

## National Differences in Extraversion and Neuroticism

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A method is proposed for measuring national differences in extraversion and neuroticism from demographic and epidemiological data. The method is to use national prevalence rates of a number of variables and treat them as indices of the levels of extraversion and neuroticism in national populations. The variables taken are the national rates of divorce, illegitimacy, accidents, crime, murder, suicide, alcoholism, chronic psychosis and coronary heart disease; and the per capita consumption of calories, cigarettes and caffeine. Data for these indices are presented for the advanced western nations. The relationship of these variables to extraversion and neuroticism among individuals is used to set up a model for their relationship among nations. The variables were factored by principal components analysis and this yielded two major factors identified as extraversion and neuroticism. The factor scores of each nation on the two factors were then computed. These indicate that the most extraverted nation is the United States and the most introverted is Japan. The most neurotic nation is Austria and the least neurotic is Ireland.

The work to be reported in this paper represents an extension of our earlier theory that there are national differences in the level of anxiety among the populations of the advanced western nations (Lynn, 1971). This theory was based on the discovery that a general factor is present among the intercorrelations of the prevalence rates and consumption figures of a number of national demographic and epidemiological phenomena, namely the rates of suicide, alcoholism, psychosis, accidents and coronary heart disease, and the consumption of tobacco and calories. The general factor underlying the intercorrelations of these phenomena was interpreted as the anxiety level in the populations.

In the present paper we are concerned with the problem of whether it is possible to extend this work by finding a second personality factor among nations. The starting point of this research is the personality systems of H. J. Eysenck and R. B. Cattell, in both of which there are two major and wholly or largely independent personality dimensions among individuals, namely those of introversion-extraversion and neuroticism (Eysenck & Eysenck, 1969) or anxiety (Cattell, 1957). The problem posed was that of attempting to determine whether these two personality dimensions could be found among nations. In other words, are there extraverted and introverted, neurotic and stable nations, as is apparently the case among individuals?

In order to answer this question it appears to be necessary to find solutions to four problems. First, it is necessary to obtain measures of extraversion and neuroticism in nations. The method adopted has been to find a number of demographic and epidemiological variables in which national levels of extraversion and neuroticism could be expected to express themselves. These are such variables as the national rates of crime, suicide, alcoholism, etc. The strategy adopted here is to use the results of work on individuals to set up a model of the factor structure of these demographic and epidemiological variables among nations.

Secondly, it is necessary to obtain data for these variables for a group of nations. Thirdly, this data has to be intercorrelated and factor analysed in order to test the prediction that there are two independent factors among national demographic and epidemiological phenomena and that the measures of these phenomena are correlated with the factors in the manner predicted in the model.

Fourthly, if these three problems can be solved, then it will be possible to proceed to the final step. This is to treat the nations as subjects in a psychometric investigation and use the demographic and epidemiological measures to derive national levels of extraversion and neuroticism.

Thus there are four stages in the analysis of the question and an account will now be given of how we have attempted to find solutions to these four problems.

### THE MODEL

Twelve demographic and epidemiological variables have been selected for the measurement of national differences in extraversion and neuroticism. These are the national prevalence rates of suicide, alcoholism, chronic psychosis, coronary heart disease, accidents, crime, murder, illegitimacy and divorce, and the per capita consumption of calories, caffeine and cigarettes. These 12 variables are taken because their relationships with extraversion and neuroticism are reasonably well established on both theoretical and empirical grounds. These relationships among individuals can therefore be used to set up a model embodying a similar set of relationships among nations. The evidence for the relationships of these 12 variables to extraversion and neuroticism, on which our model is based, is the subject of this section.

1. *Cigarette consumption.* The most extensive study of the relationship of cigarette consumption to extraversion and neuroticism appears to be that of Eysenck (1965) on a sample of 2,400 subjects in Britain. This investigation showed a significant tendency for extraverts to smoke cigarettes more heavily. Several other investigators have confirmed this result. These include Schubert (1965) in a study of 1,270 students in New England; Estabrook & Sommer (1966) in a study of 130 American students; Cattell & Krug (1967) in another study of American students; and further investigators to report the same association include Evans *et al.* (1967) and Smith (1967, 1969).

The evidence on the relationship of cigarette consumption to neuroticism is rather less clear-cut. The original study by Eysenck (1965) found no significant relationship between cigarette consumption and neuroticism and this was subsequently confirmed by Smith (1967) and Cattell & Krug (1967). On the basis of these three large-scale studies it would appear that cigarette consumption is unrelated to neuroticism. Thus these findings lead to the prediction that cigarette consumption among nations will be a positive function of national levels of extraversion but unrelated to national levels of neuroticism.

2. *Crime.* An association between extraversion and crime would be expected on theoretical grounds because important components of the extraverted personality are impulsiveness and poor socialization. Both the theory and the evidence relating extraversion to crime have been reviewed in detail by Eysenck (1964). Perhaps the

first major investigation to report the relationship is that of Glueck & Glueck (1950). In their classical study of 500 delinquent boys they estimated that 57 per cent were extraverted compared with 28 per cent of a control group. This relationship between extraversion and a propensity to commit crime was confirmed in a longitudinal study reported by Miller (1956). He took 551 children attending a child guidance clinic in Dallas and assessed them for introversion-extraversion. Over the subsequent 28 years 25 per cent of the extraverts committed crimes compared with only 5 per cent of the introverts.

There have been a number of studies of the scores of prisoners on extraversion questionnaires and the results have not been altogether clear. The first investigation of this type was published by Bartholomew (1959). He took three groups of 50 first offenders, 50 recidivists and a second group of 54 recidivists and gave them the Maudsley Personality Inventory. The results showed that the first offenders scored slightly less extraverted than the normal population, but both recidivist groups scored substantially more extraverted. The result for the first offenders is discrepant, but it should be noted that questionnaire results may be distorted when they are obtained from prisoners. An important component of extraversion is sociability, and since a prisoner has little opportunity for being sociable his score on these questions may be spuriously shifted towards introversion.

Results showing a comparatively high level of extraversion in criminals, although not always at a statistically significant level, have been reported by Eysenck & Eysenck (1964), Eysenck & Eysenck (1970), Burgess (1972*a*), Iwawaki *et al.* (1964), Cattell *et al.* (1970), Pierson & Kelly (1963), Warburton (1965) and Sanocki (1969). Results failing to show the relationship have been published by Hoghugh & Forrest (1970), Little (1963) and Burgess (1972*b*).

In addition to its relation with extraversion, criminal behaviour appears also to be related to neuroticism. This relationship has been found in all the questionnaire studies listed above, generally although not invariably at a statistically significant level. The evidence therefore suggests that criminal behaviour is a joint function of extraversion and neuroticism. Accordingly national crime rates are posited as joint functions of national levels of extraversion and neuroticism in our model of national personality dimensions.

3. *Divorce*. There are some theoretical grounds for expecting a relationship between divorce and extraversion. These lie in the greater needs for stimulation, sensation, excitement and novelty apparently felt by extraverts and their weaker inhibitions in breaching social mores for the gratification of these needs. One of the first findings of this type was the discovery that extraverts have a greater preference than introverts for pictures painted in bright and vivid colours, presumably because these afford stronger stimulation (Eysenck, 1947). Subsequently it has been found that extraverts take larger risks in gambling (Lynn & Butler, 1962) and the development of sensation-seeking questionnaires has shown that extraverts have a greater liking for sensation (Farley & Farley, 1967). If the extravert seeks to gratify his needs for sensation and novelty in sexual adventure, then it would seem probable that the outcome would be a greater tendency to divorce.

In addition to these general needs, there is some direct evidence that extraverts

have stronger tendencies than introverts to gratify their needs for sexual novelty and variety. This appears to have been demonstrated first in Germany by Giese & Schmidt (1968). They found that extraverts began to have sexual intercourse earlier than introverts and, once started, engaged in it with more partners, apparently betraying the extravert's need for novelty and stimulation. A later study by Eysenck (1972) of 800 young people in Britain obtained the same result. Thus it seems that extraverts have a stronger drive for sexual variety and it would be surprising if this were not associated with a tendency to have a higher divorce rate.

The only direct evidence on the relationship between divorce and extraversion appears to be a study by Cattell & Nesselroade (1967). They took 102 stably married couples, defined as those where there had been no known step towards dissolution of the marriage, and compared them with 37 couples who had either separated or sought advice because of marital difficulties. The separated couples were found to be more extraverted than the stably married. There was no difference between the stably and unstably married couples on Cattell's anxiety factor. Since Cattell's anxiety is highly correlated with Eysenck's neuroticism factor (e.g. Eysenck & Eysenck, 1969) the prediction for national differences is that among nations divorce rates will be positively associated with extraversion but will have no association with neuroticism.

4. *Illegitimacy*. An association between extraversion and the procreation of illegitimate children is one that would be expected on the basis of the general nature of the extraverted personality. An important feature of the extravert's personality is his impulsiveness or, perhaps more relevantly in the present context, *her* impulsiveness. Furthermore, the extravert is relatively unsocialized and has not absorbed so well the moral values of society. With this personality structure it would be surprising if the extravert were not a stronger candidate than the introvert for illegitimate parenthood.

Direct confirmation of this inference is available in a study by S. B. G. Eysenck (1961). She compared the extraversion scores of 100 unmarried mothers admitted to a maternity hospital with those of 100 matched married mothers. The unmarried mothers proved to be highly extraverted. They also scored somewhat higher than the normal population on neuroticism, so that we are led to the prediction that among nations the illegitimacy rate should be a positive function of extraversion and also of neuroticism.

5. *Accident-proneness*. The classical work on the personality structure of the accident-prone is that carried out by Tillman & Hobbs (1949) in Canada in the years immediately following the close of World War II. This work was specifically concerned with driving accidents, and the investigators concluded that how a person drives is determined by his general personality structure. As they put it, 'a man drives as he lives'.

What Tillman & Hobbs did was to take 20 taxi drivers with exceptionally good driving records and compare them with another 20 whose records had been exceptionally poor. They found that the poor taxi drivers had long life histories of comparatively psychopathic and irresponsible behaviour, including criminal records and poor employment histories. The good drivers had well-socialized hobbies

like gardening, voluntary church work and so on. Although they did not use the term extraversion, it seems fairly clear from the descriptions that the taxi drivers with the poor accident record were in fact extraverted and somewhat psychopathic, while the good taxi drivers tended to introversion.

One of the first investigators to link accident-proneness explicitly to extraversion was Fine (1963). His method was to investigate the accident records of nearly 1,000 male students at the University of Minnesota and he found a significant association between the numbers of accidents and the degree of extraversion. This result was confirmed in a study of accident-proneness among South African bus drivers by Shaw & Sichel (1971). By the use of a number of measures these authors report a correlation of +0.61 between accident-proneness and extraversion. A similar result has been obtained in Holland, where Buikhuisen (1968) has reported a high level of extraversion among people convicted of drunken driving. Others who have found this relationship include Biesheuvel & White (1949) in an investigation of accident-prone pilots in South Africa, Manheimer & Mellinger (1967) in a study of children in California, and Cattell and his associates in a number of investigations (Cattell *et al.*, 1970, p. 164).

Accident-proneness is also associated with neuroticism. The association has been found in numerous studies and the literature has been reviewed by Shaw & Sichel (1971). The implication for national differences is therefore that national rates of accidents should be associated both with national levels of extraversion and with national levels of neuroticism.

6. *Coronary heart disease.* There is evidence that coronary heart disease is related both to low neuroticism and to extraversion. This may be surprising in view of the common supposition that coronary disease is associated with stress, and hence possibly with a high level of neuroticism, but this belief has been discredited by the research on approximately a quarter of a million Bell Telephone Company employees which showed that coronaries are less prevalent among managers than among blue collar workers (Hinkle *et al.*, 1968).

One of the problems in evaluating the personality of coronary patients is that of obtaining a control group. The coronary patient has the stress of the illness and the most satisfactory controls are probably other patients. Three studies of this kind have been published. One reported that coronary patients were 'more cheerful and better socializers' (O'Leary *et al.*, 1968), suggesting a low level of neuroticism and a high level of extraversion. Questionnaire evidence for a low level of neuroticism in coronary patients has been published by Sainsbury (1960). Bendien & Groen (1963) report a tendency in the same direction and also that coronary patients are more extraverted than normal. Taking the evidence as a whole, the indications seem to be that coronary patients tend to be low on neuroticism and high on extraversion, and hence we are led to the prediction that the prevalence of coronary heart disease in nations should be associated with a low level of neuroticism and also with extraversion.

7. *Suicide.* There are several lines of evidence to indicate that people who commit suicide tend to be characterized by a high level of neuroticism. In the first place, it has often been found that such people are frequently in a state of anxiety as a result

of stresses of various kinds, such as bereavement, bankruptcy and so forth, and have turned to suicide as a way out of their stressful situation (e.g. Stengel, 1964; Roberts & Hooper, 1969). It is probably reasonable to assume that such people would score high on a test of neuroticism.

The difficulty of measuring the personality of the person who commits suicide can be overcome by testing a large sample and then comparing the scores of those who subsequently commit suicide with the norms. A study along these lines has been published by Paffenbarger & Asnes (1966) using graduates of the University of Pennsylvania. All students were given an anxiety questionnaire over a 10-year period and 50 subsequently committed suicide. These were matched with a control group and it was found that the suicide group had been significantly more anxious as students. A similar study has been published by Bunney & Fawcett (1965). They first determined the urinary 17-hydroxycorticosteroid (OHCS) level of 36 patients in a mental hospital. Subsequently, three of these patients committed suicide, and inspection of the record showed that these three had had high urinary 17-OHCS. High urinary 17-OHCS is generally regarded as a sign of high anxiety or neuroticism, so that this result indicates that people who commit suicide tend to be high on neuroticism.

Another approach to the suicidal personality is to measure by questionnaire the personality structure of those who attempt suicide but fail. One such study has been made by Philip (1970) in Edinburgh and the result showed that the attempted suicides scored highly on the anxiety scale of Cattell's 16 PF test. The only study of this type using the neuroticism scale of one of Eysenck's questionnaires (the Maudsley Personality Inventory) appears to be that of Colson (1972) on a sample of students at the University of Illinois who had attempted suicide or seriously considered suicide. He found that their neuroticism scores were considerably above the mean for American students.

In addition to the relationship with neuroticism, both questionnaire studies of attempted suicides showed that they were somewhat more introverted than the normal population. This leads us to the prediction that a high national suicide rate should be a function of a high national level of neuroticism and also have a smaller correlation with introversion.

8. *Caffeine consumption.* Caffeine is a drug that has a stimulating effect on the nervous system (e.g. Gooch, 1963). This leads to the expectation that caffeine would be taken in larger quantities by people who are low on neuroticism. The reason for this is that stimulants activate the sympathetic nervous system. People who score highly on neuroticism tend to have a sympathetic nervous system that is easily activated and hence require less stimulation to obtain sympathetic activation. They should, therefore, tend to take less caffeine. Direct evidence showing that caffeine consumption is negatively associated with neuroticism has been reported (Lynn, 1973). In this study no relationship was found between caffeine consumption and extraversion. We are therefore led to the prediction that national per capita consumption of caffeine should be a negative function of national levels of neuroticism, but be unrelated to national levels of extraversion.

9. *Alcoholism.* Alcohol is a drug which has broadly the opposite properties of

caffeine. Where caffeine stimulates the sympathetic nervous system, alcohol sedates it. Hence while individuals who are low on neuroticism apparently tend to take larger quantities of caffeine, those high on neuroticism would be expected to take larger quantities of alcohol.

The effect of alcohol on sedating the sympathetic nervous system and reducing the emotions of anxiety and fear are well established. At the physiological level it is known that alcohol has depressant effects on the nervous system, dampening down the system as a whole and the sympathetic system in particular (e.g. Block, 1962; Rosen & Gregory, 1965). At the psychological level the best known classical experiments are probably those of Masserman and his colleagues on cats (Masserman & Yum, 1946). They subjected cats to frightening stresses and found that they developed a taste for alcohol and that the alcohol reduced the cats' phobias.

It is not only cats whose anxiety level can be reduced by alcohol. The same is true of human beings and there is a good deal of evidence that people who suffer from excessive anxiety are prone to alleviate their condition by consuming alcohol. For instance, Vallance (1965) has reported a study of 65 male alcoholic patients admitted to Glasgow General Hospital in which he found that a substantial proportion had a history of neurotic symptoms and took alcohol as a means of relief. Other studies finding a high level of neuroticism in alcoholics have been reported by Rosenberg (1969) in Sydney, Hoy (1969) in Britain and Golightly & Reinehr (1969) in the United States.

In none of these four studies was alcoholism significantly related to extraversion. Thus it appears that alcoholism is a relatively pure function of neuroticism and this leads us to the prediction that among nations the prevalence of alcoholism will be a function of the national level of neuroticism.

10. *Calorie intake.* There are theoretical reasons for regarding calorie intake as a negative function of neuroticism. These lie in the reciprocally inhibiting relationship between the parasympathetic nervous system, which is involved in the ingestion of food, and the sympathetic system, which mediates fear and anxiety. If one system is active it tends to suppress the other (Morgan, 1965). An early demonstration of this reciprocally inhibiting relationship between fear and eating was given in the studies carried out in John Watson's laboratory on the counter conditioning of infants' phobias by the use of sweets (Jones, 1924). Experimental evidence demonstrating the inverse relation between calorie intake and anxiety has been published by Schachter *et al.* (1968). They stressed subjects in an experimental situation and obtained a reduction in eating. Questionnaire evidence that in normal populations obesity is associated with below average neuroticism scores has been found by Silverstone (1968) and Kalucy & Crisp (1974).

There is corroboratory evidence from a variety of other sources. For instance, damage to the frontal lobes has the effect both of reducing anxiety and nervous tension and of increasing the appetite (e.g. Hofling, 1963). Conversely, stimulant drugs increase anxiety and nervous tension and reduce appetite. Although it is sometimes maintained that anxiety can motivate eating, a large-scale study of normal eaters and overeaters among 1,000 children carried out by Brandon (1968) in Newcastle showed that the emotionally disturbed had poor appetites rather than

large ones and also had lower body weights; there was no evidence of emotional disturbance among voracious overeaters.

There appears to be no evidence for a relationship between calorie intake and extraversion. We are therefore led to the prediction that there should be an inverse relation between national levels of calorie intake and of neuroticism.

11. *Chronic psychosis.* There are several sources of evidence to indicate that the level of neuroticism tends to be low among chronic psychotics. Many chronic psychotics are cases of simple schizophrenia and Bleuler's classical description of these patients as emotionally blunted or unreactive continues to stand in psychiatric descriptions of the condition. For instance, Hofling (1963) writes of 'pervasive apathy' as the commonest symptom of these patients. This lack of emotional reactivity is suggestive of a low level of neuroticism.

This psychiatric opinion has been confirmed by more objective studies. The simplest and most straightforward evidence of a low level of neuroticism in the chronic psychotic probably comes from questionnaire data. It is important here to distinguish the questionnaire results of chronic psychotics from those of other kinds of psychotic patients, and reports on chronic patients as a distinct category are rare. But at least two have been published. The first is by Al-Issa (1964) and reports the mean scores of 34 chronic psychotics with a mean stay in hospital of 14.2 years; these patients had a mean neuroticism score at approximately a third of a standard deviation below the mean of the normal population.

A similar result has been reported in the United States by Farley (1970). He tested 20 chronic psychotics who had been in hospital for an average of 14.9 years. The test used was the Maudsley Personality Inventory, and the psychotics obtained a mean neuroticism score approximately half a standard deviation below the mean of the normal population. These results are corroborated by the work of Cattell (1957). In Cattell's personality system the psychoticism factor (UIT 25) is negatively correlated with the anxiety factors O (Guilt) and Q<sub>4</sub> (Ergic Tension).

In addition to these questionnaire results there is an extensive physiological literature indicating that typically there is a low level of sympathetic reactivity in chronic psychotics. The best-known studies in English are probably those of Gellhorn (1957), Nelson & Gellhorn (1957) showing that the majority of chronic psychotics show little sympathetic and central nervous reactivity to stimulation, e.g. a poor generation of heat following exposure to cold, low psychogalvanic reactions and reduced desynchronization of the EEG alpha rhythm.

The same conclusion has been reached in a considerable Russian literature. This originates from Pavlov's observations of the apathy of many chronic psychotics and his theory that protective inhibition has spread from the cerebral cortex to the subcortical centres and reduced the reactivity of the nervous system. Russian experimental studies of sympathetic reactivity have confirmed that it is low in chronic psychotic patients. The Russian work is reviewed in some detail in Lynn (1971).

Neither of the questionnaire studies of chronic psychotics (Al-Issa, 1964; Farley, 1970) shows any significant deviation from normality on extraversion. We are therefore led to the prediction that national prevalence rates of chronic psychosis



should be a function of a low national level of neuroticism and independent of national levels of extraversion.

12. *Murder*. There are theoretical grounds for positing a relationship between murder and extraversion. These are derived from the impulsiveness and poor socialization of the extravert. There appear to be no empirical studies on the extraversion or neuroticism levels of murderers as a distinct group, although both Warburton (1965) and Iwawaki *et al.* (1964) had murderers in their groups of criminals with high extraversion levels. Although the empirical evidence is weak it will probably seem reasonable to regard murder as a special case of crime and hence to predict that national rates of murder will follow those of crime and be related to national levels of both extraversion and neuroticism.

This concludes the summary of the evidence relating the 12 demographic and epidemiological variables to extraversion and neuroticism. The model suggested by this evidence is shown in diagrammatic form in Fig. 1. We are now ready to turn to the testing of the model.

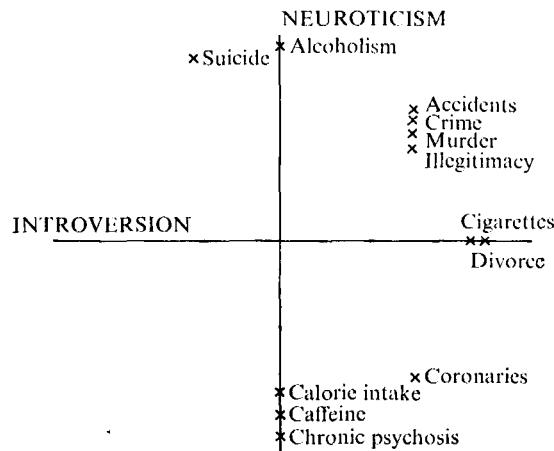


Fig. 1. Model of the relationship of the 12 demographic and epidemiological variables to neuroticism and extraversion.

## METHOD

The testing of the model requires a group of nations and a set of indices of the 12 variables. The nations taken are the 18 major advanced western nations used in the earlier analysis of national differences in levels of anxiety (Lynn, 1971), i.e. all the advanced western nations with populations over one million and a per capita income above 450 U.S. dollars in 1961, and for which data for at least 11 of the 12 variables is obtainable. These 18 nations are listed in Table 1. The data were collected for the year 1960 and are shown in Table 1. A description of the data and their sources are given below.

1. Cigarette consumption: number consumed per capita aged 15 and over, per annum. Source: Tobacco Research Council, London.

2. Crime: the number of prisoners per 10,000 population. Source: Government Statistical Offices of the individual nations. Missing data: Switzerland does not record the information.

3. Divorce: number per 10,000 population. Source: U.N. Demographic Yearbooks. Missing data: Ireland and Italy do not permit divorce.

4. Illegitimacy: percentage of live births that are illegitimate. Source: U.N. Demographic Yearbooks.

5. Accidents: number of deaths from all types of accidents per 100,000 population. Source: U.N. Demographic Yearbooks.

6. Coronary heart disease: deaths from coronary heart disease and atherosclerosis per 100,000 population. Source: U.N. Demographic Yearbooks.

7. Suicide: number of deaths per 100,000 population. Source: U.N. Demographic Yearbooks.

8. Caffeine consumption: kilograms of coffee and tea imports retained for home consumption per annum, per capita; the index of caffeine consumption was derived by weighting tea consumption twice that of coffee because tea has approximately twice the caffeine content of coffee per unit weight. Source: Pan American Coffee Bureau, New York, and International Tea Committee, London.

9. Alcoholism: number of deaths from liver cirrhosis per 100,000 population. Source: U.N. Demographic Yearbooks.

10. Calorie intake: daily intake of calories per capita. Source: U.N. Statistical Yearbooks.

11. Chronic psychosis: number of psychiatric patients per 1,000 population (because of the relatively rapid turnover of acute psychiatric patients, the number of patients in mental hospitals at any one time is heavily weighted in favour of chronic cases). Source: World Health Statistics Annual and Government Publications from the individual nations.

12. Murder: number of deaths from murder per 100,000 population. Source: U.N. Demographic Yearbooks.

## RESULTS

The data shown in Table 1 were intercorrelated and factored by principal components analysis with unities in the main diagonal. The correlation matrix is shown in Table 2 and the results of the principal components analysis in Table 3. There are three factors with eigenvalues above unity. The first factor is apparently neuroticism, with high loadings on suicide, alcoholism and accidents and, negatively, on calorie intake, caffeine consumption and chronic psychosis. The second factor is apparently extraversion, with high loadings on crime, murder, illegitimacy, coronary heart disease, accidents and cigarette consumption. Crime, murder, illegitimacy and accidents have approximately equal loadings on both neuroticism and extraversion and coronary heart disease on extraversion and emotional stability (i.e. the negative pole of neuroticism). The third factor has its highest loading on illegitimacy and will not be considered further. The comparison between the model proposed in the first part of the paper and the empirical results can be made most easily from a visual presentation of the results and this is given in Fig. 2.

The first two factors were rotated by varimax and promax. The varimax solution was closely similar to the principal components. So also was the promax solution, which is shown in Table 4. The correlation between the two factors in the promax rotation was  $+0.01$  which indicates of course that the two factors are virtually independent.

It is now possible to use the variables to measure the levels of extraversion and neuroticism in the populations of the nations. This is done by taking the factor scores obtained by the nations on the two factors. The factor scores were derived from the first two eigenvectors. On the basis of these factor scores the position of each nation can now be plotted on the two dimensions. These plots are shown in Fig. 3. The results indicate that the most extraverted nation is the United States, while the most introverted is Japan. The most neurotic nation is Austria; the least neurotic Ireland. The values of the factor scores of the nations are given in Table 5.

Table 1. *The demographic and epidemiological data*

	Chronic psychosis	Calorie intake	Caffeine con- sumption	Coronary heart disease	Alcoholism	Suicide	Murder	Crime	Divorce	Cigarette con- sumption	Illegiti- macy	Accidents
Australia	3.3	3,140	6.6	256.2	4.8	10.6	1.5	6.6	6.5	2,440	4.8	52.6
Austria	1.8	2,970	1.9	242.8	23.3	23.1	1.2	11.5	11.3	1,720	13.0	70.4
Belgium	3.0	3,060	7.4	142.3	9.5	14.6	0.7	6.3	5.0	1,570	2.1	54.6
Canada	2.9	3,020	5.5	237.0	6.1	7.5	1.4	9.6	3.9	2,910	4.3	52.5
Denmark	2.2	3,260	9.7	246.6	8.4	20.3	0.5	3.1	14.6	1,470	7.8	44.8
Finland	3.6	3,110	7.9	221.5	3.3	20.5	2.9	15.4	8.2	2,100	4.0	51.5
France	2.4	3,190	4.6	78.4	29.3	15.8	1.7	5.9	6.6	1,320	6.1	58.9
Germany (W.)	1.7	2,990	3.8	199.2	19.0	19.5	1.0	8.6	8.8	1,630	6.3	56.2
Ireland	7.2	3,480	6.9	313.5	2.0	3.0	0.2	1.3	—	2,560	1.6	32.5
Italy	2.2	2,730	2.1	188.4	17.3	6.3	1.5	7.8	—	1,300	2.4	40.7
Japan	0.8	2,330	1.6	59.1	9.7	21.6	1.9	7.7	7.4	1,880	1.2	41.8
Netherlands	2.3	3,160	6.4	168.2	3.5	6.6	0.3	3.4	4.9	1,700	1.3	36.7
New Zealand	4.3	3,490	6.1	243.7	2.3	9.7	1.1	7.7	6.9	1,930	5.3	46.0
Norway	2.0	2,930	8.3	210.0	4.2	6.5	0.4	4.4	6.6	550	3.7	43.8
Sweden	4.6	2,990	10.1	281.5	5.1	17.4	0.6	6.4	12.0	1,160	11.3	46.4
Switzerland	3.5	3,210	6.0	229.7	11.8	19.0	0.6	—	8.7	2,380	3.8	60.2
United Kingdom	3.4	3,270	9.6	314.6	2.9	10.6	0.6	5.8	4.8	2,760	5.2	39.3
United States	3.4	3,120	7.9	306.3	11.3	10.6	4.7	11.8	21.8	3,810	5.3	52.1

Table 2. *The correlation matrix (product moment correlations; decimal points omitted)*

	1	2	3	4	5	6	7	8	9	10	11	12
1. Chronic psychosis	(1.0)											
2. Calorie intake	68	(1.0)										
3. Caffeine consumption	47	55	(1.0)									
4. Coronary heart disease	63	58	56	(1.0)								
5. Alcoholism	-48	-27	-61	-45	(1.0)							
6. Suicide	-43	-31	-18	-30	42	(1.0)						
7. Murder	-12	-21	-12	00	19	14	(1.0)					
8. Crime	-23	-26	-26	01	22	43	73	(1.0)				
9. Divorce	07	03	17	37	18	25	57	25	(1.0)			
10. Cigarette consumption	35	28	11	47	-22	-18	54	32	29	(1.0)		
11. Illegitimacy	-06	10	10	33	35	51	00	25	41	-15	(1.0)	
12. Accidents	-32	-06	-30	-13	64	61	26	57	16	-02	55	(1.0)

Table 3. *The principal components analysis*

Variables	Factor loadings		
	I	II	III
1. Chronic psychosis	76	33	07
2. Calorie intake	65	35	34
3. Caffeine consumption	67	31	28
4. Coronary heart disease	61	65	18
5. Suicide	-78	01	20
6. Alcoholism	-70	22	35
7. Murder	-36	62	-61
8. Crime	-56	57	32
9. Divorce	-14	72	01
10. Cigarette consumption	24	63	-54
11. Illegitimacy	-32	51	71
12. Accidents	-69	40	30
Eigenvalues	4.03	2.85	1.75
Variance (%)	33.56	23.73	14.62

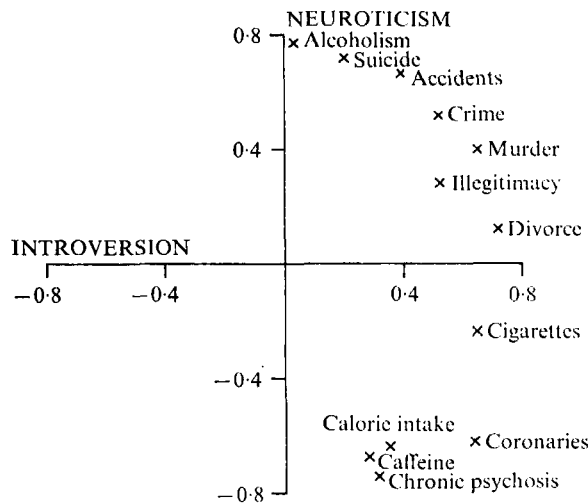


Fig. 2. The principal components analysis.

## DISCUSSION

This paper presents an attempt to extend two factor personality theory as formulated by Eysenck and Cattell to the analysis of national personality differences. The strategy adopted has been to set up a model of the relationship of twelve behavioural variables (suicide, crime, etc.) to extraversion and neuroticism, and then to test the model by an examination of the relationship of these variables among nations. The success of this enterprise will be judged by the degree to which the national data match the model. The degree to which this has been achieved can be seen by comparing the model and the empirical results, which are given in Figs. 1 and 2. The comparison shows that all the variables except one fall approximately into the

Table 4. *The promax solution*

	Factor loadings	
	Factor 1 (neuroticism)	Factor 2 (extraversion)
1. Chronic psychosis	79	26
2. Calorie intake	68	29
3. Caffeine consumption	69	25
4. Coronary heart disease	66	60
5. Suicide	-78	08
6. Alcoholism	-68	28
7. Murder	-31	65
8. Crime	-51	61
9. Divorce	-08	73
10. Cigarette consumption	29	61
11. Illegitimacy	-28	53
12. Accidents	-66	45

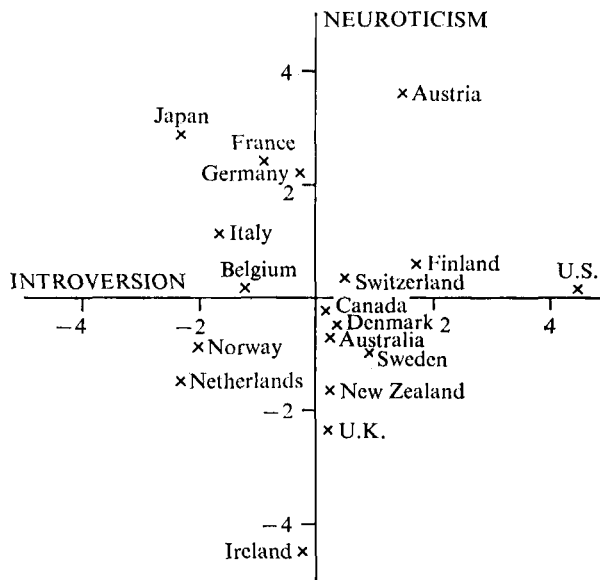


Fig. 3. Factor scores of the nations.

places described by the model. The exception is the suicide rate, which the model predicts as a function of high neuroticism with some loading on introversion, but which the data show is a function of high neuroticism with a loading on extraversion. It is possible that the explanation of this discrepant result lies in the breakdown of linearity in the neuroticism-extraversion regression at high levels of neuroticism, which is such that high neuroticism appears to push people towards introversion (e.g. Eysenck & Eysenck, 1964). The effect of this would be that people with high levels of neuroticism who attempt suicide would tend to score introverted on questionnaires. But it is only at high levels of neuroticism that this shift towards introversion occurs. A population with a relatively high mean level of neuroticism

Table 5. *Factor scores of the nations on the first two components*

(Signs on the neuroticism factor are reversed to make high positive scores represent high levels of neuroticism.)

Nation	Factor 1 (neuroticism)	Factor 2 (extraversion)
Australia	-0.75	0.36
Austria	3.73	1.62
Belgium	0.15	-1.29
Canada	-0.29	0.15
Denmark	-0.55	0.41
Finland	0.61	1.73
France	2.37	-0.94
Germany	2.11	-0.19
Ireland	-4.58	-0.17
Italy	1.05	-1.61
Japan	2.95	-2.37
Netherlands	-1.52	-2.30
New Zealand	-1.61	0.29
Norway	-0.86	-2.03
Sweden	-0.86	0.99
Switzerland	0.28	0.47
United Kingdom	-2.41	0.30
United States	0.18	4.56

would not necessarily show the effect, because in spite of a high mean it would still have only a comparatively small proportion of the population in the range of neuroticism where there is a shift towards introversion. This consideration would reconcile the apparent lack of congruity of suicide between individuals and nations.

Some readers may feel doubt about the use of the demographic and epidemiological variables in this study on the grounds that they seem likely to be heavily influenced by specific cultural and economic conditions. But it should be noted that the two factors interpreted as neuroticism and extraversion account for over 50 per cent of the variance. This is a rather substantial proportion for a psychological study, comparable to the proportion of the variance accounted for by *g* in a typical matrix of cognitive tests. There seems little doubt therefore that the specifics among this set of variables are not so important as might seem likely on *a priori* grounds and that two powerful factors are present.

In general, it is probably reasonable to conclude that the factor structure among this set of twelve demographic and epidemiological variables accords fairly closely with the model set up in the first part of this paper. It would appear therefore that two factor personality theory is capable of extension into the field of national differences and can predict and explain relationships between a number of national demographic and epidemiological variables that have not hitherto been known.

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