

Fluctuations in national levels of neuroticism and extraversion, 1935–1970

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National levels of neuroticism and extraversion in 18 advanced Western nations are measured at intervals from 1935 to 1970. It is shown that levels of neuroticism rose significantly in the nations that suffered military defeat and occupation in the Second World War and then declined during the 1950s to prewar levels. National levels of extraversion have been generally rising over this period.

This paper is concerned with the problem of how national differences in neuroticism and extraversion have fluctuated over the period 1935–70. It represents an extension of our previous work in which national levels of neuroticism and extraversion have been measured from epidemiological and demographic phenomena. The basis of the method has been to take a number of such phenomena, for instance, national rates of suicide, alcoholism, accidents, cigarette consumption and so forth, and treat them as functions of the underlying traits of neuroticism and extraversion. Twelve of these national demographic and epidemiological variables have been employed. They have been factor analysed and shown to contain two major factors, which have been interpreted as the levels of neuroticism and extraversion present in the populations of the different nations (Lynn, 1971; Lynn & Hampson, 1975). The neuroticism factor has subsequently been confirmed from questionnaire data (Hofstede, 1975).

Hitherto this work has been based on data for the year 1960. The interest of extending the measurement of national levels of neuroticism and extraversion to a number of years over a period of several decades is threefold. In the first place, it makes it possible to examine whether the factor structure of the demographic and epidemiological variables, found for the year 1960, holds for other years. If this proves to be the case we can proceed to a second problem, which is to analyse trends in the national levels of neuroticism and extraversion over the period. And thirdly, in making this analysis we can test a prediction. This prediction concerns the effects of the Second World War on national levels of neuroticism.

War is a stress which should raise the level of neuroticism, particularly in nations suffering military defeat and occupation. These nations ought to show increases in their levels of neuroticism in the Second World War and for some time afterwards followed by a decline to prewar levels. This rise and fall should not be found in the neutral nations. This is a stringent prediction and its verification would do much to strengthen the theory.

The investigation

The nations used in this study were the 18 advanced Western nations which have been used in previous analyses and are shown in Figs 1 and 2. The object was to collect data for the 12 demographic and epidemiological variables which have been used in our previous work at five yearly intervals over the period 1935–70. These variables are listed and described briefly in the Appendix. Unfortunately little of the data was collected during the Second World War and for several years afterwards, so that there is a gap here in the series. It has however proved possible to collect the data for the years 1935, 1950, 1955, 1960, 1965 and 1970. Copies of the raw data can be obtained from the authors and from the SSRC data bank at the University of Essex.

The data were first considered for each year independently. Principal components analyses and varimax rotations were carried out for each year and the factors were similar in all six years to the 1960 factors already published in Lynn & Hampson (1975). It can therefore be concluded that the factor structure is stable over this period.

In order to measure trends over time in the nations' levels of neuroticism and extraversion the following procedure has been adopted. Each nation at each year is treated as an independent subject and the demographic and epidemiological variables are treated as the subjects' scores on tests. Thus there are 108 subjects in this treatment, consisting of the 18 nations by the six years. This set of data has been intercorrelated and factored by principal components analysis with unities inserted in the principal diagonal of the correlation matrix. The correlation matrix is shown in Table 1 and the loadings of the variables on the first two factors are shown in Table 2. These loadings are similar to those obtained on individual years and published already for 1960 by Lynn & Hampson (1975). The first factor is interpreted as neuroticism and the second as extraversion. The arguments for these interpretations have been published previously (Lynn, 1971; Lynn & Hampson, 1975) and it is unnecessary to go over this ground again here. The two factors were rotated to orthogonal simple structure by varimax and the results are shown in Table 2. The varimax solution is fairly similar to the principal components analysis. The loadings obtained from the principal components analysis are used for the next step involving the calculation of nations' factor scores.

Table 1. The correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Chronic psychosis	.	.	.	.	.	.	.	.	.	.	.	.
2. Calory intake	65	.	.	.	.	.	.	.	.	.	.	.
3. Caffeine consumption	55	57	.	.	.	.	.	.	.	.	.	.
4. Coronary heart disease	61	61	58	.	.	.	.	.	.	.	.	.
5. Alcoholism	-38	-23	-42	-37	.	.	.	.	.	.	.	.
6. Suicide	-40	-31	-21	-13	33	.	.	.	.	.	.	.
7. Murder	-10	-06	-07	13	07	10	.	.	.	.	.	.
8. Crime	-29	-29	-30	-06	07	33	67	.	.	.	.	.
9. Divorce	01	05	13	24	22	15	53	12	.	.	.	.
10. Cigarette consumption	21	27	26	27	05	-17	31	07	40	.	.	.
11. Illegitimacy	-11	04	03	31	13	52	04	12	29	-10	.	.
12. Accidents	-19	09	-01	-03	57	35	33	31	26	28	17	.

Table 2. Principal components and varimax solutions

Variables	Principal components solution		Varimax solution	
	I	II	I	II
1. Chronic psychosis	83	13	82	-18
2. Calory intake	75	30	81	00
3. Caffeine consumption	75	27	80	-02
4. Coronary heart disease	68	49	81	21
5. Alcoholism	-61	22	-49	42
6. Suicide	-58	28	-43	48
7. Murder	-25	69	02	74
8. Crime	-50	44	-30	59
9. Divorce	-06	73	21	70
10. Cigarette consumption	24	57	43	45
11. Illegitimacy	-15	42	01	44
12. Accidents	-35	61	-10	70
Variance	3.50	2.63	—	—
Percentage variance	29.21	21.94	28.23	22.92

The nations' factor scores (component scores) were calculated for both factors for each year, and converted to *t* scores based on a mean of 50 and s.d. of 10 for the entire set of data. These *t* scores are given in Tables 3, 4 and 5.

Let us now consider the possible effect of the Second World War on national levels of neuroticism and examine the hypothesis suggested earlier to the effect that national levels of

Table 3. National neuroticism scores

Country	1935	1950	1955	1960	1965	1970
Australia	44.10	44.21	45.05	44.79	46.46	47.55
Austria	63.04	66.49	64.31	64.56	62.48	66.27
Belgium	49.80	51.19	52.33	50.29	51.04	51.69
Canada	50.71	48.17	47.38	47.82	47.90	50.77
Denmark	43.68	51.98	48.84	45.83	43.91	44.92
Finland	59.53	52.60	58.00	50.63	48.21	46.90
France	56.20	63.41	63.17	60.22	62.21	61.52
Germany	60.60	62.93	59.34	59.33	59.45	60.85
Ireland	30.47	27.00	24.99	26.29	27.02	31.43
Italy	59.93	62.10	59.43	56.75	55.74	57.05
Japan	69.78	73.93	72.00	67.85	63.26	61.69
Netherlands	48.14	49.09	47.23	44.55	42.88	44.46
New Zealand	40.35	37.39	40.26	40.39	39.75	44.36
Norway	46.55	50.33	46.49	46.72	46.35	45.02
Sweden	41.93	45.44	45.48	42.84	41.16	42.95
Switzerland	52.79	50.74	51.48	49.08	48.51	51.50
United Kingdom	36.99	37.76	37.13	37.32	38.48	40.28
United States	55.42	47.70	47.32	47.00	49.38	51.58

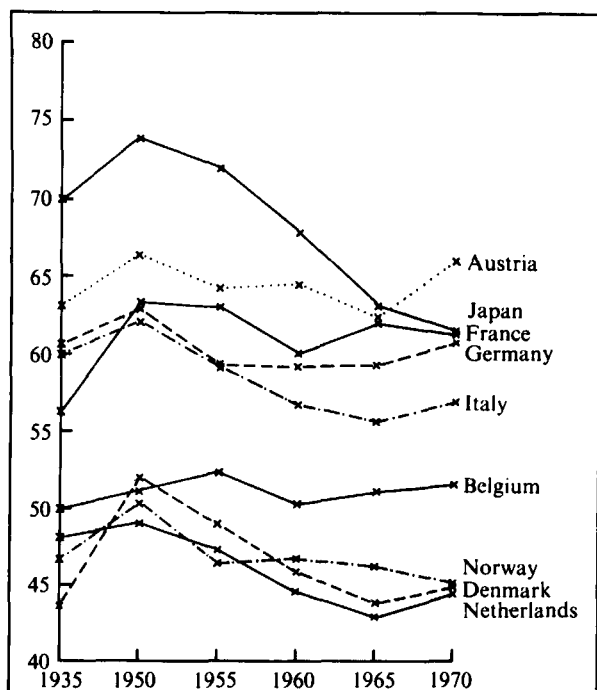
Table 4. National extraversion scores

Country	1935	1950	1955	1960	1965	1970
Australia	45.82	47.65	49.58	51.25	54.61	57.42
Austria	53.73	55.30	56.39	61.19	58.96	67.02
Belgium	40.21	40.39	42.07	44.14	47.53	51.74
Canada	42.83	46.94	48.58	50.09	54.12	60.75
Denmark	44.28	50.24	50.16	52.19	55.60	60.23
Finland	62.16	54.76	55.62	58.32	59.48	61.42
France	43.99	47.02	45.08	48.53	50.03	53.17
Germany	48.65	47.67	48.54	51.06	56.01	58.59
Ireland	40.60	46.21	47.12	45.39	47.34	51.35
Italy	39.81	38.32	39.33	42.09	43.98	44.65
Japan	34.75	38.18	39.41	39.26	38.55	40.48
Netherlands	32.10	34.25	34.42	36.94	40.60	43.10
New Zealand	45.58	47.19	45.97	49.63	53.09	59.16
Norway	35.71	34.83	38.17	38.75	41.68	45.11
Sweden	44.62	44.14	48.20	53.40	56.64	62.35
Switzerland	54.22	51.84	51.99	53.56	55.09	56.12
United Kingdom	48.55	45.69	47.96	49.37	51.85	54.28
United States	78.38	75.16	72.20	73.72	78.20	88.20

Table 5. Mean scores for the 18 nations on neuroticism and extraversion, 1935–1970

	Neuroticism		Extraversion	
	Mean	S.D.	Mean	S.D.
1935	50.56	9.81	46.44	10.52
1950	51.25	11.11	46.99	9.05
1955	50.57	10.73	47.82	8.22
1960	49.01	9.77	49.94	8.57
1965	48.57	9.23	52.41	8.78
1970	<u>50.04</u>	<u>8.59</u>	<u>56.40</u>	<u>10.51</u>
	50.00	10.00	50.00	10.00

neuroticism would be expected to rise in the nations experiencing the stress of military defeat and occupation and then fall to approximately their prewar level. It so happens that nine of the 18 nations suffered military defeat and occupation, while the remaining nine escaped this experience and can be regarded as a control group. The fluctuations of the levels of neuroticism in the two sets of nations are shown in Figs 1 and 2. It will be noted that in all nine nations experiencing military defeat and occupation there was a rise in neuroticism from 1935 to 1950 and a fall from 1950 to 1960. Among the other nine there was no rise from 1935 to 1950 in six and small increases in the other three. The statistical significance of the difference between the defeated and the undefeated nations in their 1950 neuroticism scores, adjusted for differences in 1935 levels, was tested by analysis of covariance. The F ratio between the means of the two groups for 1950 neuroticism scores was 21.89 and is statistically significant at $P < 0.01$.

**Figure 1.** Neuroticism levels in the nations suffering military defeat in the Second World War.

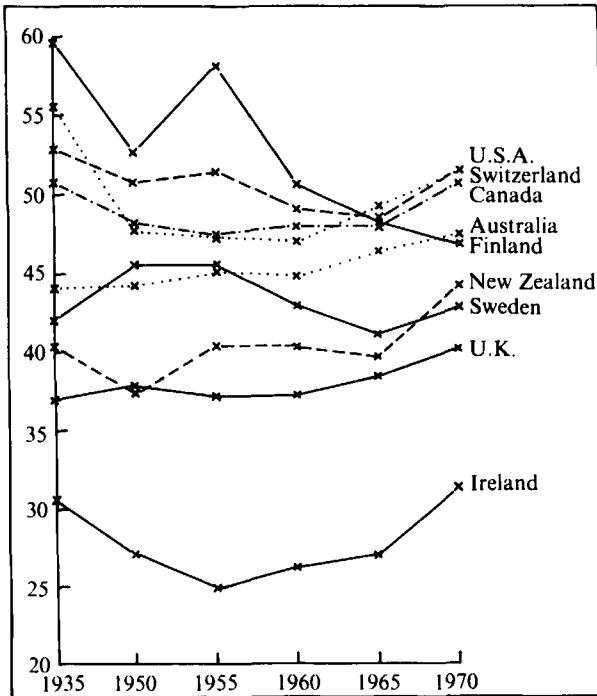


Figure 2. Neuroticism levels in the nations which escaped military defeat in the Second World War.

Discussion

Possibly the most important result is the rise in neuroticism in the nine nations which suffered military defeat and occupation in the Second World War from 1935 to 1950, and the subsequent decline from 1950 to 1960. This rise and fall occurred in all nine of the defeated nations. In contrast in the nine nations which escaped military defeat and occupation, six show a fall in neuroticism, Australia and the UK show marginal increases and Sweden shows a larger increase. Thus the only seriously discrepant case is Sweden. With this exception the magnitude of the increase in neuroticism from 1935 to 1950 discriminates perfectly between the defeated and the undefeated nations, since the rises in Australia and the UK are smaller than in any of the nine defeated nations. The discrimination is probably sufficiently clear to implicate the wartime experiences or some factor associated with them as the cause of the differential rises in neuroticism over the period. There is one psychological trait which is generally agreed to rise with stress, and that is neuroticism or its correlate anxiety. Hence the increase in this trait in the defeated nations goes some way towards validating our original thesis that neuroticism or anxiety is the common factor underlying the covariation of this set of epidemiological and demographic phenomena.

Another point of interest arises from the longer-term trend in the level of neuroticism in the advanced Western nations. The overall picture is that the level is fairly steady over the 35-year period. In ten of the nations the level of neuroticism was higher in 1970 than in 1935, while in the remaining eight it was lower. It appears that apart from powerful stresses like military defeat and occupation, levels of neuroticism in the advanced Western nations have been more or less constant. This result tells against the theory sometimes proposed to the effect that the populations of the advanced nations are becoming more neurotic as a result of the increasing complexity, stress and strain, and so forth of modern life.

The secular trend of the level of extraversion over the period is quite different. Here there has been a steady rise in extraversion, so that the level in 1970 is higher than in 1935 in all the

nations except Finland, and even here there has been a steady increase from 1950 to 1970. The general rise in extraversion levels over the 35-year period has been associated with increasing affluence and this suggests a closer look at the relationship between national levels of extraversion and per capita income. This relationship has been examined between nations in each of the six years and also over time. The correlations are given in Table 6. Here it can be seen that in five of the six years national per capita income is significantly correlated with extraversion; it is only in 1935 that the correlation does not reach statistical significance. The final correlation of +0.60 is derived from treating each nation in each year as an independent subject and expresses the magnitude of the association between national levels of extraversion and per capita income over the 35-year period. These correlations indicate that a population's mean level of extraversion is substantially associated with its per capita income both between nations at various points in time and within nations over time. The consistency of the association between extraversion and affluence suggests that the two are causally related but the nature of the causal connection must remain a matter for speculation.

Table 6. Product moment correlations between national income, neuroticism and extraversion for individual years and for all years combined. Correlations above 0.59 are statistically significant at $P < 0.01$

Year	Neuroticism	Extraversion
1935	-40	36
1950	-44	65
1955	-30	66
1960	-25	66
1965	-17	73
1970	02	65
All years	-14	60

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Received 17 February 1976

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Appendix

The sample consists of the 18 major advanced Western nations used in earlier analyses of national differences in anxiety (Lynn, 1971), and in extraversion and neuroticism (Lynn & Hampson, 1975). These include all the advanced Western nations with populations over one million and a per capita income above \$US 450 in 1961, and for which data are obtainable. In the case of Germany, prewar figures are for the German Reich, postwar figures for the Federal Republic of Germany only. The data were collected for the

years 1935, 1950, 1955, 1960, 1965, 1970 or the nearest available year. A description of the variables used and their sources is given below.

1. Chronic psychosis: number of psychiatric patients per 1000 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*; Penrose (1939); Statistical Offices of the various countries.

2. Calory intake: daily intake of available calories per capita. Source: UN Statistical Yearbooks; Statistical Office of the Food and Agricultural Organization.

3. Caffeine consumption: kilograms of coffee and tea imports retained for home consumption per annum, per capita; the index 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; International Tea Committee, London.

4. Coronary heart disease: deaths from coronary heart disease per 100000 population. There have been changes in the UN classification of causes of deaths over the period 1935–1975. The following figures were used:

1935	deaths from all heart diseases
1950–65	deaths from coronary heart disease and atherosclerosis
1970	deaths from ischaemic heart disease

Source: UN Demographic Yearbooks; WHO Statistical Office, Geneva.

5. Alcoholism: deaths from cirrhosis of the liver per 100000 population. Source: UN Demographic Yearbooks; WHO Statistical Office.

6. Suicide: deaths from suicide per 100000 population. Source: UN Demographic Yearbooks; WHO Statistical Office.

7. Murder: deaths from murder per 100000 population. In 1968 there was a change in the UN classification, such that some deaths previously included under murder were classified as accidents. However, by using the more detailed classification of deaths issued by the WHO it was possible to obtain comparable data for 1970.

Source: UN Demographic Yearbooks; WHO Statistical Annual.

8. Crime: number of prisoners in jail per 10000 population: either at the end of the year or the daily average prison population. Source: Statistical Offices of the various nations; Penrose (1939).

9. Divorce: number of divorces per 10000 population. Source: UN Statistical Yearbooks.

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

11. Illegitimacy: percentage of live births that are illegitimate. Source: UN Demographic Yearbooks; Statistical Offices of the various nations.

12. Accidents: deaths from all types of accidents per 100000 population. As explained above (see murder) it was necessary to make adjustments to the 1970 rates in order to obtain comparable figures. Source: UN Demographic Yearbooks; WHO Statistical Annual.

Estimates of per capita national income were obtained from the UN Statistical Yearbooks and from National Income Statistics 1938–48 (1950).

Tables containing full details of the data used for the analyses may be obtained on application to the authors and from the SSRC data bank at the University of Essex.