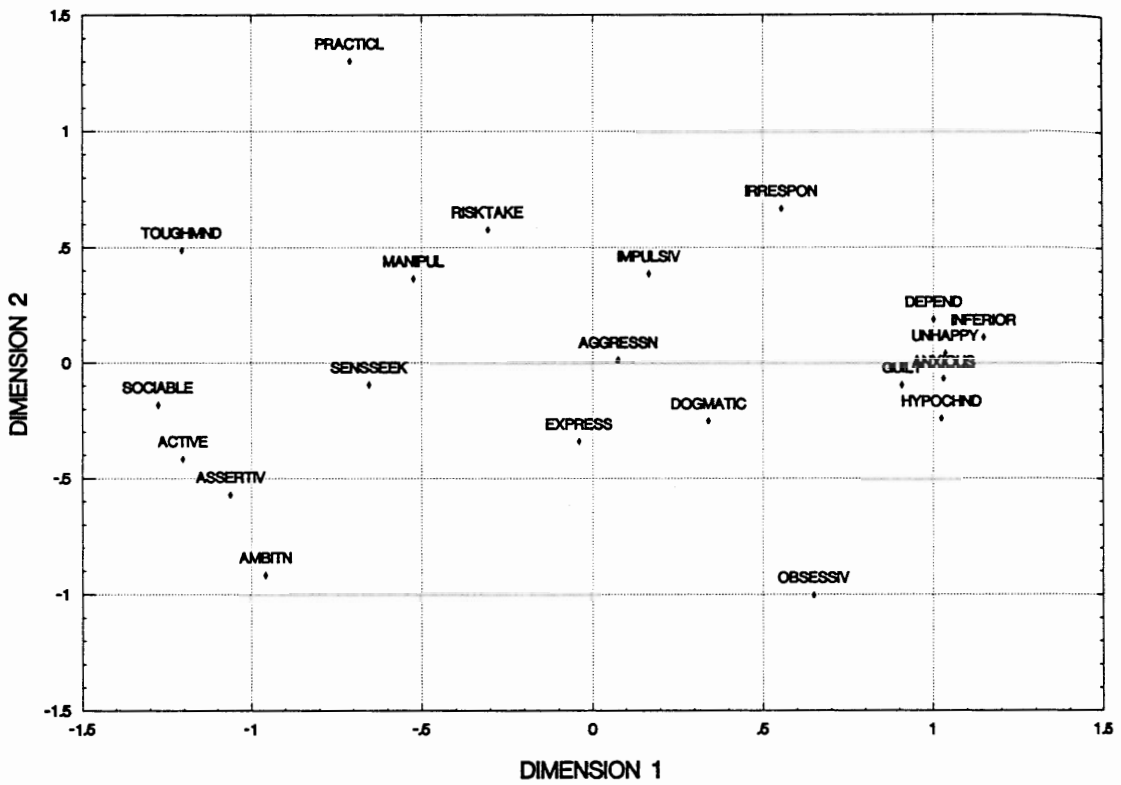


Figure 4. Multidimensional scaling analysis for 1019 males. Guttman-Lingoes smallest space analysis – stress = 0.12.

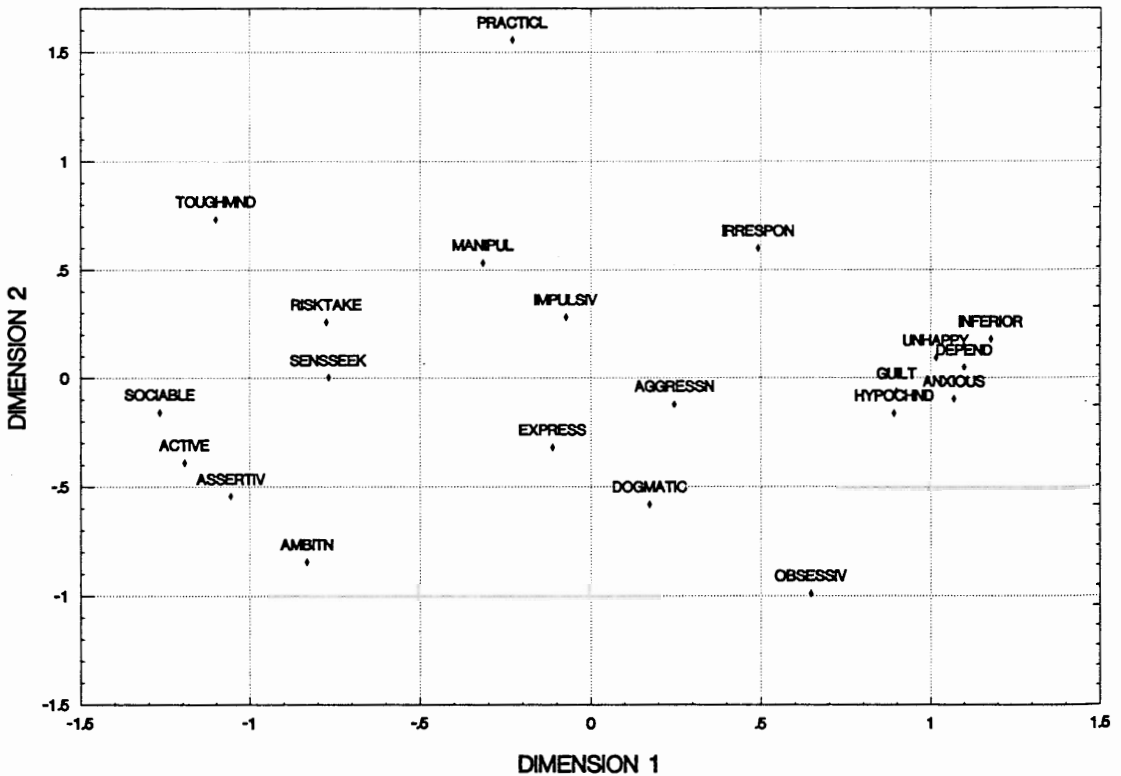


Figure 5. Multidimensional scaling analysis for 580 females. Guttman-Lingoes smallest space analysis – stress = 0.15.

Multidimensional Scaling

Factor analysis is one method of multidimensional analysis; multidimensional scaling is another, having many advantages. One of these is the immediacy with which the relations between and among variables become apparent on causal inspection. Accordingly we have carried out a Guttman-Lingoes smaller space analysis (Kruskal & Wist, 1978) on data obtained from 1019 males and 580 females under conditions of computer administration. A Lie Scale was administered also, but exclusion of the highest-scoring 15% on the scale did not alter the appearance of the Figures, so no subjects were excluded. Figs. 4 and 5 show the results for males and females respectively.

Consider Figure 4 (males) first. There is a clear cluster of N scales (dependent, inferior, unhappy, anxious, guilt-ridden, hypochondriacal). There is also a clear cluster of E scales (sociable, active, assertive, ambitious). Finally there is a rather less dense cluster of P traits (risk-taking, manipulative, sensation seeking, aggressive, impulsive, irresponsible), with dogmatic and expressive close by. The female group gives very similar results. A number of factors in these Figures may require comment.

The *closeness* of the clustering of the core components of P, E and N corresponds well with the Cronbach alpha reliability of the three superfactors, as indeed it should. N shows the closest clustering, with obsessiveness lying somewhat apart, and clearly not belonging to the core components of N. This is not unexpected; it has some affinity with psychosis, according to psychiatric speculation, and hence is displaced in that direction. E shows a slightly lesser degree of clustering, and P even less. It would be possible to make the circle tighter by leaving out sensation seeking (which in factor analyses had always correlated with E as well as P, and clearly lies closest to E of all the nominal P scales.) Risk-taking, particularly for the females, also lies close to E.

Certain scales do not fit in well with these core clusters. We have already mentioned obsessiveness; toughmindedness (formerly called masculinity) is another, lying between E and P, as perhaps it should. Dogmatism and expressiveness lie close to P, and might be included in that cluster. Practicality clearly does not belong properly with P, E or N. Dimensional scaling does not remove the element of arbitrariness that characterizes factor analysis, but it makes it more obvious.

The essence of smallest space analysis is that the distances between scale points indicates the degree

of similarity between scales; the closer, the more similar in content. When clustering close together, as in the case of the six N scales, interpretation is easy. The same may be said of the four E scales. There are eight P scales forming a much less obvious cluster, indeed risk-taking, manipulation and sensation seeking might be judged to be as close to the E cluster as to the impulsive, aggressive and expressive scales.

This is merely another way of expressing the difficulty mentioned at the beginning of this article, namely that not all scales are loading on a single factor, but may load two or even three. The reason why it seems preferable to include manipulation, risk-taking and sensation seeking in the P cluster has been discussed at length elsewhere (Eysenck, 1992); it relates to the extension of the argument from psychometrics to experimental psychology, and the inclusion of *causal* considerations in the discussion.

Some scales appear to belong to none of the three clusters, namely toughmindedness (masculinity), practicality and obsessiveness. We might easily include obsessive in the N cluster, but at the risk of disregarding its link with P, a link which finds support in psychiatric observations. Our best plan would be to use scores for P, E and N based on 8, 4 and 6 scales respectively, while for profile analyses all 21 scales may be used.

Factor Analysis

Factor analysis cannot in the nature of things give a very different picture from that given by multidimensional scaling, but for the purpose of giving a complete picture of the data, a principal components analysis of the 21 scales was undertaken for both the males and females separately. For the male dataset, the Kaiser Alpha criterion (Mulaik, 1972; Kline and Barrett, 1983) indicated 3 factors above 0.5, with the fourth factor alpha at 0.19. The Velicer MAP test (Velicer, 1978) also indicated 3 significant factors, as did Barrett and Kline's (1982) AUTOSCREEN. For the female dataset, the Kaiser Alpha criterion indicated 3 factors above 0.5, with the fourth at 0.21. The MAP test also indicated 3 factors, but AUTOSCREEN indicated 4 factors. Subsequently, a hyperplane maximized direct oblimin rotation was undertaken on both the male and female data, with ξ swept from -40.0 to 0.5 in steps of 0.1 (looking for the maximum hyperplane count at a particular parameter value). Both rotated factor solutions were then compared using a modified con-

Table 3. Factor Pattern Matrix for 21 scales, using total sample of 1,599 males and females.

	FACTOR	FACTOR	FACTOR	Alpha Reliability	
	1	2	3	Males:	Females:
1. Activity	0.452	-0.276	-0.425	0.754	0.769
2. Sociable	0.446	-0.376	0.165	0.815	0.812
3. Expressive	-0.227	-0.626	0.148	0.602	0.600
4. Assertive	0.482	-0.404	0.381	0.744	0.767
5. Ambitious	0.297	-0.157	0.699	0.796	0.800
6. Dogmatic	-0.346	-0.425	0.326	0.560	0.600
7. Aggressive	-0.294	-0.646	0.155	0.700	0.669
8. Inferiority	-0.849	0.055	-0.077	0.846	0.849
9. Unhappy	-0.833	-0.120	0.021	0.849	0.893
10. Anxiety	-0.848	-0.066	0.098	0.829	0.848
11. Dependence	-0.831	-0.088	-0.080	0.745	0.765
12. Hypochondriacal	-0.747	-0.120	0.138	0.748	0.691
13. Guilt	-0.793	-0.206	0.124	0.813	0.790
14. Obsessive	-0.422	0.170	0.664	0.710	0.690
15. Risk-taking	0.133	-0.777	-0.345	0.688	0.676
16. Impulsive	-0.234	-0.688	-0.299	0.753	0.752
17. Irresponsible	-0.400	-0.552	-0.560	0.760	0.681
18. Manipulative	0.080	-0.474	0.124	0.650	0.630
19. Sensation-seeking	0.221	-0.694	0.033	0.748	0.761
20. Tough-minded	0.414	-0.302	-0.017	0.557	0.409
21. Practical	0.213	0.002	-0.307	0.732	0.767
HYPCT.					
*****	1	4	6		
VARIANCE.					
*****	5.678	3.687	2.132		
<i>FACTOR CORRELATION MATRIX</i>					
	<i>FAC. 1.</i>	<i>FAC. 2.</i>	<i>FAC. 3.</i>		
	1.0000	-0.0069	0.0268		
	-0.0069	1.0000	-0.1223		
	0.0268	-0.1223	1.0000		

gruential fit procedure based on the Kaiser, Hunka and Bianchini (1971) algorithm, but using coefficients computed directly over the transformed comparison matrices (Barrett and Hammond, submitted). The results of this analysis yielded an overall factor space similarity coefficient of 0.98, with the three factor congruence coefficients (Tucker, 1954) all above 0.96. Thus it was decided to merge the male and female data and produce a factor structure based upon the combined dataset. Principal components analysis of this combined dataset yielded 3 factors with a Kaiser Alpha greater than 0.5, the fourth having a value of 0.30. The MAP test also indicated 3 factors for rotation. AUTOSCREEN indicated 4 factors with 56% certainty and 3 factors with 17% certainty. Thus, 3 factors were rotated using the methodology as above.

Table 3 shows the results, as well as alpha reliabilities for the two sexes, and the factor intercorrelations. Maximum simple structure was at Delta 0.5, with hyperplane counts of 1, 4 and 6 respectively. Variance accounted for was 5.678, 3.687 and 2.132 respectively.

Factor 1 is clearly N, with high loadings on the inferiority, unhappiness, anxiety, dependence, hypochondriacal and guilt scales; in addition obsessive and irresponsible, lack of tough-mindedness, inactivity, unassertive and social shyness fill in the picture with middling loadings. Factor 2 is clearly P, with high loadings on aggressive, risk-taking, impulsive, irresponsible, manipulative, sensation-seeking, expressive; tough-minded also has a medium loading, as has assertive. Factor 3 resembles E, with active, assertive, ambitious and responsible having the highest loadings. Unexpectedly sociable has a low loading; this must throw some doubt on the interpretation of this factor, although of course it has been established that social shyness is correlated with N (as here) as well as with introversion (Eysenck, 1956). Possibly in this sample (lack of) sociability is more highly correlated with N than with introversion.

Alpha reliabilities are acceptable for the great majority of the scales, but expressiveness, dogmatism, manipulative and tough-minded have reliabilities below the (arbitrary) .700 level, with risk-

Table 4. Factor Pattern Matrix for males, omitting scales with low h^2 (dogmatic and practical).

	Factor 1	Factor 2	Factor 3
Activity	-0.343	-0.018	-0.626
Sociable	-0.373	-0.224	-0.418
Expressive	0.287	-0.430	-0.416
Assertive	-0.355	-0.120	-0.597
Ambitious	-0.194	0.242	-0.777
Aggression	0.382	-0.415	-0.407
Inferiority	0.833	0.040	0.138
Unhappy	0.831	-0.084	0.038
Anxiety	0.854	0.019	-0.085
Dependence	0.814	-0.106	0.097
Hypochondr.	0.783	0.034	-0.136
Guilt	0.833	-0.057	-0.156
Obsessive	0.521	0.506	-0.528
Risk-taking	-0.059	-0.837	0.003
Impulsive	0.283	-0.710	-0.024
Irresponsible	0.370	-0.727	0.352
Manipulative	0.034	-0.329	-0.338
Sensation-seek.	-0.094	-0.572	-0.362
Toughminded	-0.362	-0.313	-0.159
Hyp. Ct. *****	3	6	5
Variance. *****	5.408	3.077	2.687

Factor Correlation Matrix

Factor 1	Factor 2	Factor 3
1.0000	-0.0385	0.0995
-0.0385	1.0000	0.1931
0.0995	0.1931	1.0000

Table 5. Factor Pattern Matrix for females, omitting scales with low h^2 (dogmatic and practical).

	Factor 1	Factor 2	Factor 3
Activity	-0.321	-0.039	-0.610
Sociable	-0.359	-0.303	-0.395
Expressive	0.282	-0.521	-0.387
Assertive	-0.340	-0.219	-0.575
Ambitious	-0.049	0.148	-0.798
Aggression	0.506	-0.422	-0.309
Inferiority	0.789	0.024	0.239
Unhappy	0.841	-0.062	0.073
Anxiety	0.857	0.000	-0.005
Dependence	0.807	-0.043	-0.153
Hypochondr.	0.774	0.038	-0.094
Guilt	0.810	-0.108	-0.063
Obsessive	0.511	0.494	-0.548
Risk-taking	-0.147	-0.787	-0.020
Impulsive	0.142	-0.739	0.031
Irresponsible	0.340	-0.696	0.377
Manipulative	0.132	-0.200	-0.395
Sensation-seek.	-0.070	-0.580	-0.330
Toughminded	-0.235	-0.226	-0.077
Hyp. Ct. *****	2	6	7
Variance. *****	5.194	3.000	2.640

Factor Correlation Matrix

Factor 1	Factor 2	Factor 3
1.0000	-0.0060	0.1039
-0.0060	1.0000	0.1940
0.1039	0.1940	1.0000

taking only just below that level. Reliabilities for the two sexes are very similar, suggesting that the values are good estimates of the true reliabilities. The factor correlation matrix shows that the 3 factors are essentially independent, sharing at most 1% of the variance.

Note that Practicality and Tough-mindedness are not only remote from our three clusters, but have very low commonalities (h^2), i. e. .139 and .262; these two features are of course related, and suggest that while these two scales may be useful in profile analyses, they do not fit well into the PEN scheme. Dogmatism also has a rather low h^2 (.41), and does not fit too well into the scheme. We will give factor analyses omitting dogmatism and practicality; they have the least theoretical basis for inclusion. Tough-mindedness (or masculinity, as it was originally named), does have such theoretical links, and is therefore retained.

The low h^2 values for "dogmatic" and "practical" suggesting that it might be better to omit these scales from the factor analysis, Tables 4 and 5 show the results for males and females separately; the fac-

tor structure is clearly improved, and sociability now has much higher loadings on the E factor (.418 and .395, respectively). Hyperplane counts are 3, 6 and 5, and 2, 6 and 7, respectively. Maximum simple structure is at Delta = -40.5 and 0.0 respectively.

A final attempt to gain an understanding of the complex structure of the 21 variables involved *target rotation*. It was felt that the analytic rotation was perhaps not achieving the best representation of the factor loading matrix. To this end, an orthogonal target rotation was performed, using a 1,0 target matrix, the 1s defining the scales for P, E, and N, respectively. All other loadings were set to 0. The Kaiser least squares criterion was used again, maximizing the spatial congruency between the two factor structures. The overall loading similarity coefficient was 0.80, with all congruence coefficients greater than 0.80 for P, E, and N factors respectively. Although these values appear low by conventional standards, they are in fact significantly high given the artificially constrained target matrix loading structure. Table 6 below shows the resultant three factor target rotation structure matrix.

Table 6. Targeted Factors Pattern Matrix for total sample.

	Factor 1	Factor 2	Factor 3
Activity	0.5891	-0.3373	0.0114
Sociable	0.4441	-0.3479	0.2215
Expressive	0.4562	0.3324	0.3828
Assertive	0.6342	-0.3492	0.1305
Ambitious	0.7183	-0.1840	-0.2273
Dogmatic	0.4532	0.4291	0.1291
Aggression	0.4619	0.4016	-0.3911
Inferiority	-0.2637	0.8114	0.0510
Unhappy	-0.1060	0.8328	0.0549
Anxiety	-0.0434	0.8583	-0.0513
Dependence	-0.1750	0.8182	0.0620
Hypochondr.	0.0440	0.7673	-0.0245
Guilt	0.0759	0.8233	-0.0461
Obsessive	0.3828	0.4725	-0.5274
Risk-taking	0.2250	-0.0435	0.8290
Impulsive	0.1322	-0.3213	0.7051
Irresponsible	-0.2175	0.4399	0.7336
Manipulative	0.3994	-0.0114	0.2953
Sensation-seek.	0.4944	-0.1002	0.5264
Toughminded	0.2522	-0.3582	0.2663
Practical	-0.2197	-0.2447	0.1769

For Factor 1(E) all targeted variables have loadings of above .4. For Factor 2(N) all targeted variables have loadings of above .4. For Factor 3(P) only four targeted variables have loadings of above .4, but of course "toughmindedness" and "practicality" have such poor h^2 values that they have little representation in the present factor space. Clearly further work will have to be done to achieve a seven-scale combination for psychoticism.

Summary and Conclusions

Factor analysis and multidimensional scaling methods (smallest space analysis) have been applied to 21 scales theoretically relevant to the superfactors P, E and N. Reasonable factors and clusters have been found to identify these superfactors, but (1) not all scales find a representation on the three factors, and (2) some scales load on more than one factor. While on the whole structure was as expected, there were also some deviations from expectation. In part these may be due to the nature of the sample, and to the conditions of testing. The sample was largely composed of business people, with only a smattering of working class representatives, and/or students, and many were tested in connection with job-related conditions, e.g. selection or advancement. The EPP was constructed for commercial purposes, and hence these are the conditions under

which it is likely to be used most frequently; that even under conditions favouring dissimulation the scales still correlate together in meaningful ways is a tribute to the robustness of the theory underlying this study.

The scales originally drawn up to cover a wide sector of personality (Eysenck and Wilson, 1975) were based on a large body of published material, and our present data duplicate earlier findings. Thus Hernandez and Manger (1980) showed that while *assertiveness* correlated with E, aggressiveness correlated with P. Similarly, Allsop, Eysenck and Eysenck (1991) showed that as expected Machiavellianism correlated with P, and at a lower level with E; there was no correlation with N. There is clearly a strong, replicable pattern of relationships defining our higher-order factors or dimensions, a feature which also becomes apparent in the large number of transcultural factor comparisons that have been made for P, E and N (Eysenck and Eysenck, 1983; Barrett and Eysenck, 1984).

These considerations are relevant to answering the important questions: Is there a paradigm in personality research? (Eysenck, 1983), and; Can personality ever be scientific? (Eysenck, 1986). To arrive at a positive answer we must go beyond simple psychometrics and consider seriously the usefulness of *theory* (Eysenck, 1984, 1985). The theory relating to P, E and N is based on the bio-social nature of man (Eysenck, 1980a, b), and accordingly extends research beyond correlational to causal, biological factors (Eysenck, 1990). Factor analysis and other psychometric techniques are a useful *pons asinorum*, but by themselves they are a poor guide to truth.

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