

PERSONALITY FACTORS IN THE EYSENCK PERSONALITY QUESTIONNAIRE

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Summary—Hierarchical factor analyses were carried out on raw scored EPQ data yielded from two samples of subjects, a Gallup adult quota sample of 1198 subjects and 406 university undergraduates. Each sample was split by sex providing six data sets for analysis. Results at the second order level clearly indicated the recovery of practically all the E, N and L items as three distinct factors, P item recovery differed among males and females. Adult female and student female subject groups did not show clear recovery of a substantial majority of P items. Although P, as a factor, did not appear recognisably in the male student sample, this was interpreted as being due either to the low subject:variable ratio and/or to the low subject number ($N = 171$) and its resultant lack of definition of initial P item variance. The P factor appeared most strongly as a second order in the total Gallup, total student, and male Gallup sample.

The Eysenck Personality Questionnaire (EPQ) is a relatively new personality inventory, introduced by Eysenck and Eysenck (1975) as a measure of Extraversion (E), Neuroticism/Anxiety (N), Psychoticism (P) and including a Social Desirability scale (L) (Eysenck and Eysenck, 1976; Buros, 1978). The location of factors in hierarchical factor analysis has, however, been open to question, Eysenck (1978) claiming that they generally appear at the 2nd or 3rd order, although they may also appear at the 1st order (Eysenck and Eysenck, 1968).

Recently Loo (1979) presented results from a hierarchical item factoring of the EPQ, using 262 university students as subjects. He extracted sixteen oblique 1st order factors, six 2nd order, and two 3rd order factors; principal components being the extraction method employed at all levels. Only at the 2nd order did he find a factor akin to L, E, N or P, this factor he named Social Extraversion. However, there are reasons to suggest that the results are misleading. On a general level, there was a lack of information as to the criteria adopted in the factoring procedures, in addition there was careless naming of factors at the 1st and 2nd order levels, e.g. 1st order Impulsivity, Cooperative Sociability; 2nd order Psychopathy. Specifically, no information was provided as to the tests used for ceasing to extract factors from any of the orders; grounded (Hendrickson and White, 1966) or non-grounded (Cattell and White, 1962) higher order rotation procedures were not specified; apparently no attempt was made to seek a maximum hyperplane count (HC) for each oblique rotation, although the HCs reported were so high that this is probably not so important; and finally no mention was made of oblique factor intercorrelations at any level. Loo also used a strange procedure for his higher order factor interpretation, he interpreted these factors on the basis of Varimax solutions, then, assuming that they would remain the same, obliquely rotated them to obtain correlations for further factoring; no test or evidence was reported to justify this procedure. The final, and perhaps the most worrying aspect of the results is that Loo appears to have overfactored at the 1st order, there being nine factors identified with ≤ 5 item salients $> \pm 0.29$; factor V Nervous Tension consists of three high loading items, N31, N41, and N75, and E25 (0.30), this is without any doubt a specific.

Thus it was seen as essential to carry out an analysis that took into account the points made above, and to produce results that rested on a sounder methodological footing (Vaughan, 1973).

METHOD

Subjects

235 male and 171 female undergraduates were administered the EPQ under group testing conditions. A Gallup quota sample of 600 English male adults and 598 English female adults was also used as data for this study. The characteristics of this sample and details of data collection are provided in Eysenck (1979). The samples were split into six data subsets of total student ($N = 406$), student male ($N = 171$), student female ($N = 235$), total Gallup ($N = 1198$), Gallup male ($n = 600$) and Gallup female ($N = 598$). E, P, N, and L scale means and standard deviations were calculated for each sex specific sample.

Factor Analysis

For each of the 6 raw scored data sets, phi coefficient matrices were computed. Measures of sampling adequacy (MSA) were computed for all six data sets prior to each level of factoring (Kaiser and Rice, 1974; Cerny and Kaiser, 1977; Meyer *et al.*, 1977). A principal components analysis was carried out, using both the Kaiser-Guttman (K-G) and Scree test (Cattell, 1966; Cattell and Vogelmann, 1977; Horn and Engstrom, 1979) to select those factors for retention at the 1st order level. The factors thus retained were rotated using the direct oblimin procedure (Jennrich and Sampson, 1966; Jennrich, 1979) with the δ parameter swept from -30 to 0.5 in steps of 0.5 , the convergence criterion set at 0.00001 , with a maximum of 400 iterations per δ . The associated overall HC (± 0.1 bound) for each of these rotations was noted, the appropriate solution being given by the maximum HC and its associated δ . Then the rotation was again carried out around this δ value in steps of 0.1 to 'fix' the solution. (Direct oblimin has the attractive characteristic that obliquity can be varied from near orthogonality to strong obliquity by varying the parameter δ , thus the solution is virtually unconstrained by the rotation method.) Again the maximum HC determined the solution, the minimum overall sum of squared loadings within the hyperplanes fixed the solution within possible equal HC plateaus. This solution was accordingly interpreted. Given that a sufficient number of factors had been extracted at this order, a 2nd order solution was undertaken. This involved principal component factoring of the 1st order factor correlation matrix, a Hendrickson-White (H-W) grounding operation on the chosen unrotated 2nd order factors, then the same direct oblimin procedures as above to yield a maximised simple structure solution. This higher order factoring procedure would continue as required. However, there is a real problem with the extraction criteria to be used at the higher order stages of factoring. The K-G criterion, if applied to the unrotated higher order factor eigenvalues, will yield results that differ markedly from the grounded variable unrotated higher order factor eigenvalues (if they can be said to represent such). The H-W operation will obviously boost the variance explained by the inclusion of all item variables into that factor. In order to resolve this apparent dilemma, it was decided that extraction at higher orders would be under a loose expectation of finding representative factors for E, N, P and L. This involved taking out 2, 3 and 4 factors above the K-G criterion on the nongrounded unrotated higher order factors, even when it indicated a lesser number. The solution showing the most interpretable clarity and most closely approximating the E, N, P and L factorial structure was chosen. Finally, oblique rotated factor variance coefficients were calculated for the higher order factors, and the overall significance of the simple structure solution assessed where possible by the Bargmann Test (1955) using the tables provided by Kameoka and Sine (1978) given in Cattell (1978). Mean HC per solution were used in these comparisons as the Bargmann test tables present values for only generalised solutions.

RESULTS

The E,N,P and L scale means and standard deviations for the sex specific subject groups are shown in Table 1, with the associated mean and standard deviation of each

Table 1. Scale means and standard deviations

Scale	Gallup male N = 600		Gallup female N = 598		Student male N = 171		Student female N = 235	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
L	7.6	4.1	9.3	4.1	4.9	3.5	5.7	3.3
E	12.6	5.2	12.7	4.9	12.6	5.0	13.7	4.9
N	9.8	5.4	13.2	5.2	10.2	5.0	11.7	5.1
P	4.0	3.7	2.4	2.3	4.9	3.5	3.4	2.9
AGE	34.3	12.1	33.7	12.2	21.1	5.6	20.2	3.3

sample age. Tables 2–7 present the first order pattern solution and associated statistics for each of the six data sets; only salient loadings $> \pm 0.3$ appear in the tables. Factor names were chosen on the basis of reasonably clear loading patterns. Those factors with apparently complex patterns were left unnamed. Premature naming of such factors is not helpful, rather, the factors are presented purely for future reference in any other item factoring of the EPQ. (The stability of such ‘unexpected’ factors was not known at the time of writing.) The rotations for each final δ all reached convergence at less than the 400 iterations specified. All solutions were shown to have reached a satisfactory simple structure using Bargmann’s test ($p < 0.01$). All 1st order factor correlations were less than ± 0.26 .

All solutions were subsequently taken to the 2nd order, using the procedures described above. Tables 8–13 present the six 2nd order pattern solutions. Once again all rotations for the retained δ reached convergence at less than 400 iterations. Factor naming was, for these factors, straightforward. Pearson r and Tucker congruences were subsequently computed between all factors in all six solutions in order to aid factor matching across data sets. Coefficients > 0.75 were taken as demonstrating sufficient similarity for two factors to be said to be jointly represented. Factors 3 and 4 in the student female, factor 4

Table 2. Total student primaries

Extraversion Factor 1	Moody irritability Factor 2	Social desirability Factor 3	Anxious worrying Factor 4	Caution Factor 5	Factor 6
E1 0.303	N3 0.558	L4 0.545	P11 -0.439	P2 0.316	L20 0.324
E5 0.636	N7 0.614	L8 0.450	N12 0.483	P6 0.417	P26 0.375
E10 0.664	N15 0.412	L16 0.499	N19 0.380	P9 0.517	P30 0.552
E14 0.516	N23 0.655	L24 0.369	N27 0.449	L13 -0.320	N41 0.351
E17 0.549	N31 0.337	L28 0.307	N31 0.339	P22 0.381	E56 0.335
E21 0.686	N34 0.386	L39 0.429	P33 -0.437	P37 0.475	P65 0.447
E25 0.533	N41 0.364	L44 0.407	N34 0.413	P57 0.529	P76 0.385
E29 0.589	N54 0.381	L48 0.347	N38 0.430	P67 0.436	L85 0.344
E32 0.540	N58 0.584	L59 0.553	N41 0.315	P74 0.644	P87 0.430
E40 0.498	N62 0.434	L63 0.511	P53 -0.462	L81 -0.498	
E42 0.621	N68 0.426	N66 -0.346	P71 -0.327		
E45 0.486	N75 0.380	L78 0.485	N72 0.542		
E49 0.387	N77 0.409	L89 0.490	P79 -0.331		
E52 0.642	N84 0.511		N80 0.465		
E60 0.325			P83 -0.339		
E64 0.307					
E70 0.533					
E82 0.584					
E86 0.649					
Eigenvalue (unrotated)					
7.686	5.694	4.210	3.188	2.329	2.111

Total solution HC = 275.
 Total solution HC% = 51.
 Mean HC = 46.
 $\delta = 4.1$.
 MSA = 0.75.

Table 3. Student male primaries

	Sociability Factor 1	Moody irritability Factor 2	Social desirability Factor 3	Anxious worrying Factor 4	Liveliness Factor 5	Insensitivity Factor 6	Factor 7	Factor 8	Factor 9								
E5	0.551	N3	0.460	L4	0.571	P6	-0.379	E1	0.315	P11	0.440	P9	0.412	P18	0.404	L20	0.301
E10	0.564	N7	0.507	L8	0.547	N12	0.673	E14	0.575	N15	0.476	L13	-0.350	E36	0.356	N31	-0.356
E17	0.327	N23	0.371	L16	0.462	N19	0.463	E21	0.352	P22	0.356	E17	0.376	P37	0.349	L35	0.533
E21	0.505	P30	0.548	L24	0.422	N27	0.465	P22	0.341	P26	0.551	L20	-0.304	P43	0.379	L48	0.359
E29	0.447	N38	0.307	L28	0.476	N34	0.492	E25	0.646	P33	0.607	P22	0.309	P50	0.328	L51	0.546
E32	0.415	N41	0.403	L39	0.577	N38	0.406	F42	0.367	P53	0.350	N47	0.330	P61	0.503	L55	0.368
E40	0.552	N54	0.465	L44	0.559	N47	0.343	E52	0.460	N68	0.331	E56	-0.459	P67	0.668	N75	-0.412
E42	0.393	N58	0.380	L59	0.563	P53	-0.513	L55	-0.480	P71	0.492	P57	0.439	P76	0.311	N84	-0.312
E45	0.709	N62	0.412	L63	0.485	N66	0.324	E60	0.523	P79	0.331	N58	0.349			L85	0.527
E49	0.441	P65	0.573	L78	0.572	N72	0.674	E82	0.516	P83	0.496	P74	0.604				
E52	0.367	P76	0.555	L89	0.464	N80	0.458	N88	-0.399			L81	-0.541				
E70	0.712	N77	0.511														
E86	0.650	P87	0.483														
Eigenvalue (unrotated)	8.225		6.213		4.076		3.557		2.805		2.552		2.340		2.265		2.098

Total solution HC = 418.

Total solution HC₀ = 52.

Mean HC = 46.

 $\delta = -1.2$.

MSA = 0.54.

Table 4. Student female primaries

	Extraversion Factor 1	Anxious worrying Factor 2	Social desirability Factor 3	Moody irritability Factor 4	Caution Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
E1	0.319	N12	L4	N3	P2	P2	P22	P11	E1
E5	0.595	N15	L8	N7	P6	L8	P26	N19	E52
E10	0.686	N19	L24	N15	P9	P18	P46	P30	E56
E14	0.453	N27	L28	N23	L13	L20	P65	P37	P79
E17	0.620	P30	L35	N58	P50	P37	P76	L55	0.465
E21	0.683	N31	L39	N62	P53	E45	P83	N68	
E25	0.561	N34	L48	P71	P57	P67	L85	N88	
E29	0.648	E36	L51	N84	P74	E70	L85	L89	
E32	0.525	N38	L59		L81	P87	P332	P90	
E36	0.302	N41	L63						
E40	0.478	N47	L37						
E42	0.631	P53	L78						
E45	0.482	N72	N80						
E49	0.321	N75	L89						
E52	0.645	N77							
E56	0.374	N80							
E64	0.378								
E70	0.505								
E82	0.538								
E86	0.734								
Eigenvalue (unrotated)	7.889		3.932	3.354	2.653	2.347	2.148	2.052	2.042
Total solution HC = 440.		5.986							
Total solution HC% = 54.									
Mean HC = 49.									
$\delta = 0.0$.									
MSA = 0.66.									

Total solution HC = 440.
 Total solution HC% = 54.
 Mean HC = 49.
 $\delta = 0.0$.
 MSA = 0.66.

Table 5. Total Gallup primaries

	Extraversion Factor 1	Anxious worrying Factor 2	Social desirability Factor 3	Moody irritability Factor 4	Factor 5	Insensitivity Factor 6	Social liveliness Factor 7	Caution Factor 8	Factor 9
E5	0.334	P6	L4	N3	P18	L4	E1	P9	P2
E10	0.420	N12	L8	N7	P30	P11	E5	P18	E5
E14	0.483	N19	L16	N15	P43	P26	E10	P22	E21
E17	0.665	N27	L20	N23	P65	P33	E40	P43	E31
E21	0.380	N31	L24	N58	P67	P46	E42	P57	N41
E25	0.584	N34	L28	N62	P76	P71	E45	P67	E42
E29	0.678	N38	L39	N68	N77	P79	E60	P74	E42
E32	0.511	N41	L44	N77	P87	P83	E64		N75
E36	0.403	N47	L48	N84		P90	E70		
E40	0.445	P53	L51				L85		
E42	0.326	N66	L59				E86		
E45	0.377	N72	L63						
E49	0.340	N75	L73						
E52	0.720	N80	L81						
E70	0.385								
E82	0.529								
E86	0.368								
Eigenvalue (unrotated)									
	7.690	6.235	4.603	3.800	1.975	1.757	1.677	1.613	1.461

Total solution HC = 492.

Total solution HC% = 61.

Mean HC = 55.

 $\delta = -0.8$.

MSA = 0.87.

Table 6. Male Gallup primaries

	Interpersonal social desirability								
	Extraversion Factor 1	Anxious worrying Factor 2	Moody irritability Factor 3	Factor 4	Factor 5	Psychotic depression Factor 6	Abstract morality Factor 7	Caution Factor 8	Factor 9
E5	0.494	P6	N3	E5	L4	P30	L8	P9	L35
E10	0.542	N12	N7	P11	L8	P43	L13	P18	L48
E14	0.509	N19	N15	P26	L16	P50	L16	P22	L51
E17	0.684	N27	N23	P33	L24	P53	L20	P37	L73
E21	0.529	N31	N58	E42	L39	N62	L28	P43	L73
E25	0.625	N34	N62	P61	L59	P65	L44	P57	L73
E29	0.659	N38	N68	P71	L63	P76	L78	P67	L73
E32	0.537	N41	N77	L85	L69	N77	L81	P74	L73
E36	0.375	N47	N84	P90	P79	P87	L85		
E40	0.609	P53					L89		
E42	0.517	N66							
E45	0.520	N72							
E49	0.330	N75							
E52	0.729	N80							
E70	0.576	N88							
E82	0.483								
E86	0.534								
Eigenvalue (unrotated)	7.902	6.803	4.429	4.215	2.240	1.915	1.771	1.609	1.565

Total solution HC = 469.
 Total solution HC% = 58.
 Mean HC = 52.
 $\delta = -0.2$
 MSA = 0.83.

Table 7. Female Gallup primaries

Extraversion Factor 1	Neuroticism Factor 2	Social desirability Factor 3	Anxious worrying Factor 4	Factor 5	Social liveliness Factor 6	Factor 7							
E5	0.458	N3	0.365	L4	0.363	P6	-0.315	P18	0.506	E1	0.482	N3	0.395
E10	0.493	N7	0.334	L8	0.615	N12	0.546	P30	0.361	E10	0.384	N7	0.392
E14	0.546	N15	0.385	L13	0.343	N19	0.542	P33	0.426	E42	0.301	N23	0.342
E17	0.655	N23	0.430	L16	0.500	N34	0.434	P43	0.481	E60	0.496	P57	0.479
E21	0.490	N27	0.350	L20	0.368	N38	0.378	P65	0.434	E64	0.412	N58	0.323
E25	0.523	N31	0.685	L24	0.530	P53	-0.413	P67	0.583	L85	0.377	P74	0.588
E29	0.639	E32	-0.364	L28	0.368	N66	0.439	P71	0.314	E86	0.432	L81	-0.321
E32	0.481	N34	0.424	L35	0.371	N72	0.495	P87	0.367			N84	0.323
E33	0.432	N38	0.375	L39	0.450	N80	0.580						
E36	0.432	N41	0.697	L44	0.485	N88	0.328						
E40	0.499	N47	0.328	L48	0.507								
E42	0.421	N54	0.357	L51	0.346								
E45	0.451	N58	0.382	L55	0.307								
E49	0.425	N62	0.419	L59	0.505								
E52	0.701	N68	0.357	L63	0.596								
E70	0.498	N75	0.745	L73	0.348								
E82	0.562	P76	0.388	L78	0.346								
E86	0.402	N77	0.425	L89	0.342								
		P87	0.377										
Eigenvalue (unrotated)													
	7.364												
		5.963			3.863		2.912		1.924		1.864		1.742

Total solution HC = 366.
 Total solution HC% = 58.
 Mean HC = 52.
 $\delta = -0.4$.
 MSA = 0.80.

Table 8. Total student secondaries

Extraversion		Neuroticism		Psychoticism		Social desirability	
Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading
Factor 1		Factor 2		Factor 3		Factor 4	
E1	0.310	N3	0.403	P2	0.389	L4	0.404
E5	0.646	N7	0.357	P6	0.546	L8	0.477
E10	0.653	N12	0.375	P9	0.457		
E14	0.400	N15	0.515	P11	0.300	L13	0.353
E17	0.480	N19	0.438	N12	-0.304	L16	0.388
E21	0.659	N23	0.456	P18	0.367	L20	0.357
E25	0.455	N27	0.453	P22	0.444	L24	0.390
E29	0.513	P30	0.444	P26	0.308	L35	0.334
E32	0.519	N31	0.554	P33	0.382	L39	0.348
E36	0.324	N34	0.598	E36	0.365	L44	0.372
E40	0.533	N38	0.533	P37	0.486	L48	0.399
E42	0.612	N41	0.635	P46	0.378	L51	0.369
E45	0.550	N47	0.345	P53	0.364	L59	0.426
E49	0.416	N54	0.395	P67	0.422	L63	0.409
E52	0.539	N58	0.359	P71	0.351	L78	0.410
E56	0.404	N62	0.358	N72	-0.384	L81	0.370
E60	0.364	P65	0.406	P74	0.330	L85	0.348
E64	0.311	N66	0.321	N80	-0.356	L89	0.439
E70	0.608	N68	0.384				
E82	0.540	N72	0.433				
E86	0.674	N75	0.556				
		P76	0.392				
		N77	0.543				
		N80	0.382				
		P80	0.362				
		N88	0.367				
Rotated factor variance coeff.		6.346		5.928		4.362	
						3.926	

Total solution HC = 166.
 Total solution HC% = 46.
 $\delta = -25.2$.
 MSA = 0.51.

Table 9. Student male secondaries

Extraversion Factor 1		Neuroticism Factor 2		Social desirability Factor 3		Factor 4	
Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading
E5	0.644	N3	0.334	L4	0.509	P2	0.401
E10	0.669	N12	0.425	L13	0.374	P6	0.518
E14	0.435	N15	0.507	L16	0.400	P9	0.523
E21	0.662	N19	0.392	L20	0.355	P11	0.331
E25	0.429	N23	0.458	L39	0.400	P18	0.352
E29	0.388	P26	0.315	L44	0.507	P22	0.421
N31	-0.412	N27	0.490	L48	0.518	E36	0.439
E32	0.514	P30	0.477	P50	0.352	P37	0.446
P33	0.309	N31	0.411	L51	0.309	P46	0.355
E36	0.304	N34	0.567	N58	-0.386	P53	0.343
E40	0.425	N38	0.419	L59	0.424	P57	0.399
E42	0.640	N41	0.504	L63	0.429	P61	0.411
E45	0.511	N54	0.358	P79	-0.374	P67	0.573
E49	0.526	N62	0.412	L81	0.507	N72	-0.364
E52	0.530	P65	0.519	L85	0.477	P74	0.382
E56	0.333	N66	0.379	L89	0.424		
E60	0.461	N68	0.394				
E70	0.543	N72	0.372				
E82	0.582	N75	0.383				
E86	0.569	P76	0.449				
		N77	0.547				
		N80	0.331				
		P83	0.329				
		P87	0.309				
		N88	0.385				
	6.463		5.921		4.651		4.450

Rotated factor variance coeff.

Total solution HC = 153.
 Total solution HC% = 43.
 $\delta = -6.3$.
 MSA = 0.57.

Table 10. Student female secondaries

Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading
Extraversion Factor 1		Neuroticism Factor 2		Factor 3		Factor 4	
E1	0.324	N3	0.435	P3	-0.339	L4	0.302
E5	0.530	N7	0.454	P9	-0.460	L8	0.376
E10	0.467	N15	0.480	L13	0.529	P11	0.381
E14	0.328	N23	0.544	L24	0.370	N12	-0.355
E17	0.361	P30	0.349	L28	0.354	L16	0.426
L20	0.411	N31	0.546	E29	-0.455	N19	-0.423
E21	0.489	N34	0.527	P37	-0.463	E29	-0.493
E25	0.371	N38	0.332	L39	0.333	L48	0.351
P26	0.466	N41	0.569	P53	-0.387	N66	-0.366
E29	0.402	N47	0.383	L55	0.353	L73	0.346
P30	0.401	N54	0.464	P57	-0.365	L78	0.440
E32	0.336	N58	0.439	L59	0.402	N80	-0.511
P33	0.322	N62	0.473	P61	-0.334	N88	-0.418
E36	0.330	P65	0.356	P71	-0.318	L89	0.460
E40	0.448	N68	0.413	P74	-0.456		
E42	0.455	N72	0.311	L81	0.494		
E45	0.461	N75	0.601	L85	0.346		
P46	0.330	P76	0.324				
E49	0.333	N77	0.511				
E56	0.514	N84	0.452				
E60	0.382	N88	0.313				
E70	0.572						
E82	0.369						
P83	0.395						
E86	0.532						
P87	0.397						
Rotated factor variance coeff.	6.006		5.555		4.322		3.831

Total solution HC = 144.
 Total solution HC% = 40.
 $\delta = 0.6$.
 MSA = 0.55.

Table 11. Total Gallup secondaries

Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading
Neuroticism Factor 1							
N3	0.524	Extraversion Factor 2					
N7	0.552	E1	0.324	Psychoticism Factor 3			
N12	0.425	E5	0.552	P6	0.373	Social desirability Factor 4	
N15	0.492	E10	0.668	P9	0.323	L4	0.336
N19	0.482	E14	0.479	P11	0.488	L8	0.525
N23	0.615	E17	0.504	P18	0.404	L13	0.403
N27	0.520	E21	0.557	P22	0.431	L16	0.390
N31	0.607	E25	0.449	P26	0.550	L20	0.435
N34	0.632	E29	0.456	P30	0.383	L24	0.465
N38	0.578	E32	0.417	P33	0.515	L28	0.337
N41	0.601	E36	0.391	P37	0.448	L35	0.418
N47	0.414	E40	0.613	P43	0.485	L39	0.355
N54	0.412	E42	0.558	P46	0.302	L44	0.390
N58	0.469	E45	0.618	P50	0.307	L48	0.442
N62	0.483	E49	0.340	P53	0.398	L51	0.383
N66	0.358	E52	0.549	P57	0.339	L59	0.387
N68	0.434	E56	0.375	P61	0.345	L63	0.490
N72	0.485	E60	0.392	P65	0.426	L69	0.387
N75	0.637	E82	0.504	P67	0.374	L73	0.394
N77	0.548	E86	0.634	P71	0.436	L78	0.454
N80	0.448			P76	0.390	L81	0.438
N84	0.375			P83	0.406	L85	0.384
N88	0.431			P87	0.310	L89	0.345
Rotated factor variance coeff.	6.561		5.937	P90	0.434		
					4.849		4.355

Total solution HC = 181.
 Total solution HC% = 50.
 $\delta = 0.2$.
 MSA = 0.54.

Table 12. Gallup male secondaries

Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading				
Neuroticism Factor 1	N3	0.557	Extraversion Factor 2	E1	0.353	Psychoticism Factor 3	P2	0.340	Social desirability Factor 4	L4	0.401
	N7	0.550		E5	0.522		L4	-0.309		L8	0.553
	N12	0.403		E10	0.678		P6	0.384		L13	0.432
	N15	0.506		E14	0.446		P9	0.415		L16	0.424
	N19	0.482		E17	0.341		P11	0.543		L20	0.461
	N23	0.664		E21	0.500		P18	0.422		L24	0.487
	N27	0.517		E25	0.371		P22	0.482		L28	0.381
	N31	0.566		E29	0.339		P26	0.650		L35	0.315
	N34	0.625		P30	0.326		P30	0.340		L39	0.366
	N38	0.571		E32	0.365		P33	0.535		L44	0.373
	N41	0.518		E36	0.438		P37	0.497		L48	0.410
	N47	0.452		E40	0.601		P43	0.513		L55	0.340
	N54	0.440		E42	0.528		P46	0.313		L59	0.498
	N58	0.472		E45	0.684		P50	0.353		L63	0.524
	N62	0.506		E49	0.322		P53	0.403		L69	0.390
	N68	0.410		E52	0.421		P57	0.430		L73	0.333
	N72	0.372		E56	0.388		P61	0.415		L78	0.424
	N75	0.542		E60	0.411		P65	0.402		L81	0.496
	N77	0.548		E70	0.694		P67	0.336		L85	0.491
	N80	0.435		E82	0.489		P71	0.421		L89	0.351
N84	0.410	E86	0.651	P74	0.378						
N88	0.486			P76	0.383						
				P83	0.419						
				P90	0.463						
Rotated factor variance coeff.	6.373		5.919		5.546		4.609				

Total solution HC = 168.
 Total solution HC% = 47.
 $\delta = 0.5$.
 MSA = 0.56.

Table 13. Gallup female secondaries

Var. title	Loading	Var. title	Loading	Var. title	Loading	Var. title	Loading
Neuroticism Factor 1	0.504	E1	0.440	N7	-0.333	P2	0.323
	0.428	E5	0.524	L8	0.473	P18	0.348
	0.461	E10	0.646	L13	0.405	P26	0.310
	0.437	E14	0.371	L16	0.302	P30	0.401
	0.505	E17	0.433	L20	0.353	P33	0.406
	0.522	E21	0.524	L24	0.411	P43	0.402
	0.489	E25	0.354	L35	0.426	E45	0.309
	0.464	E32	0.349	L44	0.331	P53	0.388
	0.622	E40	0.542	L48	0.402	P65	0.454
	0.549	E42	0.558	L51	0.420	P67	0.446
	0.487	E45	0.511	P57	-0.351	N68	0.342
	0.459	E52	0.432	L63	0.367	P71	0.375
	-0.333	E56	0.388	L69	0.348	P76	0.419
	0.315	E60	0.513	L73	0.376	P79	0.308
	0.378	E64	0.403	P74	-0.424	P87	0.492
	0.407	E70	0.514	L78	0.401		
	0.441	E82	0.426	L81	0.418		
	0.558	E86	0.614	L85	0.331		
	0.538			L89	0.335		
	0.485						
0.507							
0.337							
0.420							
Rotated factor variance coeff.	5.848		5.286		3.989		3.664

Total solution HC = 180.
 Total solution HC% = 50.
 $\delta = -21.0$.
 MSA = 0.52.

Table 14. Numbers of E, N, P and L items loading on the second order factors

Sample	E	N	L	P
Total students	21 ₁	23 ₂	17 ₄	14 ₃
Male students	18 ₁	19 ₂	13 ₃	13 ₄
Female students	19 ₁	18 ₂	L/P	N/L
			ITEMS	ITEMS
Total Gallup	20 ₂	23 ₁	20 ₄	22 ₃
Male Gallup	20 ₂	22 ₁	20 ₄	23 ₃
Female Gallup	18 ₂	22 ₁	16 ₃	13 ₄

Where subscript denotes factor extraction order.

No. of E scale items = 21.

No. of N scale items = 23.

No. of L scale items = 21.

No. of P scale items = 25.

in the Gallup female, and factor 4 in the student male, could not be matched across all six studies. No tests of simple structure were made on these data as there are no tabled probability values available for this size of solution. Table 14 presents a summary of the salient scale items of E, N, P and L, appearing in the 2nd order factor solutions. All 2nd order factor correlations were less than ± 0.2 excepting that between factors 1 and 3 in the female student data. No further analysis took place.

DISCUSSION

Before discussing these results, it is perhaps of value to state the procedures adopted for reducing the 49 total 1st order factors extracted to a common and specific subset. Those factors on which the same loading pattern was clearly discernable across all six studies were considered replicable primaries. The factors remaining which could be named were considered specific, just how specific depended upon cross matches by sex and by status (adult-student). For the 24 total 2nd order factors, this procedure was not required as the patterns were all so similar in but a few cases noted above. In all six 1st order studies, two factors were common, Moody Irritability and Anxious Worrying; two factors were common to five of these studies, Extraversion and Social Desirability; in the student male sample, Sociability was a more accurate interpretation of the item loadings than was the global concept of Extraversion; in the Gallup male study, Social Desirability appeared to split into two meaningful factors of Interpersonal Social Desirability and Abstract Morality. Notably for the Extraversion factor, practically the entire scale emerged at the 1st order, supporting in part Eysenck and Eysenck's (1968) claim that E, N and P can be found at the 1st as well as the 2nd and 3rd order. The remaining 1st order factors that were named did not appear to be status specific or sex specific, rather they were virtually study specific.

The 2nd order factors from the six data sets are in one sense quite spectacular. From Table 14, it can be seen that practically all the items of the E, N and L scales were recovered across the data sets. The P scale items, however, appeared with such clarity only in the total Gallup and male Gallup samples. Factor similarity analysis demonstrating that the total Gallup and total student factors were very similar in content if not in quantity of salients.

Where the factors (subsequently named using Eysenck's descriptions) did not appear, two interpretations are available: either these factors are approximating the concepts or they are sample specific item patterns. Noting the samples in which no matching occurred, factors 3 and 4 in the student female sample appear to represent two sets of covarying items, L and P, L and N. Why this should be so is not at all clear [Loo (1979) reported such evidence of covariance between the L and P scales in his student female subsample]. However, the difficulty of obtaining a clear P factor is probably due to the sensitivity of the factor to the item score patterns, notably the mean of the raw scores on the P scale for both female samples (student and Gallup) is very low for a 25 item

scale—the score distribution is greatly distorted; there is simply insufficient variance to be factored. The missing P factor in the student male sample may perhaps be attributed to the very low variable to subject ratio in this group (1:1.9).

Interestingly, a factor of Impulsivity did not appear in any of the data sets (unlike Loo's results). However, this is not very surprising as Eysenck and Eysenck (1977, 1978) stated that general Impulsivity items were specifically excluded from the EPQ E scale. They did this because of the correlation of Impulsivity with both E and P, which would yield an artifactual correlation between factors E and P in a factor analysis. They also concluded that general Impulsivity was related more to P and abnormality rather than to Extraversion *per se*; additionally, the Impulsivity concept was split into four separate components and thus viewed as a factor complex rather than a unitary dimension, contrary to Guilford's (1975, 1977) statements and primary factor constructs. Thus Loo's factor of 'Impulsivity' can be seen as the result of premature naming of a specific. Factors with only four or less salients $> \pm 0.3$ as a 90 item questionnaire cannot be regarded as common factors (Nunnally, 1978).

On a final methodological note, there is one possible difficulty in acceptance of these results, as they stand. The charge of underfactoring may be levelled against these analyses, essentially at the 1st order extraction phase. The arguments against this have been put forward above—the emergence of small factors loading on a few items (specifics) and the use of the scree test for determining the number of factors to be extracted within the K–G bound. Looking at Tables 2 to 7, it is apparent that the last one or two factors are becoming in some cases item cluster specifics, and in others, producing dissociated item factors which cannot be interpreted. Perhaps the strongest argument is that at the 2nd order, extremely clear results were demonstrated across all 6 data sets, results as would generally be expected by Eysenck and Eysenck's original studies on these factors.

Also of a purely methodological interest, is the factorial behaviour associated with MSA coefficients. An MSA coefficient > 0.65 indicates that the data are relatively suitable for factoring, the absolute lower limit being 0.5. Generally, for the 1st order solutions, the clarity of solution remained effectively the same, given the range of MSA coefficients. For the 2nd order solutions, all MSAs were very low, yet clear replicable structures resulted. However, overall the MSA seems to indicate the degree of structural clarity, rather than any severe disruption or distortions.

In conclusion the study may be summarised as containing major results:

- (i) Eysenck's factors of E, N, P and L have been found to exist at the 2nd order level of factoring. The P factor was not found satisfactorily in the female samples, or in the lowest variable to subject ratio sample of male students.
- (ii) E appears the strongest factor at the 1st order, changing little if any at the 2nd order. N was the strongest factor only at the 2nd order in the Gallup sample subsets.
- (ii) Two 1st order factors were found to exist across all 6 data sets, Moody Irritability and Anxious Worry. Two others appeared in 5 of the 6 data sets, Extraversion and Social Desirability.
- (iv) Variable to subject ratios (ranging from 1:9 to 1:13) did not grossly affect the resultant 2nd order solution, rather a 'firming up' of loading pattern was observed.

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