

THE BIOLOGICAL BASIS OF CROSS-CULTURAL DIFFERENCES IN PERSONALITY: BLOOD GROUP ANTIGENS¹

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Strange is it, that our bloods,
Of colour, weight and heat, all pour'd together,
Would quite confound distinction, yet stand off
In differences so mighty.

Shakespeare, *All's Well That Ends Well*. II, ii.

Summary.—The present study extends previous work on the relationship between personality and blood group antigens to the consideration of cross-cultural differences. It is shown that for both neuroticism and extraversion, correlations between frequency of blood group antigens and personality over different countries are in the predicted direction. This is in line with hypotheses implicating genetic factors in the causation of differences in personality. Data also are given for the personality dimension of psychoticism, but for this no predictions were made.

There is good evidence that various countries differ with respect to the major dimensions of personality (psychoticism-superego control; extraversion-introversion; neuroticism-emotional stability) which appear to emerge from many different factor analytic studies of personality inventories carried out in many countries (Royce, 1973). These three superfactors have been given many different names, but we shall here use those used by Eysenck and Eysenck (1982) in their numerous cross-cultural studies of personality. The derivation, validation, and biological basis of these factors have all been discussed in detail by Eysenck and Eysenck (1969, 1976) and will not be discussed again here. A review of the whole field is given by Lynn (1981) who has himself made an outstanding contribution to the field of cross-cultural studies through the use of demographic indices for the measurement of national differences in personality (Lynn, 1971; Lynn & Hampson, 1975, 1977).

In addition to the numerous studies carried out by Eysenck and Eysenck and their collaborators, in which the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) is used in measuring Psychoticism, Extraversion, and Neuroticism, there are numerous other studies, reviewed by Lynn (1981), using the earlier Eysenck Personality Inventory (Eysenck & Eysenck, 1965) which gave scores only for Extraversion and Neuroticism. In addition, there is the important work of Hofstede (1976, 1980) which is only concerned

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with neuroticism. Hofstede collected his data on approximately 70,000 subjects employed in a multinational organization in 40 different nations. He required his subjects to answer on a five-point scale the question: "How often do you feel nervous or tense at work?", a question clearly related to neuroticism-anxiety. One question of course is a rather inadequate measure of a complex trait like this, but it has good face validity, high retest reliability, and the sample used is more closely equated for socio-economic status, academic ability, and other variables than are most samples in this field. Lynn (1981) and Eysenck (1982) have shown that there is quite good agreement between Eysenck's neuroticism scale scores for different countries, and Hofstede's/anxiety-question scores.

In spite of the very different measures used by Eysenck and Hofstede, on the one hand, and the demographic data on which Lynn has relied, there are unexpectedly high correlations between them when these measures are employed on identical populations. Lynn (1981) has reported a correlation of .70 between his demographic data and the Eysenck Questionnaire data and one of .75 between the Hofstede data and the demographic variables, as far as neuroticism-anxiety is concerned. As regards extraversion, comparisons are only possible between the Eysenck data and the Lynn data, Hofstede not having included any questions relating to extraversion. There are nine countries for which there are scores on both measures, and the product-moment correlation between the two scores is 0.84, indicating a high degree of consistency.

We thus have some evidence that different cultures and nations differ with respect to the major personality dimensions of Psychoticism, Extraversion, and Neuroticism, and the question arises as to possible causes of these differences. There are three major types of theories put forward in this connection. The first of these would relate personality differences to such aspects of the environment as the climate, the type of country involved, etc.; Lynn (1971) has favoured such a hypothesis and gives some factual evidence in support. The second type of hypothesis would favour accidental features in the history of a given population, such as winning or losing a war or remaining neutral; Lynn and Hampson (1977) give some evidence to support this view. It seems likely that both the first and the second hypothesis play a prominent part in the differences between scores on personality tests for different nations.

However, there is also a third possibility, namely, that there are *genetic differences* between populations and that these are linked in some way to the observed differences in personality. It is of course difficult to find a methodology which would enable us to sort out the genetic from the environmental factors, but one such approach has been suggested by Eysenck (1977).

His argument takes its starting point from the findings of Angst and Maurer-Groeli (1974) that there are significant differences in the frequency

of blood groups found among European introverts and extraverts and between highly emotional and unemotional persons. Introversions were found significantly more frequently among persons having the AB blood group. Emotionality was significantly more frequent in persons having blood group B. If we can interpret these findings as evidence for some pleiotropic mechanism linking blood groups and personality, then it will become possible to put forward testable hypotheses relating to national and racial comparisons in the personality field. In particular, Eysenck predicted that Japanese would have a significantly higher proportion of persons with the AB blood group and also that they would have a significantly smaller number of persons with blood group A than with blood group B; he used the ratio A/B to test this hypothesis. The reason for contrasting the Japanese and the English was that the Japanese had exceptionally high scores on introversion and neuroticism and that detailed figures for blood groups for both the Japanese and the English could be found in Mourant, *et al.* (1976).

Regarding the percentage of persons with blood group AB, the proportions were 3.01 in England, and 9.98 in Japan, a very sizeable difference in the predicted direction. There was some variation in different samples and in different parts of the countries in question; the extreme values of large samples were 1.63 and 4.11 for England and 6.63 and 12.88 in Japan; there was no overlap.

The ratio A/B was, as predicted, larger in England than in Japan; the mean values were 4.54 and 1.64, respectively. Variability within each country was large, ranging from 2.0 to 7.33 in England and from 1.32 to 1.95 in Japan; again there was no overlap. There seemed to be little doubt that with such very large samples (the total British sample amounted to 616,106 persons, the total Japanese sample to 421,151 persons) the predicted differences are significant statistically. These data bear out the hypothesis that there are genetic factors predisposing the Japanese to be more introverted and more neurotic than the British.

In an unpublished paper, Dr. Jogawar studied 590 young Indian subjects with respect to blood group and neuroticism, using the Cattell 16 PF. He found that persons with blood group B were more affected by feelings (Factor C), were more apprehensive (Factor O), were less self-sufficient (Factor Q₂), and were more tense (Factor Q₄) than persons with other blood group antigens. These results are all in line with the Swiss data in linking blood group B with emotional instability. (Jogawar did not test for extraversion-blood group relation.)

This agreement is encouraging, particularly as the two groups involved are racially very different, and suggest that possibly an extension of the English-Japanese comparison to other nations might be feasible. Our first step was to

look at the Hofstede data, dividing the countries into three groups of seven each, namely, seven anxiety plus countries, seven countries with average anxiety, and seven countries which were anxiety minus. Countries for which too few blood group data were available were excluded from the comparisons as obviously very large numbers are required to produce reliable data. (It will be remembered that even for the large groups available for England and Japan, quite divergent values for different samples could be obtained.) Table 1 shows the results of the study. It will be seen that the percentage of B blood groups in the anxiety-plus countries is 14.60 on the average; for the anxiety-average countries it is 12.71; and for the anxiety-minus countries it is 9.91. While there is considerable variability within each of the three groups, the means decline in a fashion conforming to the hypothesis under investigation. In these data, the anxiety level of a country seems to vary consistently with the proportion of persons in that country belonging to the B blood group.

TABLE 1
LEVEL OF ANXIETY, HOFSTEDE SCORE, AND % BLOOD GROUP B

	Anxiety	B%
Anxiety + Countries		
1. Japan	2.55	22.90
2. Greece	2.03	13.51
3. Belgium	2.74	7.95
4. Argentina	2.75	9.95
5. Colombo	2.85	10.14
6. Yugoslavia	2.97	14.48
7. Taiwan	2.96	23.30
<i>M</i>		14.60
Anxiety = Countries		
8. Italy	2.99	11.35
9. Spain	3.00	9.01
10. France	3.02	8.74
11. Turkey	3.09	15.95
12. West Germany	3.14	12.28
13. South Africa	3.17	21.49
14. Canada	3.21	10.17
<i>M</i>		12.71
Anxiety - Countries		
15. Australia	3.21	10.96
16. U.S.A.	3.31	10.37
17. Ireland	3.33	10.64
18. Great Britain	3.33	8.67
19. New Zealand	3.34	8.92
20. Sweden	3.50	10.11
21. Denmark	3.68	10.22
<i>M</i>		9.91

TABLE 2
 PERCENTAGE OF BLOOD GROUP ANTIGEN B FOR COUNTRIES
 HIGH (+) AND LOW (-) ON NEUROTICISM

+ Countries	B%	Standard Score	- Countries	B%	Standard Score
Egypt	24.28	63.0	Australia	8.54	50.6
France	8.59	54.1	Canada	10.17	50.7
West Germany	12.34	51.8	India	36.64	48.6
Greece	13.38	54.5	Italy	11.11	50.5
Iran	23.79	55.2	Sweden	10.12	41.7
Japan	21.04	53.8	Turkey	15.73	44.6
Poland	19.04	55.1	U.K.	8.52	50.0
South Africa	11.38	52.2	U.S.A.	9.90	50.0
<i>M</i>	16.73		Yugoslavia	14.76	49.2
			<i>M</i>	13.94	
			(without India) =	11.11	

We next turn to the neuroticism values for different countries tabulated by Lynn (1981). The countries were divided into high neuroticism and low neuroticism countries, and their scores and percentage of B blood group figures are given in Table 2. It will be seen that the neuroticism plus countries have an average B blood group of 16.73, while the neuroticism minus countries have an average of 13.94, which decreases to 11.11 when we exclude India where the percentage of blood group B is very much higher than in any other country whatsoever, thus unduly weighting the average. Iran has been included in Table 2 and excluded in Table 1 for reasons to be discussed presently.

Table 3 shows the relationship between extraversion and AB blood group percentage, again for the Eysenck data tabulated by Lynn (1981). It will be

TABLE 3
 PERCENTAGE OF BLOOD GROUP ANTIGEN AB FOR COUNTRIES
 HIGH (+) AND LOW (-) ON EXTRAVERSION

+ Countries	AB%	Standard Score	- Countries	AB%	Standard Score
Australia	3.16	51.5	Egypt	7.57	48.5
Canada	4.34	53.8	France	3.44	48.1
Greece	4.93	52.5	West Germany	5.23	49.1
India	7.74	50.8	Iran	6.73	48.0
Poland	7.95	51.9	Japan	8.86	46.6
South Africa	4.18	51.7	Turkey	7.23	49.4
Sweden	4.77	50.8	Yugoslavia	7.02	47.6
U.K.	3.04	50.0			
U.S.A.	3.75	56.6			
Italy	4.05	50.5			
<i>M</i>	4.79		<i>M</i>	6.68	

seen that the extraverted countries have an average AB proportion of 4.79, while the introverted countries have one of 6.68, a difference which is in the predicted direction. The difference is only 2% in absolute terms, but introverts gave a 50% higher score than extraverts, using the percentages as they stand. (Here as elsewhere we have averaged the percentage for a given blood group without weighting it for the number of cases involved, as this seemed an unnecessary and unreasonable refinement when groups less than 1,000 in number are excluded.)

TABLE 4
PERCENTAGE OF BLOOD GROUP ANTIGENS B AND AB FOR COUNTRIES
HIGH (+) AND LOW (−) ON PSYCHOTICISM

	Psychoticism	% B	% AB
+ Countries			
West Germany	66.1	12.34	5.23
Greece	65.9	13.38	4.93
Japan	73.0	21.04	8.86
Turkey	68.0	15.73	7.23
Yugoslavia	67.9	14.76	7.02
India	61.9	36.64	7.74
<i>M</i>		18.98	6.83
− Countries			
Australia	59.0	8.54	3.16
Canada	44.1	10.17	4.34
Iran	57.9	23.79	6.73
U.K.	50.0	8.52	3.04
U.S.A.	50.1	9.90	3.75
<i>M</i>		12.18	4.20

In these tables we have looked at the results of predictions made on the basis of previous studies, incorporating neuroticism and extraversion-introversion; no previous data are available for Psychoticism, and consequently we can only give the data for B and AB blood groups as an empirical finding not based on any prior hypothesis. Again using Eysenck's data as summarized by Lynn (1981), we have divided the countries into those high and low, respectively, on psychoticism, and their P scores, as well as the proportion in each country of blood groups B and AB, are given in Table 4. It will be seen that the Psychoticism plus groups have a much higher proportion of blood group B than Psychoticism minus groups, and also a much higher proportion of AB blood groups. Indeed, as far as blood group AB is concerned, the differences for Psychoticism are slightly greater than for Extraversion; similarly, for blood group O the difference for Psychoticism is somewhat greater than the difference for Neuroticism. The interpretations of these findings are somewhat obscure.

These are the raw data; we must now turn to a discussion of their interpretation, and the qualifications to be used in evaluating them. The first, and most obvious criticism of the data surveyed is that a number of decisions had to be made about exclusion and inclusion of nations, both as regards personality test scores and also blood group proportions, which are in part at least subjective. To take but one example, Lynn (1981) discusses the comparison of the Hofstede and the Eysenck data, for which the correlation between anxiety and Neuroticism was 0.36 over all the countries studied jointly. He argues that: "If the data are examined in detail it will be seen that the correlation is substantially lowered by the inconsistent results for Iran. Of the 15 countries for which there are scores on both measures, Iran comes out highest on Neuroticism in the Eysenck series and lowest in the Hofstede series. Of the two we prefer the Eysenck data since they are based on three separate studies which all yield high neuroticism means for Iran." Based on this argument, which was of course presented prior to our own analysis, we decided in advance that Iran would be included in the analysis of the Eysenck data but excluded from analysis of the Hofstede data. Such a decision is of course in part subjective and may be criticized; it is impossible to be certain of the true answer.

Another subjective element enters into the admission of nations on the basis of blood group data. We have excluded nations for which the groups studied were small and the total numbers were insufficient; again in view of the wide divergence of the numbers involved, and the distributions and their variability, such a decision must to some extent be subjective, and other investigators might make different decisions. It is to be hoped that indeed other workers will be encouraged to replicate studies of this kind, so that various subjective judgments may cancel out and leave us with a more reliable result.

For some countries, racial mixture produces an insuperable difficulty. For the USA and South Africa, fortunately, different values are given for white and black inhabitants, and as our own questionnaire studies have been conducted on whites only, it was easy to make the proper comparison. However, for a country like Brazil it would be impossible to sort out the racial proportions, and if the proportions should differ for the questionnaire studies and the blood group studies, then meaningless results might have been obtained. Similar differences in racial composition may, of course, occur within a given country; thus Great Britain (and the USA also) might be said to be made up of mixtures of different races, and in different parts of the countries involved these may be quite pronounced. Such factors may attenuate the observed relationships drastically, suggesting that the observed figures may err in a conservative direction. Ideally identical groups should be given the personality inventories and submitted to a blood group test; only in this way can these difficulties be overcome.

Another problem that arises is what to do with a country whose scores are clearly outside the range of scores of all the other countries. An example is India, where the proportion of blood group B is 37; the range of all the other countries included is from 9 to 24, i.e., a range of 15. Compared to this range, the difference between India and the second ranking country (Egypt) is 13, i.e., almost as large as the total variation between all the other countries! We have given data with India both included and excluded. An alternative might have been to give the median; this is 10.17 for the neuroticism minus countries and 16.1 for the neuroticism plus countries. These values are very similar to those which would have been obtained had India been omitted. However, it is probably better to give all the data and leave the reader to form his own opinion, rather than to preempt the discussion by omitting India.

We have used throughout the actual blood groups O, A, B and AB. As is well known, these are dependent on a set of three allelic genes, A, B, and O (for the frequencies of which the symbols p, q, r are commonly used). Gene A, when present at all, on one or both of the chromosomes concerned, determines the presence of the A substance on the red cells. The B gene similarly determines the presence of the B antigen. The O gene gives rise to neither antigen, and in the heterozygote with an A or a B gene it has little influence on the expression of that gene in producing the A or B antigen, but homozygote OO bloods carry neither antigen. We have also tabulated and looked at the distribution of the three gene estimates, but as far as they go they simply repeat the findings of the blood groups proportions themselves and do not add anything to the argument; hence we will not give data on gene frequencies themselves.

One final criticism must be considered. The data given for the Eysenck inventories are essentially raw or transformed scores using the weight matrix obtained originally from the English population; as Eysenck and Eysenck (1982) have repeatedly emphasized, it is strictly speaking inadmissible to do this, and a weight matrix based on items which give similarly high loadings in both countries should be substituted. This would have been impossible to do as not sufficient countries had been dealt with in this way, but it is felt that the present data give a rather conservative picture of the true relations, as any inaccuracies in using the original weight matrix would introduce random error and lower the observed relations. It is to be hoped that in the future it may be possible to rely on adjusted weight matrices for making comparisons of this kind.

Another plausible line of investigation would be a study of the relationship between personality, disease, and blood group, i.e., using diseases as an intermediary link between personality and blood groups. There is evidence linking personality with disease, particularly lung cancer and other types of

cancer (Kissen & Eysenck, 1962) as well as cardiovascular disease, etc. (Eysenck, 1981). While these relationships are rather isolated and have not been very thoroughly studied, there is an enormous literature on the relationship between disease and blood group (Mourant, *et al.*, 1978). No study joining these different disciplines has as yet been reported, but the link would be of considerable interest. First steps towards its realization have been taken by Lynn (1971), who associated cigarette smoking (as one of his demographic indices) with personality across nations, and by Rae and McCall (1973), who find correlations between national personality levels and cancer mortality as follows: Extraversion and males' lung cancer, $r = 0.66$; Extraversion and females' lung cancer, $r = 0.72$; Extraversion and cancer of the cervix, $r = 0.64$; Anxiety and males' lung cancer, $r = -0.52$; Anxiety and females' lung cancer, $r = -0.71$; Anxiety and cancer of the cervix, $r = -0.30$. (Significant values are italicized.) Cigarette smoking was not significantly correlated with cancer across these national groups.

These values show good agreement with direct personality-disease correlations within nations (Eysenck, 1980), and an extension of this type of work to include blood groups would certainly be of interest, although at the moment the only polymorphism found to be associated with lung cancer is the anyl hydrocarbon hydroxylase one (Kellerman, *et al.*, 1973a, 1973b). For some of the complexities of this type of study, see Eysenck (1982).

In summary, we may perhaps say that the data reported here suggest that genetic factors may play a part in producing personality differences between nations and cultures. The conclusion cannot be stronger than that, in view of the many qualifications that had to be made and the possible criticisms which have been discussed above. It seems that what our study has established is the feasibility of looking at blood-group polymorphisms as possibly leading us to genetic markers for personality which can be used in cross-cultural studies. To do so on the basis of published data alone has obvious drawbacks and difficulties, as we have seen; a separate study ought to be done along the lines suggested, i.e., deriving personality estimates and blood group estimates from the same populations in the various countries involved. In view of the great expense involved it might be best to choose just a few countries (possibly only two) where differences are particularly marked, such as between one of the Nordic European countries, which are low in blood group B proportion and in anxiety-neuroticism-instability, and a country like Japan, or Taiwan, or Egypt, where both are high. In making such comparisons, of course, it would be necessary to use the reduced weight matrix for scoring the questionnaires, as explained by Eysenck and Eysenck (1982). However, in principle there does not seem to be any difficulty in using the method here outlined, and it is to be hoped that in due course more reliable and valid results

will be obtainable to answer the question, so often raised but hitherto not susceptible to an empirical solution, of the genetic determination of racial and national differences in personality.

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