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National Differences in Anxiety

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## *National Differences in Anxiety*

R. LYNN\*

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**T**his monograph presents a psychological theory of national variations in a number of demographic phenomena. The theory is developed with particular reference to the remarkable demographic character of the Republic of Ireland. There are several features of Ireland which have long puzzled investigators. Among the most well known are the low prevalence of suicide, apparently the lowest of all advanced countries; the uniquely high hospitalised psychosis rate, and the exceptional *per capita* calorie intake, equalled only by that in New Zealand.

This monograph is concerned with two questions. First, are these and other characteristics interrelated in the sense that there is some common factor underlying them, or is it merely chance that Ireland is exceptional in all these respects? We shall find that they do form a single syndrome. This gives rise to a second question: what is the underlying factor in this syndrome? It will be suggested that the answer lies in the anxiety levels of the population and that Ireland is characterised by an exceptionally low level of anxiety.

### 1. A FACTOR ANALYTIC MODEL FOR DEMOGRAPHY

The approach taken to the question of whether these demographic characteristics form a single syndrome lies in the application of factor analysis. This

\*The author is a research professor at The Economic and Social Research Institute. The paper has been accepted for publication by the Institute. The author is responsible for the contents of the paper including the views expressed therein. The present paper is a short version of a theory presented at greater length in *Personality and National Character*, Pergamon Press, 1971. The author would like to record his indebtedness to Professor Sir Cyril Burt and Professor H. J. Eysenck for their comments on early drafts of the theory, and to Miss S. L. Hampson, research assistant at the E.S.R.I., for assistance on data collection and statistical computation.

statistical technique examines the intercorrelations between a number of variables and extracts a smaller number of underlying factors. Each factor is essentially a cluster of intercorrelating variables, and where such a cluster occurs the existence of a single underlying factor can be inferred.

The technique was first proposed by Karl Pearson for the study of differences between individuals and has since been extensively adopted by psychologists, especially in the field of intelligence. The initial step is to take a number of tests of what seem *prima facie* to be measures of intelligence, e.g. tests of mental arithmetic, verbal abilities, general knowledge, memory, logical analysis and so forth. These are then given to a number of subjects and the scores intercorrelated. The results show that the tests intercorrelate and from this the existence of a single underlying factor of "general intelligence" is inferred. The technique of factor analysis is concerned with a detailed description of this factor and of other factors whose existence may also be inferred from the pattern of the intercorrelations.

The essence of the logic of factor analysis rests on the proposition that where two or more variables are correlated there is some causal relationship between them, although the inference of such a causal relationship does not of course imply that one variable causes the other, since there may well be some common cause which gives rise to correlated effects. This principle was stated by J. S. Mill in his *System of Logic*:

"Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation."

The research to be described in this paper involves the application of the technique of factor analysis to the problems of Irish demography. To find out whether a common factor underlies the various features of Irish demography we must ask whether these variables are intercorrelated. The method adopted for doing this is to take a number of countries and examine the intercorrelations between the variables. What is being done here is to see whether the pattern which occurs in Ireland (low suicide in conjunction with high psychosis, etc.) is also present in other countries. If it occurs frequently, it may be inferred that the relationship is not due to chance but that some kind of law is operating to determine the co-variation of the variables. In tackling the problem in this way our procedure is to treat countries in the same way as individual persons are treated in conventional factor analysis. Demographic measures are treated as scores, intercorrelated, and factor analysed.

The first step in this approach is to select an appropriate group of nations and the group chosen is what may be broadly called the advanced western nations, comprising the countries of northern Europe, the old Commonwealth, the USA and Japan. This means that the results will only be valid for purposes of comparison within this group of nations. In due course I shall argue that

there is a low level of anxiety in Ireland. Naturally this conclusion could not be extended to other countries outside the group and further investigations would have to be made before any wider comparisons could be drawn. The reason for confining the group of countries to the advanced western nations is that the statistics which concern us are either unavailable or of doubtful validity as we move away from the advanced world.

In selecting any group of nations there must inevitably be borderline cases for which arguments for inclusion and exclusion could be made. The rules adopted were that for inclusion a country should have had a *per capita* GDP of over 450 US dollars in 1961, a population of over one million over the period 1950-61 and belong to the group of nations which are broadly regarded as advanced western democracies. These criteria yield the eighteen countries shown in Table 1.

## 2. A SIMPLE VERSION OF THE MODEL: SUICIDE AND MENTAL ILLNESS

In order to make the exposition as simple as possible, let us first take two of the demographic variables, namely suicide and hospitalised mental illness. The product-moment correlation between these two rates over the eighteen nations is  $-0.50$ . The negative co-variation of the two variables supports the hypothesis that there is some factor which tends to increase the suicide rate in a country and at the same time decrease the prevalence of hospitalised mental illness. It would be possible to advance a number of explanations as to what this factor might be. The hypothesis suggested here is that the common factor is the level of anxiety in the population. The assumptions of this hypothesis are that high anxiety is one of the principal causes of suicide and low anxiety one of the principal causes of chronic hospitalised mental illness. These assumptions will be supported in due course. From this theory it follows that where the mean level of anxiety in a country is high, there would be a high proportion of suicides and a low proportion of chronic psychotics; where the mean anxiety level is low, the proportions would be reversed. Such a model can explain the observed negative correlation between a country's suicide rate and the prevalence of mental illness. The model is illustrated in Figure 1.

The hypothesis requires extension and justification at two points. First, it would be desirable to show that there are other demographic characteristics which can also be explained by the model. Second, it must be shown that a good case can be made for regarding suicide and mental illness as functions of anxiety. These matters are discussed in the following sections.

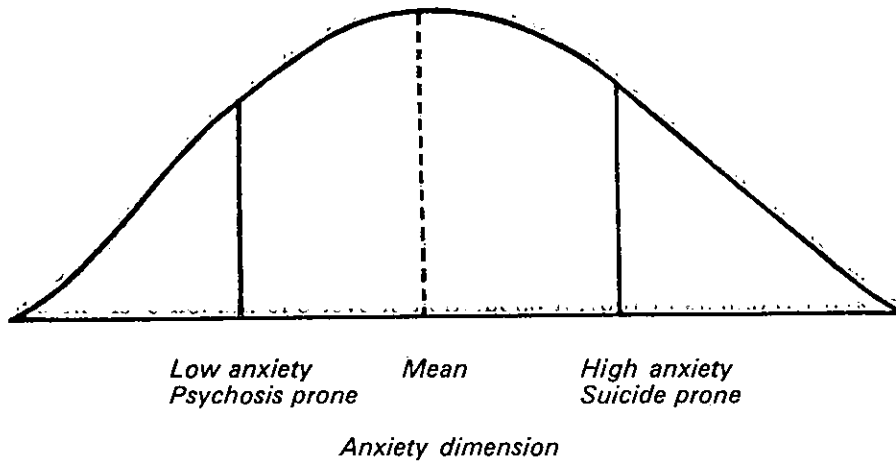


Figure 1: *Model to explain the negative relationship between suicide and psychosis.*

### 3: THE FACTOR ANALYSIS

The method adopted now is to take a number of possible indices of a country's anxiety level and subject them to factor analysis. The hypothesis demands that the factor analysis should yield a single general factor on which all the variables are loaded, i.e. that the variables should all be reasonably well intercorrelated. All measures were annual rates taken for 1960, or, if this year was not available, 1961. The measures taken are as follows:—

1. Hospitalised mental illness
2. Deaths from coronary heart disease
3. Road accident deaths per vehicle
4. Caloric intake
5. Suicide
6. Deaths from alcoholism and liver cirrhosis
7. Cigarette consumption
8. Deaths from gastric and duodenal ulcers
9. The murder rate
10. Celibacy (the percentage of the male population single)
11. Deaths from hypertension.

These data for the eighteen countries are shown in Table 1. The variables were intercorrelated, and the correlation matrix (Table 2) was factored by



TABLE 1. *International data used in the factor analysis*

	<i>Hospitalised mental illness (per 1,000 pop.)</i>	<i>Coronary heart disease deaths*</i>	<i>Road accident deaths (per 1,000 vehicles)</i>	<i>Calorie intake (per person per day)</i>	<i>Suicides*</i>	<i>Cirrhosis and alcoholism deaths*</i>	<i>Cigarette consumption (per adult per year)</i>	<i>Gastric and duodenal ulcer deaths*</i>	<i>Murders*</i>	<i>Celibacy (% single males)</i>	<i>Hyper- tension deaths*</i>
Australia	3.1	256.2	0.9	3,140	10.6	6.3	2,440	6.6	1.5	38.2	10.2
Austria	1.9	242.8	3.2	2,970	23.1	23.3	1,720	9.4	1.2	42.9	6.1
Belgium	3.1	142.3	1.9	3,040	14.6	10.7	1,570	5.7	0.7	34.4	25.8
Canada	3.9	237.0	0.7	3,020	7.5	6.8	2,910	5.1	1.4	37.8	5.5
Denmark	2.2	246.6	1.3	3,370	20.3	8.5	1,470	6.7	0.5	39.9	2.5
Finland	3.6	221.5	3.0	3,110	20.5	3.5	2,100	5.6	2.9	42.8	2.9
France	2.1	78.4	1.1	3,190	15.8	40.4	1,320	3.2	1.7	41.9	4.8
Germany	1.7	199.2	2.7	2,960	19.5	18.8	1,630	6.1	1.0	39.8	4.0
Ireland	7.3	313.5	1.1	3,490	3.0	2.1	2,560	7.4	0.2	60.9	12.4
Italy	2.2	188.4	3.6	2,720	6.3	18.3	1,300	6.3	1.5	49.9	7.6
Japan	1.1	50.1	7.3	2,260	21.6	10.2	1,880	11.9	1.9	45.5	9.2
Netherlands	2.3	168.2	2.8	3,030	6.6	3.8	1,700	4.9	0.3	40.9	4.4
New Zealand	3.5	243.7	0.6	3,490	9.7	3.2	1,930	6.7	1.1	35.8	4.6
Norway	2.9	210.0	0.9	2,930	6.5	4.5	550	3.0	0.4	41.2	4.4
Sweden	4.8	281.5	0.8	3,000	17.4	5.5	1,160	7.6	0.6	42.9	3.7
Switzerland	3.5	229.7	2.2	3,220	19.0	14.9	2,380	5.7	0.6	45.0	4.1
UK	4.5	314.6	1.0	3,280	10.6	3.0	2,760	10.2	0.6	36.2	13.7
USA	4.3	306.3	0.5	3,110	10.6	12.5	3,810	6.3	4.7	30.8	7.0

\*per 100,000 population.

TABLE 2: *The Correlation Matrix*

<i>Variables</i>	<i>Rate</i>	1	2	3	4	5	6	7	8	9	10	11
1. Hospitalised mental illness	Low	(1.0)	.72	.57	.58	.50	.49	.46	.00	.06	-.29	.21
2. Coronary heart disease deaths	Low		(1.0)	.64	.61	.30	.49	.47	-.10	.00	.02	-.07
3. Road accident deaths	High			(1.0)	.79	.44	.14	.20	.51	.08	.31	-.02
4. Calorie intake	Low				(1.0)	.26	.17	.26	.30	.20	.05	-.03
5. Suicides	High					(1.0)	.37	.18	.34	.14	-.15	.19
6. Cirrhosis and alcoholism deaths	High						(1.0)	.21	-.20	.19	.01	.12
7. Cigarette consumption	Low							(1.0)	-.26	-.54	.22	.15
8. Ulcer deaths	High								(1.0)	.02	.13	-.23
9. Murders	High									(1.0)	-.36	.12
10. Celibacy	High										(1.0)	.08
11. Hypertension deaths	Low											(1.0)

Variables which loaded negatively on the factor have been reversed in order that the existence of a general factor might be shown clearly in the correlation matrix by the absence of any large negative correlations. These variables are marked as having a low rate.

principal component analysis, with unities in the main diagonal. Four factors with eigenvalues (factor variances) above unity were extracted and the factor loadings are shown in Table 3. The first factor accounts for 33.5 per cent of the variance and it is with this factor that we are concerned. With such a small number of variables the second, third, and fourth factors are unlikely to be of much significance,\* and some of their higher loadings are probably artifacts due to the insertion of unities in the main diagonal.

TABLE 3: *The Factor Loadings*

Variables	Rate	Unrotated factor loadings			
		I	II	III	IV
Hospitalised mental illness	Low	.87	-.12	.28	.06
Coronary heart disease deaths	Low	.84	-.20	.02	.32
Road accident deaths	High	.82	.32	-.38	-.07
Calorie intake	Low	.79	.26	-.17	.15
Suicides	High	.60	.22	.18	-.39
Cirrhosis and alcoholism deaths	High	.52	-.24	.43	-.03
Cigarette consumption	Low	.49	-.72	-.23	.00
Ulcer deaths	High	.19	.72	-.48	-.18
Murders	High	.07	.59	.63	-.04
Celibacy	High	.03	-.23	-.71	-.37
Hypertension deaths	Low	.11	-.27	.33	-.80
Eigenvalues		3.69	1.86	1.76	1.10
Variance (%)		33.5	16.9	16.0	10.1

Table 2 shows clearly significant correlations between hospitalised mental illness, coronary heart disease deaths and calorie intake (all low) and road accident deaths (high),† and suggestive though not always clearly significant correlations between some of these variables and suicide and alcoholism (high) and cigarette consumption (low). The correlations for celibacy, hypertension deaths, and murder, and perhaps also ulcer deaths, are too low to be of much interest. The factor analysis in Table 3 in turn makes it clear that these last four

\*Applying T. W. Anderson's theory to the first two eigenvalues in Table 3, we find 95 per cent confidence limits for the largest: 2.23 to 10.64. If the series were independent and indefinitely large in number all the eigenvalues would not differ much from unity. As the lower confidence limit is 2.23 we can safely infer that the first factor is significant.

†For a group of this size clearly significant correlations (5 per cent level) are those above 0.47. It is arguable that since the nations are the complete universe of advanced western nations according to our criteria of size and wealth, tests of statistical significance are not appropriate. If this view is taken the anxiety factor would be of purely descriptive interest and applicable only to this group of countries at the present time. On the other hand, it may be arguable on various grounds that the nations do constitute a sample. This view has certain advantages since it gives the theory predictive power and the same technique would then be applicable to other groups of nations and to other time periods.

variables are not to any significant extent loaded on the first factor, which we call anxiety. They are accordingly dismissed from the main part of the further analysis in this paper; a discussion of them is given in Appendix 2.

With the exception of the four discarded variables Table 3 shows that the hypothesis that the underlying national anxiety level would emerge as a general factor has been supported. The interpretation of the factor in terms of anxiety level implies the following trends in countries where the anxiety level is high: a high rate of deaths from vehicle accidents, suicide, and alcoholism; a low rate of deaths from coronary heart disease, a low calorie intake, a low consumption of cigarettes and a low prevalence of hospitalised psychosis. As can be seen from Table 1, the pattern of results for Ireland suggests an exceptionally low level of anxiety and indeed, as will be seen in Section 12, the anxiety level of Ireland is the lowest of all the eighteen countries. Probably the only measure which may occasion surprise in Table 1 is the comparatively low prevalence of alcoholism in Ireland. The problems of the reliability of the alcoholism and other data with particular reference to Ireland are discussed in Appendix 1.

In the next sections we discuss the nature of anxiety, and the evidence for regarding the variables as functions of anxiety is considered for each of the variables in turn.

#### 4. THE NATURE OF ANXIETY

What is anxiety? There are a number of schools in psychology which use the concept of anxiety in roughly, although not always exactly, the same sense. But while there are differences of detail between these schools, there is agreement in broad outline about what anxiety is and on its significance as an important personality characteristic. The disagreements are principally matters of detail and are on a different plane from that on which we are working in this paper. For example, Eysenck (e.g. 1967) regards anxiety as a product of the two more fundamental personality traits of neuroticism and introversion. This does not mean that Eysenck does not regard anxiety as an important and useful concept. His position is simply that where something (e.g. suicide) is associated with anxiety, it is possible to make a further refinement in terms of the more fundamental traits of neuroticism and introversion.

Where Eysenck breaks anxiety down into two subfactors, Cattell breaks it down into the five subfactors of guilt, ergic tension, poor ego-strength, suspiciousness and poorly developed self-sentiment. Many others, such as Gellhorn (1957), think of anxiety as a unitary trait dependent largely on the dominance of the sympathetic nervous system. Others again, such as the

Spence (1960) school, think of anxiety as a single drive in terms of Hull's behaviour system. But these are differences within the family, and there is broad agreement on the nature of anxiety and its significance. While there is much to be said for the Eysenck and Cattell approaches of breaking the concept down into its components, there are circumstances where the data are only sufficient to enable us to work in terms of the broad concept and this seems to be the case with our epidemiological data. In short, there appears to be sufficient evidence to posit a national personality factor of anxiety, the strength of which is responsible for the national patterns with which we are concerned; but it seems doubtful whether at this stage it would be fruitful to push the analysis further and make any judgements about whether the national differences lie in neuroticism or introversion, or any of the subfactors of the Cattell system.

Furthermore, neither the Eysenck analysis of anxiety in terms of neuroticism and introversion nor the Cattell analysis or indeed any other single approach is universally accepted. Which of the personality constructs eventually emerge will probably depend on the identification of their physiological bases. It may be, as Eysenck (1967) suggests, that the level of excitation in the brain stem reticular formation gives rise to introversion and that in the thalamic reticular formation underlies neuroticism, and that when there is a high level in both they tend to augment each other, giving rise to a correlation between the two personality factors and a joint factor of anxiety. However, from our own point of view these possibilities are beyond the range of our data and it seems best to interpret our factor in terms of the broad concept of anxiety. When personality theory has sorted out the details of the structure of anxiety, our factor should easily fall into place with whatever personality system finally emerges.

Although anxiety has seemed the best term for the factor with which we are concerned, it should be pointed out that it has undesirable ambiguities. As an alternative there is much to be said for the term *emotionality*, which was suggested as a general factor some decades ago by Sir Cyril Burt (1915). One advantage of *emotionality* is that it is a fairly neutral term, whereas anxiety has come to have pejorative connotations. This flavour has been acquired comparatively recently, largely as a result of Freud's theory of anxiety as the underlying condition in neurosis. Before Freud's work became popular, the association of anxiety with neurosis was less strong and it was more commonly used in the sense of "earnestly desirous" or "strained or solicitous desire". Thus Nelson is said to have written in 1794 that "the general seems as anxious as anyone to expedite the fall of the place". Similarly, W. S. Gilbert wrote

"If you're anxious to shine  
In the high aesthetic line. . . ."

This usage still exists today, although it has possibly become overshadowed by the associations of anxiety with maladjustment.

As used in this paper, the term anxiety is intended to convey both the

implications of worry and strong motivation. Which is predominant depends on the intensity of the anxiety. At a low level of anxiety an individual is exceptionally emotionally stable and free from all kinds of worry and nervous tension. In its middle range, anxiety manifests itself as nervous energy or "strained or solicitous desire", and it is here that it is used in the sense of a person being anxious to achieve something. This usage has a slight connotation of worry, but the chief implication is one of strong motivation. It is only when anxiety becomes intense that it takes on the Freudian association of *angst* and becomes a neurotic condition which both induces unhappiness and interferes with endeavour. It is probably advantageous, as far as achievement is concerned, to have the moderate level of anxiety where it manifests itself as strong motivation, although disadvantageous for the anxiety to be so high that it turns into neurosis. Thus anxiety can be useful or otherwise, depending on its degree of intensity.

Pride of place for the establishment of anxiety as a central concept in both psychiatry and psychology should probably be given to Freud (e.g. 1936), who regarded it as the underlying condition responsible for many neurotic and psychotic states. He took the view that the person with high anxiety develops "defence mechanisms" for alleviating the anxiety, and these may take the form of neurotic or psychotic symptoms. For instance, someone who is excessively anxious about what he might meet in the street might develop a phobia about going out of doors. While not all of Freud's formulations have been universally accepted, his view of anxiety as a concept of fundamental importance in psychiatry and psychology has met with virtually universal agreement.

Among psychiatrists anxiety is generally assessed in a qualitative or "clinical" manner, that is to say an overall judgement is made of the significance of anxiety in a patient's symptomatology. The approach of psychologists has been to try to put the concept on a more objective basis by devising tests by which a person's level of anxiety can be measured. The model followed has been the concept of intelligence, which has been successfully lifted from the level of subjective assessment to that of objective measurement by intelligence tests. Psychologists have endeavoured to do the same thing with anxiety.

Concepts resembling anxiety have a long history in the description of human personality. Some such concept seems to have been present in classical Greece in Hippocrates' classification of the four personality types, the melancholic and choleric having high anxiety and the sanguine and phlegmatic low anxiety. But in contemporary times four groups of psychologists and physiologists have been particularly prominent in the use made of the concept of anxiety. The first may be called the London school and has its origin in the work of Professor Sir Cyril Burt, who drew attention early in the century to a factor which he called *general emotionality* (Burt, 1915). This factor has many similarities to anxiety, since Burt suggested that people who are high on *general emotionality* tend to be neurotic.

This approach has been pushed further by Eysenck (1947, 1952), a pupil of

Sir Cyril Burt. He too has formulated a general personality trait or *dimension*, as he has preferred to call it, of emotionality, and for this he has suggested the term *neuroticism*. This is conceived as a personality scale, continuum or *dimension on which an individual can be placed and on which neurotics form an extreme group*. Hence the designation of the scale. One of the chief contributions of Eysenck is that he has devised a number of tests, including questionnaires, for measuring a person's position on this scale.

A similar approach to that of the London group has been taken by Cattell (1957) at the University of Illinois. He has used the term anxiety and devised scales for its measurement in the general population. One of the distinctive contributions of Cattell is that he has analysed the general anxiety factor into a number of subfactors, such as guilt, suspiciousness, nervous tension and so forth. These subfactors correlate with one another, but the correlations are sufficiently low (they are generally of the order of around 0.3) for it to be useful to consider them as distinct subfactors. Once again, an illustrative parallel can be drawn with general intelligence. This too can be broken into a number of positively intercorrelated subfactors such as verbal ability, mechanical aptitude, memory and so on. For some purposes it is useful to consider these as separate entities; for others, to combine them into one broad factor of general intelligence. Both usages are legitimate and neither precludes or invalidates the other. The same is true of anxiety: one can work in the subfactors isolated by Cattell; or with the general factor considered as a single entity.

A third group which has isolated a factor resembling anxiety has worked in Moscow under the direction of the late B. M. Teplov (1964) and V. D. Nebylitsyn (1964). This group has carried on the conceptual framework formulated by Pavlov. In his work on experimental neurosis Pavlov was interested in the question of why some dogs break down when subjected to stress more easily than other dogs. He suggested that the answer lies in a constitutional factor which he called "the strength of the nervous system". The nervous system's strength is the degree to which it can withstand stress. If the nervous system is weak, then a comparatively minor degree of stress is sufficient to precipitate the dog (or human being) into a nervous breakdown. This concept has something in common with the western concept of anxiety, because anxiety is also conceived as a general trait whose extreme is characterised by susceptibility to neurotic breakdown.

Pavlov's successors in Moscow have established measures of the trait, consisting principally of tests of perceptual sensitivity and nervous exhaustion. There are some dozen measures which intercorrelate positively, thereby defining a general underlying factor. Some are simply tests of absolute sensory thresholds. Others are more complex. For example, one measure is the conditioned photochemical reaction. The subject is first dark adapted and his absolute visual threshold measured. A flash of light is then presented, which has the effect of decreasing the subject's sensitivity. This reduction in sensitivity can be conditioned by presenting a neutral stimulus before the flash. With continued reinforced trials

the conditioned stimulus has less and less effect in evoking a response. The percentage reduction in the strength of the conditioned reaction is taken as a measure of the weakness of the nervous system. This is justified statistically by its positive intercorrelation with other measures of the factor, and theoretically, because it reflects the exhaustion of the nervous system under the stress of repeated stimulation. Nebylitsyn (1964) has himself drawn attention to the similarity between the Pavlovian concept and the western concept of anxiety. It should perhaps be noted that Eysenck (1967) has argued that the strength of the nervous system could be identified with introversion rather than anxiety or neuroticism. It is possible that this may turn out to be right but this would not embarrass the present argument. Anxiety is partly a function of introversion (see e.g. Eysenck, 1957, for detailed evidence of this association), so that up to a point the Eysenck position overlaps with the present one, although admittedly anxiety is more strongly associated with neuroticism than introversion in Eysenck's system. But in any case, our purpose here is only to show that in addition to several schools in the West, the Russian workers have also arrived at a concept resembling anxiety.

Thus there are a number of schools of psychologists which have stressed the importance of anxiety: the psychoanalytic group derived from Freud; Sir Cyril Burt and Professor H. J. Eysenck in London; Professor R. B. Cattell in the USA; and the Pavlovian group in Moscow. In addition, there is a long-standing tradition of a similar concept in physiology and physiological psychology. Over the course of the century it has appeared and reappeared in several different guises. Creed, Denny-Brown, Eccles, Liddell and Sherrington (1932) postulated the concept of a "central excitatory state", whose level of activity augmented or diminished reflex actions. At about the same time Duffy (1930) advanced the concept of excitation, which she has later identified with the similar concept of activation. She defined excitation as "the extent to which the organism as a whole is activated or aroused", as assessed by a number of physiological measures such as skin resistance, muscle tension, cardiovascular measures and EEG frequency and amplitude. Cannon (1929) put forward a similar view in his theory of a general emotional state arising from excitation in the thalamus and hypothalamus and manifesting itself in fear or aggression.

In the post-1945 period these theories were restated. Lindsley (1951) put forward an "activation" theory of emotion. He accepted the hypothalamus as the primary locus for emotional expression, but drew attention to the recent work of Moruzzi and Magoun demonstrating that the brain stem reticular formation also plays a part in maintaining the general level of activation. A few years later Morgan (1959) formulated a physiological theory of drive in terms of a "central motive state", which determined the intensity of motivated behaviour. Beach (1958) has also suggested a central arousal mechanism.

There are therefore a number of workers primarily in physiology who have suggested the existence of a general emotional factor, for which activation or arousal are now the commonest terms. It seems probable that this is the

physiological basis of anxiety. The physiology of anxiety is now reasonably well understood, at least in broad outline, and it has much in common with the physiologists' concepts of activation and arousal. The maintenance of anxiety depends to a considerable extent upon the level of neural activity of the frontal lobes, the hypothalamic centres of the sympathetic nervous system, and probably also the brain stem reticular formation. The part played by these areas can be demonstrated in a number of ways. For instance, the frontal lobes can be severed from the rest of the brain by the surgical procedure of prefrontal leucotomy. This operation is sometimes performed to reduce anxiety or other neurotic conditions in which anxiety plays a prominent part. The inference is that the frontal lobes normally maintain anxiety, so that rendering them inactive reduced a person's anxiety level. The effectiveness of the operation in reducing anxiety has been established by psychological tests given before and after the operation (Petrie, 1952). These show a reduction in anxiety after the operation has been completed.

The sympathetic nervous system also plays an important part in the maintenance of anxiety. The sympathetic system is activated by novel or significant stimulation, and by threat. It mobilises the body for action by increasing the blood supply to the head, accelerating the respiration and heart rate and other physiological changes, and increasing the sensitivity of the sense organs (Lynn, 1966). These are the physiological concomitants of anxiety. It is probable that anxious people have sympathetic nervous systems which are exceptionally responsive to stimulation. There is considerable evidence in favour of this view. For example, Runquist and Ross (1959) showed a positive correlation between subjects' anxiety scores on a questionnaire (the Taylor Manifest Anxiety Scale) and the amplitude of the heart rate acceleration and psychogalvanic reactions to stimulation.

Thus anxiety can be defined as a personality trait or dimension, measurable both by psychological tests such as questionnaires, and by physiological tests of the reactivity of the sympathetic nervous system. This is the personality trait which it is suggested varies in different countries and underlies the inter-correlations between national rates of mental illness, suicide, alcoholism, calorie intake and other variables loaded on the factor.

## 5. INTERPRETATION OF THE FACTOR: VEHICLE ACCIDENTS

We now consider each of the variables in turn and the justification for regarding them as products of anxiety. Taking vehicle accidents first, there are two principal reasons why there should be a high rate of deaths from vehicle accidents in countries where the general anxiety level is high.



In the first place, there is an association between anxiety and accident proneness, particularly in vehicle accidents (Cattell, 1964). This is partly due to the well-known effect of anxiety in impairing the performance of skilled tasks, which has frequently been demonstrated. For example, Eysenck and Gillan (1964) carried out an experiment on two groups of boys, one of which was led to understand that the task they were about to perform was part of a selection test for a job (the anxious group), while the other merely thought they were assisting some psychologists in an academic inquiry (the unanxious group). The task involved holding a stylus for 15 seconds in a small hole, without touching the sides. Every time the subject allowed the stylus to touch the side an automatic recording was made. The anxious subjects made significantly more mistakes, presumably due to poorer muscular control, than the unanxious. Kellogg (1932) has also demonstrated a relationship between emotional excitement and poor muscular control, and the association between high anxiety and impaired performance in skilled tasks is fairly well established (Mednick, 1958; Spence, 1960; Kimble, 1961; Eysenck, 1964).

Thus high anxiety is likely to lead to vehicle accidents because it impairs motor control. In addition, anxiety tends to make people aggressive, and this could also lead to driving accidents. Anxiety and aggressiveness have much in common. They are difficult if not impossible to distinguish physiologically. Both involve an activation of the sympathetic nervous system entailing an increase in heart rate, respiration rate, and other changes designed to mobilise the body for energetic action (Morgan, 1965). Indeed the evolutionary function of anxiety is generally regarded as the mobilisation of the body for dealing with threat, and one of the commonest courses of action in the face of anxiety has been aggression. Hence the similarity between the two conditions.

In view of this association we might expect that anxious people would tend to be aggressive and in particular might drive aggressively. This in turn would be likely to result in accidents. The aggressive element in driving has been investigated by Parry (1968), who has devised a questionnaire consisting of questions like "Do you flash your lights in anger?" and "Do you make rude signs at other motorists when you are provoked?". By the use of this questionnaire he has measured driving aggressiveness and found an association between high scores on the questionnaire and actual motor accidents. This study demonstrates the links on the one hand between anxiety and aggression and on the other between aggression and vehicle accidents.

Deaths from vehicle accidents can be regarded as a function of accident proneness. There are several studies indicating that the accident prone individual is anxious. Heimsta, Ellingstad and Dekock (1967) set up a simulated driving task in which they were able to measure driving errors and hence accident proneness. They put 175 men and 175 women through the task and then asked them to check adjectives particularly applicable to themselves. Those who made most errors scored high on adjectives indicating anxiety and aggressiveness.

Alonso-Fernandez (1966) found similar results in Spain. He investigated a number of people who had been involved in car accidents and concluded that most of them were "alcoholics, and insecure and aggressive personalities". They tend to react to stress with deterioration of motor co-ordination, and this in turn makes them accident prone. The association between alcoholism and accident proneness is particularly interesting from our own point of view because it implies that countries with a high prevalence of alcoholism should have a high incidence of vehicle accidents and this is what is found in the correlation matrix shown in Table 2.

A study by Mannheim and Mellinger (1967) divided 684 children into three groups of high, medium and low accident proneness on the basis of their life histories of involvement in accidents. They found that the high accident-prone group had a number of symptoms of maladjustment, which can probably be regarded as associated with anxiety. Litman and Tabachnick (1967) attempted a posthumous psychological assessment of 15 men who had died in car accidents and concluded that they were "active, impulsive, quick, independent, adventurous and rebellious". These are signs of the highly aroused personality, with which anxiety is associated (Lynn, 1966; Claridge, 1967; Eysenck, 1967). Thus there is reasonably strong evidence suggesting an association between anxiety and vehicle accidents.

## 6. SUICIDE

The suicide loading on the factor is positive, suggesting that an important cause of suicide is high anxiety. Many writers have regarded anxiety as an important cause of suicide. For example, Stengel (1964) in his book on the subject lists the causes and gives as the first "depression with guilt feelings, self-depreciation and self-accusations, associated with anxiety and tension". Dublin (1965) writes:

"The reasons most often indicated by the person who commits suicide or by the family are ill health, economic distress, the loss of a loved one and domestic discord. Behind all these characteristics are found almost invariably certain emotional attitudes and fears and anxieties, a sense of inferiority and insecurity, hatred, aggressiveness, guilt, frustration or revenge."

This passage indicates that suicide occurs principally in highly emotional, i.e. anxious people; this is especially the case when they are subjected to stress,

such as bereavement or economic crises, which has the effect of increasing anxiety still further.

A similar view was taken by Rook (1959) in his investigation of suicide among Cambridge University students. He reached the conclusion that over half had an excessive fear of examinations and the majority of student suicides do occur around the time of examinations. Although there is some tendency for all suicides to occur in the months of April to July, this tendency is much more pronounced among university students. Similar conclusions have been reached about students who commit suicide in Berkeley, California. Seiden (1966) investigated a number of cases and concluded that the principal causes were anxieties about work, health and personal relationships. The association between anxiety and suicide is further confirmed in an investigation by Philip (1970). He tested one hundred attempted suicides in Edinburgh with Cattell's 16 P.F. Test. The suicide patients scored significantly higher on anxiety than the mean for the population.

It is not necessary for the present thesis to maintain that all suicides are a result of high anxiety. It need only be granted that some suicides are so caused. So long as the other causes of suicide are constant from one nation to another, it would then follow that if there were a comparatively high proportion of anxious people in a country, there would be a high incidence of suicide.

## 7. CALORIE INTAKE

The loading of calorie intake on the factor is negative, indicating a negative relation between calorie intake and anxiety. People who are emotionally stable normally have a good hearty appetite, while among those who are anxious the appetite tends to be reduced. The reason for this is that eating and the digestive processes are mediated by the parasympathetic system while anxiety is mediated by the sympathetic system, and these two systems have a reciprocally inhibiting relationship with each other (Gellhorn, 1956). It is common in general medical practice to prescribe amphetamines to women who wish to slim, and the rationale for this is that the amphetamines are sympathetic stimulators which suppress the appetite. In cases of *anorexia nervosa*, in which there is a high level of anxiety, the patient will not eat at all and dies of starvation unless forcibly fed.

The evolutionary process by which appetite and anxiety have come to have this reciprocally inhibiting relationship is reasonably well understood. It has come about because when an animal is in a state of anxiety it must be prepared for energetic action which consists normally of either fighting or fleeing. The

digestive processes consume energy which could be better deployed for these emergency reactions, so that in states of anxiety the digestive processes are inhibited.

Another source of evidence on the inverse relationship of eating and anxiety is derived from the effects of the operation of prefrontal leucotomy. This operation involves severing the neural connections between the frontal lobes and the thalamus, as a result of which the frontal lobes are rendered inoperative. The operation is now mainly performed for the relief of intense anxiety or obsessional neurosis in which anxiety is prominent. One of the effects of the operation which has frequently been recorded is that in addition to reducing anxiety it increases the appetite. For instance, Henderson and Batchelor in their *Textbook of Psychiatry* write of prefrontal leucotomy that "apart from the relief of distress and tension, there has been recorded . . . increased appetite and a gain in weight" (1962, p. 348). Meyer and McLardy (1948) observed that after the operation "a morbidly increased appetite may lead to obesity". Hofling (1963, p. 176) also states that prefrontal leucotomy tends to lead to obesity. Increases in calorie intake following prefrontal leucotomy have also been reported quite frequently in animals (e.g. Richter and Hawkes, 1939; Langworthy and Richter, 1939). The effect of these operations is particularly interesting because they are virtually experiments in that they control the time sequence and demonstrate that the reduction of anxiety is followed as a consequence by the increase of appetite. Thus where the appetite in an individual or in a whole population is high, the inference is that anxiety is likely to be low.

It might be expected to follow from the negative relationship between calorie intake and anxiety that anxious people would tend to be thin. Evidence confirming this association has been collected by Eysenck (1952) and, independently, by Rees (1950). Measurements of chest circumference, holding height constant, are associated with measures of the neuroticism factor. There may of course be other constitutional determinants of this association, but it seems probable that differential calorie intake would contribute to it.

Extreme over-eaters have been investigated by Atkinson and Ringuette (1957). They examined 21 cases of obesity whose weight was double the normal for their height, a rare condition affecting around 1 in 10,000 of the population. Their most prominent psychological characteristic was found to be depression, for which one-third of the patients had received psychiatric treatment. Leckie and Withers (1967) have also found that obese patients tend to be depressed. Depression is frequently associated with apathy and lack of energy, so that it would be possible to interpret these results as indicating a low level of anxiety among these obese patients. This would be in line with the Gellhorn theory of depression outlined below. But unfortunately the diagnostic category of depression is a loose one and it is impossible to be certain of the anxiety levels of these patients from this description.

It may be felt that in certain circumstances people eat to reduce their

anxiety and that the association between anxiety and calorie intake might therefore be positive. It is probable that this can occur. The explanation lies in the reciprocally inhibiting relationship of anxiety and food intake to which reference has been made. Just as anxiety tends to inhibit food intake, so food intake tends to inhibit anxiety. For this reason food intake can be used as an anxiety reducing mechanism. However, the well-known effect of the amphetamines on reducing appetite, the association between neuroticism and thinness, and the hyperphagic effects of leucotomy suggest that typically the effect of anxiety is to reduce appetite and food intake.

### 8. HOSPITALISED MENTAL ILLNESS

It will no doubt have been noted that the thesis being advanced regards hospitalised mental illness as principally a manifestation of low anxiety. The commonest varieties of hospitalised mental illness are schizophrenia, psychotic depression and senile psychosis. It may occasion surprise that these illnesses should be regarded as conditions of low anxiety. Nevertheless, there is considerable evidence in favour of such a conclusion. To take schizophrenia first, the word itself was coined to describe the emotionally apathetic state of the chronic patient, a condition which approximates to what is meant by a low level of anxiety. The "split" refers to the apparent division between the intellectual faculties, which are tolerably well-preserved so that the patient can understand and converse with reasonable intelligence and coherence, and the emotional faculties which seem to have atrophied, so that the patient has none of the normal emotional reaction to stress or stimulation. This is the classical state of chronic "burnt-out" schizophrenia in which the patient appears emotionally unresponsive.

This is the typical symptomatology of classical chronic schizophrenia, described and named at the beginning of the century by Bleuler. The phrase "lack of effect" is often used for such cases, which are described in much the same terms today. For example, Hofling (1963) in his *Textbook of Psychiatry for Medical Practice* writes:

"While schizophrenic patients may, at times, give way to strange and even violent expressions of emotions, the commonest form of affective deviation from the normal seen in this condition is pervasive apathy."

Similarly Mednick (1958) in a review of the literature writes that "the lack of anxiety of the schizophrenic, often considered an aspect of 'flat affect' or emotionlessness, has received considerable attention".

In psychotic depression the level of anxiety is more difficult to determine. Patients suffering from psychotic depression should be distinguished from cases of neurotic depression, in which anxiety is more commonly present. In psychotic depression the patient has feelings principally of despair and hopelessness. These are sometimes regarded as signs of anxiety. But it should be noted that one of the most prominent symptoms of psychotic depression is the lack of energy which is often so pronounced that the patient sits doing nothing for long periods of time. This inertness can be regarded as a lack of anxiety, and has frequently been interpreted in this manner.

As long as we are in the world of clinical description there is inevitably disagreement about the precise meaning of the term anxiety and whether or not a particular patient has it. We therefore turn now to more rigorous measures of the anxiety level in psychotics.

There is a good deal of physiological evidence suggesting that there is a low level of anxiety in the majority of chronic hospitalised psychotics. One of the most extensive investigations of the physiology of psychosis is that of Gellhorn (1956, 1957). His theory is that in chronic schizophrenia and depressive psychosis sympathetic tone and reactivity are reduced. This is itself a result of lowered activity and responsiveness of the sympathetic centres in the posterior hypothalamus. Since the sympathetic system is associated with the maintenance of anxiety Gellhorn's theory is essentially a low anxiety theory of psychosis.

The verification of the theory involves taking measures of sympathetic tone and reactivity in psychotics, and Gellhorn has reported low tone or diminished reactivity on the following measures: (a) a low systolic and diastolic blood pressure and minimal rise in blood pressure following stimulation; (b) reduced rise in blood sugar level following stimulation; (c) poor generation of heat after exposure to cold; (d) minimal lymphopenic response to stress; (e) reduced psychogalvanic reactions to stimulation; (f) reduced EEG desynchronisation of the alpha-rhythm in response to stimulation; (g) poor rise in blood pressure following the injection of mecholyl.

Gellhorn has shown that various shock therapies increase sympathetic tone and reactivity, which accounts for their success in chronic schizophrenia and depression. For example, electroconvulsive therapy induces a sympathetically mediated rise in blood pressure, an increase in adrenaline, an increase in blood sugar and a rise in body temperature. Other shock treatments stimulating the sympathetic system include insulin hypoglycemia, sleep therapy, nitrogen and carbon dioxide inhalation, fever therapy and amphetamines. The same argument has been presented by Rubin (1962) to account for the successful treatment of depressives by iproniazid (Marsilid). This drug is a sympathetic stimulator and improves depressives by raising sympathetic tone and reactivity. A similar theory is put forward by Claridge (1967) to account for the therapeutic effect of imipramine (another stimulant) for depression. Sargent and Slater (1963) advance the same argument for the beneficial effects of ECT on depressed, apathetic and retarded schizophrenics.

Gellhorn's work indicates that depressives have poor sympathetic tone and reactivity and that schizophrenics fall into two groups, the majority being under-reactors and a minority being over-reactors (Nelson and Gellhorn, 1957). This finding of two groups of schizophrenics has been duplicated by a number of other investigators. Neurotics tend to have enhanced sympathetic reactivity, indicating that they have high anxiety and are in this respect the opposite of the majority group of schizophrenics. Gellhorn has also found that among normal people there is a reduction of sympathetic reactivity with age. This finding is consistent with the well-known increase in the incidence of psychosis among older people and it may be assumed that with the general lowering of sympathetic reactivity accompanying ageing a higher proportion of people become prone to psychotic breakdown (Lynn, 1962).

Similar results have been reported by a number of investigators. Funkenstein, Greenblatt and Solomon (1951) have worked principally with the mecholyl test. Mecholyl is injected, and this induces a fall in blood pressure which stimulates the sympathetic centre in the hypothalamus; this in turn induces a rise in blood pressure. Schizophrenics give only small blood pressure increases, indicating reduced sympathetic reactivity. Altman, Pratt and Cotton (1943) have reported the same results. Poor reactions in depressives have been reported by Alexander (1955) and Jones (1956).

The work of Alexander (1959, 1961, 1962) on conditioning in normals, anxiety neurotics and depressives points to a similar conclusion. Electric shocks were given to the finger as unconditioned stimuli, and tones of different frequencies served as positive and negative conditioned stimuli. The effects of the conditioned stimuli on the EEG and the PGR were recorded. Normal subjects discriminate, giving conditioned reactions to the positive conditioned stimuli but no reactions to the negative conditioned stimuli. Anxiety neurotics give reactions to both positive and negative conditioned stimuli. This "over-generalisation" phenomenon in highly anxious subjects has been reported by others (e.g. Mednick, 1957). On the other hand, depressed patients show a weak response to both stimuli, or even no response at all. This suggests that anxiety neurotics and depressives are at the opposite ends of an anxiety continuum.

Many investigators have distinguished between acute schizophrenics characterised by abnormally large sympathetic reactions and chronic schizophrenics and depressives with minimal sympathetic reactions. Such investigators include Monroe *et al.* (1961), Earle and Earle (1955), Venables (1960, 1964), Shagass (1957), Shattock (1950) and Rubin (1960). The literature is now so extensive that Claridge (1967, p. 147) in a useful review regarded as a "somewhat obvious conclusion that both hypo- and hyper-reactors were more frequent among psychotics than in control groups". There is an extensive Russian literature on the subject which points to the same conclusion (Lynn, 1963).

Taking the literature as a whole, the results suggest that psychotic depression and chronic schizophrenia are characterised by poor sympathetic tone and reactivity or, in psychological terminology, low anxiety. There is also a smaller

group of acute (and possibly largely paranoid) schizophrenics characterised by high sympathetic reactivity and high anxiety. It should be noted that acute schizophrenics are generally more responsive to treatment (e.g. Henderson and Batchelor, 1962), so that a country's statistics of hospitalised schizophrenia will tend to reflect predominantly the chronic low anxiety patients. This means that even if Gellhorn and others are incorrect in their view that the majority of schizophrenics are low on sympathetic reactivity, these are still likely to be the majority in mental hospitals since the high reactors are more likely to have been discharged. Hence we should expect that the lower the mean anxiety level in a country, the higher the proportion of hospitalised psychotics at any particular point in time.

### 9. ATHEROSCLEROSIS AND CORONARY HEART DISEASE

We now turn to two medical conditions in which anxiety is sometimes regarded as a contributory cause: atherosclerosis and coronary heart disease. Atherosclerosis is a condition in which the smooth inner lining of the arteries become roughened and thickened, leading to narrowing of the bore of the vessels and the possibility of obstruction. It is a chronic degenerative disease which progresses slowly over the years and is probably present in all adults in affluent countries to a greater or lesser degree. This arterial condition is responsible for a number of illnesses, the two commonest being coronary heart disease and stroke. Coronary heart disease can manifest itself as coronary thrombosis, cardiac infarction and angina pectoris. The condition is exceptionally common in Ireland, where nearly 50 per cent of deaths are accounted for by coronary heart disease or strokes (Mulcahy, 1968).

It will be noted that atherosclerosis and coronary heart disease have a negative loading on the factor, indicating that they are inversely related to the national anxiety level. Such a result may occasion some surprise, since coronary heart disease is sometimes regarded as a function of anxiety. However, the part played by personality in these conditions has been a subject of considerable dispute and must be regarded with doubt. Forssman and Lindegard (1958) reported that coronary patients were subject to depression. Unfortunately, the term depression is one of the more ambiguous in psychiatry. If this is psychotic depression and our previous argument of an inverse relation between psychotic depression and anxiety is accepted, then this result is clearly in line with our thesis; it is the depressed, unanxious people who are prone to coronaries. This would explain the high incidence of atherosclerosis in Ireland and other low anxiety countries.

On the other hand, it should be admitted that some investigators have



claimed that coronary patients tend to be anxious. For example, Friedman and Rosenman (1960) claimed that coronary patients were typically extremely competitive and restless, which they regarded as symptoms of anxiety. Finn, Mulcahy and O'Doherty (1966) administered Cattell's 16 P.F. questionnaire to 63 male Irish coronary patients and found that they scored more highly than the American norms on the principal anxiety factors (C, O and Q<sub>4</sub>). One of the difficulties which besets this and many other investigations is that the patients are tested after they have had a coronary attack. It could easily be argued that this has itself been responsible for raising their anxiety level, since such patients are faced with the prospect of unemployment, reduced capacity and death itself. This possibility makes the assessment of the coronary personality a difficult problem.

In addition to the various claims that there are personality correlates of coronary heart disease and atherosclerosis many investigators have concluded that there are no significant or established correlates. Finn, Mulcahy and O'Doherty (1966) concluded their review of the literature with the statement that "the situation today would seem to be the same as that in 1959 when Ostfeld stated that, after 50 years of study, the relevance of psychological stress to vascular disease is still unclear". Kessel and Munro (1964) concluded their review with the opinion that there was little evidence to support the theory of a "coronary personality".

However, many studies have indicated a relation between atherosclerosis and coronary heart disease on the one hand and caloric intake and obesity on the other (e.g. Albrink, 1967, p. 1165, Friedberg, 1967, p. 543). It is true that there have been some investigations which have not shown an abnormally high caloric intake in coronary patients. In Ireland, Finegan, Hickey, Maurer and Mulcahy (1968, 1969) found no significant differences in caloric intake between CHD patients and matched controls, either in men or women. It should, however, be noted that these results depend on patients' own account of what they eat, and it is not improbable that they may understate their intake. To admit to a high caloric intake may seem tantamount to admitting personal responsibility for the illness, and this is something about which patients may well feel reluctance. It may be noted that where Mulcahy and his associates considered body weights, they found their CHD patients were heavier than the controls (112 against 107 in the units of the Metropolitan Life Insurance Tables, based on the American ideal weight of 100), though they claimed to eat the same amount. This result was obtained with both males and females and casts some doubt on the patients' veracity.

Our own finding of a high negative correlation between national atherosclerosis deaths and anxiety levels clearly tells against the theory that anxiety is a contributory factor in coronary heart disease. Indeed, it suggests that low anxiety may be a contributory cause. The most probable explanation of this relationship would seem to be that low anxiety is associated with a high caloric intake, as we have previously argued, and that the high caloric intake is a

contributory factor in coronary heart disease. This would explain the exceptionally high incidence of atherosclerosis in Ireland in terms of the exceptionally high calorie intake, which is itself partly a function of the low anxiety level. This high correlation between the incidence of atherosclerosis in different countries and the national calorie intake has previously been noted by Keys (1963).

This conclusion that the high incidence of atherosclerosis in Ireland is related to the high calorie intake accords with the views of the Dublin Heart Disease Research Group, who have written that the "abnormally high dietary findings may contribute to the atheroma-proneness of the Irish population" (Finegan, Hickey, Maurer and Mulcahy, 1969).

#### 10. ALCOHOLISM

The positive loading of alcoholism on the factor indicates a positive association between alcoholism and anxiety. Such a relationship is generally accepted and alcoholism is commonly regarded as a reaction to anxiety (Franks, 1958). Alcohol reduces anxiety, so that when people are in a state of anxiety one of the avenues of relief lies in imbibing alcohol. There is considerable psychological evidence for the anxiety-reducing properties of alcohol, which has been shown to overcome fear in animals and human beings in a variety of situations. For example, Masserman and Yum (1946) carried out an experiment in which they first trained cats to manipulate some apparatus for food. The cats were then given electric shocks when they touched the apparatus. This made them anxious about approaching it, and they refused to touch it. They were then given alcohol, after which they again approached the apparatus. This result was interpreted as showing that alcohol reduces anxiety. A further observation of Masserman and Yum was that cats ordinarily prefer plain milk to milk containing five per cent alcohol. Yet after the experimental cats had been given the electric shocks, they developed a preference for milk laced with alcohol. At a later stage of the experiment the cats' anxieties were removed, and they then reverted to their preference for plain milk. This seems to show that animals can develop a taste for alcohol when they are in states of anxiety, presumably as a means of alleviating the anxiety.

The physiological basis of this effect lies in the depressant effect of alcohol on the nervous system. Alcohol is one of a group of nervous system depressants which reduce the transmission of neural impulses both at the synapses and in the axons. In addition, depressants seem to have a particularly powerful effect on the reticular activating system in the brain stem (Gooch, 1963). The system

plays a part in the maintenance of anxiety through its tonic effect on the thalamic structures, so that this appears to be one of the mechanisms through which the depressants reduce anxiety (Samuels, 1959).

Among many quotations which could be cited for the sedating effect of alcohol the following are representative. Rosen and Gregory (1965, p. 398) write that "contrary to popular belief alcohol is not a stimulant but a sedative. Its immediate physiological effect is to depress the functioning of the higher brain centres. This results in firstly, impairment of perceptual and intellectual functioning, secondly, relief from anxiety, fear and sorrow". Strange (1965, p. 195) writes that "when in the blood stream, ethyl alcohol even in amounts of one-tenth of one per cent of the total blood volume, acts as a depressant or general anaesthetic on the CNS, in an action similar to that of chloroform or anaesthetic ethyl ether". Block (1962, p. 116) writes that "alcohol affects the nervous system as a depressant of the higher brain centres concerned with behaviour and speech and memory . . . the early ingestion of alcohol therefore produces initial symptoms that result from depression of centres concerned with worry and anxiety".

As a result of the anxiety-reducing properties of alcohol, people who are highly anxious can alleviate their anxiety through drinking. Thus there tends to be an association between alcoholism and anxiety. This association has frequently been described. For example, Hoffing (1963) writes that "the alcoholic is one who is psychologically ill . . . as one of his defence measures, he comes to rely upon an excessive intake of alcohol". Bleuler (1955, p. 406) writes that: "the typical individual who drinks heavily does so to reduce anxiety". Strange (1965, p. 116) writes of the alcoholic that "he begins to seek out social situations that allow drinking for he has discovered that his tensions are eased whenever he is under the influence of alcohol". Vallance (1965) reported a study of 66 male alcoholic patients admitted to Glasgow General Hospital and found that 42 per cent had a history of neurotic symptoms and took alcohol for relief.

Since alcohol reduces anxiety, and is sometimes used by anxious people as a means of reducing anxiety, we should expect that in societies where anxiety levels are high there would be a high consumption of alcohol. This inference has been investigated by Horton (1943). He took 56 primitive societies and assessed the incidence of drunkenness and the degree to which the people were exposed to stress from subsistence hazards (crop failures, droughts, etc.) and from aggressive neighbours, which he presumed would increase their anxiety. He found that there was a significant positive correlation: the greater the stress, the more the alcoholism. This suggests that the amount of alcohol consumed in a society is a function of the anxiety level of the people, and runs parallel to our own thesis of the relation between alcoholism and anxiety in advanced societies.

## 11. CIGARETTE CONSUMPTION

The loading of cigarette consumption on the factor is negative, indicating a negative association between smoking and anxiety. Although such a result may be surprising, it is consistent with what is known about the correlates and effects of tobacco. In the first place, investigations of the personality correlates of smoking generally indicate that it is not positively associated with anxiety. In an extensive investigation of 2,400 subjects by Eysenck (1965) it was found that there was no association between smoking and neuroticism, the Eysenck factor which most closely resembles anxiety. There was, however, a significant association between cigarette smoking and extroversion, a factor which has some small negative association with anxiety (Eysenck, 1957). Thus the Eysenck results indicate a negative association between cigarette smoking and anxiety, which is what our own result indicates at the international level.

While some investigators have claimed that there is a relationship between smoking and anxiety (e.g. Seltzer, 1967), several independent workers have supported Eysenck's view that extroversion is the chief personality correlate. Cattell and Krug (1967) confirmed the Eysenck result on student smokers in the United States. Schubert (1965) also obtained this result in a study of 1,270 students in New England.

The finding that cigarette smoking is negatively correlated with anxiety is consistent with what is known of the physiological properties of nicotine. It belongs to a class of drugs which are broadly known as stimulants and have the effect of making those who take them slightly more efficient over a variety of perceptual and motor tasks. For example, an experiment by Warwick and Eysenck (1963) used the test of critical flicker fusion. The test consists of a light flashing on and off, and as the speed of the flashes is increased there comes a point at which it is seen as a steady light. This is the point at which the eye fails to discriminate the flashes. The administration of 0.1 mg. of nicotine improved the perception and the subjects could distinguish the flashes in what they saw previously as a steady light.

Apart from increasing the efficiency of the sense organs and of reactions, stimulants also increase anxiety (Lynn, 1966; Eysenck, 1967). For this reason we should expect that people who normally have a high level of anxiety would tend not to take stimulants, whose effect would be to raise their anxiety still further. It seems probable that people like best to be at some intermediate level of anxiety, neither excessively high nor excessively low. Evidence for this view has been marshalled by Berlyne (1960). If this is so, we should expect those who have exceptionally high anxiety levels to take depressants to bring their anxiety level down. This is apparently one of the reasons for the high prevalence of alcoholism in high anxiety countries like France. Conversely, where the level of anxiety is low there should be a higher consumption of stimulant drugs, such as tobacco. This would account for the high consumption of tobacco in countries which have low anxiety levels, like Ireland and Britain.

## 12. CONCLUSION: THE ANXIETY LEVEL IN IRELAND

Finally, we turn to the problem of scaling the countries in terms of their anxiety level. This is done by calculating each nation's factor score. The procedure adopted is to rank the nations on each of the first seven variables, multiply the rankings by the loadings of the variable on the factor, sum the products and rank the nations on the basis of the sums of the products. The resulting rank order of the nations is shown in Table 4. Not too much importance

TABLE 4: *Rank Order of Nations on the anxiety factor*

<i>ANXIETY LEVELS</i>		
<i>High</i>	<i>Moderate</i>	<i>Low</i>
1. Japan	7. Netherlands	13. Australia
2. Germany	8. Norway	14. Canada
3. Austria	9. Finland	15. USA
4. Italy	10. Denmark	16. New Zealand
5. France	11. Switzerland	17. United Kingdom
6. Belgium	12. Sweden	18. Ireland

should be attached to the exact positions, since these would show small changes if some of the variables had been omitted or others added. It is preferable to consider the results in terms of three broad groupings of national anxiety levels. There is a group of high anxiety nations, consisting of Japan, Italy, Austria, Germany, France and Belgium; a moderate anxiety group, consisting of Finland, the Netherlands, Norway, Sweden, Switzerland and Denmark; and a low anxiety group, consisting of Australia, Britain, New Zealand, Canada, Ireland and the United States.

Now that the countries have been ranked on the basis of the demographic measures, it is possible to check the interpretation of the factor in terms of anxiety. This can be done by examining the relation of the factor ranks to estimates of national anxiety levels made from the results of anxiety questionnaires. Questionnaire measures of anxiety are available for male university students for eleven of the eighteen countries. While university students are not necessarily fully representative of the populations of their respective countries, it does not seem improbable that the anxiety level of a nation as a whole will tend to be reflected in the anxiety level of its university students. The eleven nations for which student questionnaire results are available have therefore been ranked on anxiety (the procedure for doing this has been described elsewhere: Lynn, 1968); when this rank order is correlated with the rank order based on the demographic variables, the correlation is  $+0.73$  ( $P < 0.02$ ). This correlation confirms the interpretation of the factor as anxiety. Thus the results of the analysis suggest that a number of the remarkable epidemiological features of Ireland can be understood in terms of a low level of anxiety among

the population. What factors are responsible for the differences in nations' anxiety levels and particularly the low level of anxiety in Ireland, present an intriguing question. There are some indications that climatic and genetic influences may be important (Lynn, 1971), but discussion of the causal factors is beyond the scope of this monograph.

### 13. SUMMARY

This monograph presents a psychological theory to account for national variations in a number of demographic and social phenomena. These are: the rates of suicide, mental illness, alcoholism, vehicle accidents deaths, calorie intake, coronary heart disease and cigarette consumption. The theory advanced is that these are all functions of the level of anxiety in the population.

The theory is tested by factorial analysis. The demographic variables are taken for all the advanced western nations, intercorrelated and factor analysed. The factor analysis reveals the existence of an underlying factor, which is interpreted as the level of anxiety in the population. A nation with a high level of anxiety has a high rate of suicide, alcoholism and vehicle accident deaths, and a low rate of mental illness, cigarette consumption, calorie intake and coronary heart disease. The analysis suggests that the nation with the highest anxiety level is Japan and that with the lowest anxiety level is Ireland.

### APPENDIX 1. THE RELIABILITY OF THE DATA

In this appendix we consider the problem of the reliability of the Irish data on suicide, mental illness, calorie intake and alcoholism.

#### (a) *Suicide*

Two arguments are commonly presented about the apparently low Irish suicide figures. One is that they are depressed by the strong Roman Catholic Church and the other that they are falsified by incorrect certification of the causes of deaths by doctors and coroners. These are of course quite different objections. The first maintains that Irish suicide is genuinely low, and attributes this to the influence of the Church. The second that suicide may not be

particularly low in Ireland but is merely a reflection of the vagaries of certification.

As far as the first argument is concerned, it is probably true that there is some tendency for suicide to be low in Catholic countries. To estimate the significance of Catholicism the proportion of Roman Catholics in the population of the 18 countries has been taken from the Catholic Directories. These figures are shown in Table 5. The rank correlation between these and the suicide rates is  $-.28$ , indicating a small tendency for suicide rates to be lower in strongly Roman Catholic countries. Evidence for the existence of such an association in the nineteenth century was marshalled by Durkheim (1897). However, from the size of the correlation, it would seem that among the group of countries we are considering, Roman Catholicism must be regarded as a fairly minor factor affecting national suicide rates.

This admission would not of course preclude the operation of other factors, such as anxiety. Both Roman Catholicism and anxiety may affect suicide rates. Consider the incidence of motor accidents: the isolation of one causal factor, e.g. worn tyres, does not rule out the operation of others, such as inebriation. Thus the present thesis is not damaged by the admission that Roman Catholicism may have some effect in depressing national suicide rates.

TABLE 5: *Proportions of Roman Catholics*

<i>Country</i>	<i>Percentage of Roman Catholics in population</i>	<i>Rank</i>
Australia	22.4	11
Austria	91.4	4
Belgium	94.4	3
Canada	41.3	8
Denmark	0.6	15
Finland	0.1	18
France	80.3	5
Germany	49.0	6
Ireland	94.9	2
Italy	95.1	1
Japan	0.3	16
Netherlands	41.0	9
Norway	0.2	17
New Zealand	16.2	12
Sweden	0.6	14
Switzerland	45.9	7
UK	9.9	13
USA	27.3	10

The other objection, that Irish suicide figures mean nothing because of the inadequacy of certification of death, is more crucial. If it were true, the correlation of Irish suicide rates with mental illness, calorie intake, alcoholism

and so forth would have to be regarded as merely chance, since meaningless figures cannot be expected to correlate with anything. However, two arguments may be presented against the view that Irish suicide figures are unreliable. First, a study of the accuracy of recording has been made in Dublin by McCarthy and Walsh (1966). They made a detailed investigation of all cases coming before the coroners in Dublin between 1954 and 1963, and concluded that the true rate in Dublin was 4.5 per 100,000, which is around double the official rate. They infer that the same ratio of true official suicide may well be true of the rest of Ireland, giving a true rate of less than 5.5 per 100,000. If this is accepted it would still leave Ireland with the lowest suicide rate of all the 18 countries, as may be seen from the figures given in Table 1. In addition, it should be borne in mind that the suicide rate is likely to be under-recorded in other countries as well as Ireland, so that this result supports the view that there is a genuinely low rate of suicide in Ireland.

A second argument has been presented by Sainsbury and Barraclough (1968). They considered the suicide rates of immigrants from a number of countries into the United States. If national suicide rates are genuine reflections of national character the same rates should be found among immigrant groups. If, on the other hand, suicide rates merely reflect the vagaries of national statistics collection, coroners' idiosyncrasies and so forth, there should be no tendency for the national differences in suicide to be preserved among immigrant groups in the USA. In fact, the rank order of suicide rates of countries is almost exactly the same among immigrant groups in the USA as in the countries from which they emigrated. These figures are shown in Table 6. It will be noted that the low Irish propensity to commit suicide is preserved among Irish immigrants in the USA. This result clearly constitutes a powerful argument that national suicide rates reflect some genuine national characteristic.

TABLE 6: *Suicide Rates in 1959 of Foreign-born US Citizens, compared with those of their countries of birth. This correlation is 0.87 ( $p < .001$ )*

<i>Country</i>	<i>Suicide rate of foreign-born in USA per 100,000</i>	<i>Suicide rate of country of origin per 100,000</i>
Sweden	34.2	18.1
Austria	32.5	24.8
Czechoslovakia	31.5	24.9
West Germany	25.7	18.7
Poland	25.2	8.0
Norway	23.7	7.8
England	19.2	11.5
Italy	18.2	6.2
Canada	17.5	7.4
Ireland	9.8	2.5
Mexico	7.9	2.1



(b) *Mental Illness*

It is sometimes suggested that the proportion of hospitalised psychotics in a country is simply a function of the number of hospital beds, the implication being that there is a kind of Parkinson's law by which mental illness expands to fill the number of beds available. This possibility has been suggested for Ireland by Browne (1963).

The problem of the exceptionally high incidence of psychosis in Ireland has been considered by Walsh (1968) who has concluded that "these rates reflect a genuinely increased rate of morbidity in Ireland". He also points out that the high psychosis rate, like the low suicide, has been characteristic of Ireland for some decades: "Irish all-admission, first admission and hospitalisation rates were high by international standards in 1901". The consistently high Irish rates over the course of more than sixty years suggests that the figures have some meaning. A further consideration is that psychosis rates are normally higher in cities than in the country (Hoch and Zubin, 1961). Since Ireland is comparatively rural, this would entail the probability that Irish psychosis rates would be lower than those of more urbanised countries. The fact that they are higher again indicates the presence of some special factor influencing Irish psychosis rates.

It is sometimes held that not all inmates of mental hospitals are genuinely mentally ill, but that some are incompetents kept there for want of a better alternative. A study of this problem of genuinely mentally ill patients at St. Otteran's Hospital in Waterford has been reported by Meehan (1963). He concluded that 50 per cent of the inmates needed mental hospital treatment, while 27 per cent were elderly geriatric patients, 13 per cent were in hospital for socio-economic reasons such as lack of employment and the unfavourable attitude of relatives, and 10 per cent were mentally handicapped. Meehan concluded that the real incidence of psychiatric illness was about 4 per 1,000 of the population. If this figure is compared with the other national indices shown in Table 1, it will be seen that the Irish figure is still high, surpassed only by Sweden (4.8), Britain (4.5) and the USA (4.3). But this comparison assumes that these figures can be taken at their face value for all countries except Ireland. It is more probable that other countries have a proportion of geriatric patients, unemployables and defectives in their mental hospitals, so that their figures should also be scaled down. However, even on the unlikely assumption that Ireland is unique in having some patients in mental hospitals who are not genuine psychiatric cases, the incidence of mental illness in Ireland would remain high by international standards.

Meehan's figures only relate to one hospital, and figures for all the district mental hospitals have been given by Browne (1963) and are shown in Table 7. Browne concludes that these "show a high preponderance of psychotic disorders". There are of course some individual differences in psychiatric diagnosis in cases of burnt-out schizophrenia and inadequate personality, which may account for the discrepancy between the two results, or possibly the Waterford

hospital is not typical. But which ever set of figures is taken, both indicate that hospitalised psychosis in Ireland is high.

TABLE 7: *Diagnostic Categories of Patients in Mental Hospitals*

<i>Diagnostic Category</i>	<i>% of patients under care on 31 December, 1958</i>	<i>% of patients admitted during year ending 31 December, 1958</i>
Schizophrenic disorders, paranoid and puerperal psychoses	53.73	31.18
Manic-depressive and involuntional disorders	15.53	33.78
Mental deficiency	10.61	3.45
Senile, presenile psychoses, organic and epileptic conditions	15.82	14.56
Pathological and immature personality, character disorders	1.48	2.00
Neurotic disorders	2.21	9.76
Alcoholism	0.48	4.99
Drug addiction	0.04	0.24

(c) *Calorie Intake*

A check on the exceptionally high calorie intake in Ireland is available from the work of Trulson, Clancy, Jessop, Childers and Stare (1964). They matched male Irish immigrants in Boston with their brothers in Ireland. They obtained 153 pairs and found those remaining in Ireland had a calorie intake of 3,800, around 600 more calories than the emigrants. Besides confirming a high calorie intake in Ireland, this result suggests that the factor underlying calorie intake may be related to the tendency to emigrate.

Other results confirming this conclusion have been reported by Finegan, Hickey, Maurer and Mulcahy (1968, 1969). In their studies of coronary heart disease in Ireland they have taken CHD patients and matched controls and investigated their calorie intake and body weight. With both males and females taken separately, Irish CHD patients and controls from the Irish population had heavier body weights than the American norms taken from the Metropolitan Life Insurance tables. This suggests a higher calorie intake in Ireland. Direct assessments of the Irish control samples gave a calorie intake of 3,591 for men and 2,881 for women. While these seem quite high, it is difficult to assess calorie intake with complete accuracy, and it would probably be hazardous to put too much weight on this rather small sample.

(d) *Alcoholism*

This is probably the most controversial characteristic to measure accurately, and it should be admitted that there is no universally accepted method of assessing national differences in alcoholism. Some formulae have been devised,

of which Jellinek's (1951) is the best known, but they have not become generally accepted as wholly satisfactory. Nevertheless, sufficient data exists to make an attempt at estimating national differences in alcoholism. Three types of data are available, namely deaths from alcoholism and from cirrhosis of the liver, and *per capita* alcohol consumption. Contrary to common belief, all sets of data consistently indicate that alcoholism and alcohol consumption are comparatively low in Ireland by international standards.

Two types of death are commonly taken. The first is from alcoholism as such, and the second is from cirrhosis of the liver, a condition in which the liver hardens as a result of the development of new fibrous tissue. This is due to two main causes, namely damage to the liver cells produced by virus, microbes or toxic substances and dietary deficiencies interfering with the nutrition of liver cells. The second is often the result of alcoholism, and the disease is three times as common among alcoholics as among non-drinkers. Since cirrhosis of the liver frequently results from excessive intake of alcohol, the two indices should tend to be associated both over time and between countries or regions. Within countries, Popham (1966) has shown that this is so in 21 instances, drawn from most European countries and North America. The correlations are high, ranging from +.45 to +.89.

Of these two causes of death, cirrhosis of the liver is considerably more common in the official statistics (see Table 8). This may well be the effect of a reluctance to record alcoholism as a cause of death. As a result of this, Leitch (1961) states that "it is largely agreed that indirect measurements such as the

TABLE 8: *Deaths from Alcoholism and Cirrhosis of the Liver, per 100,000 population, in 1960*

Country	Alcoholism	Cirrhosis	Total
Australia	1.5	4.8	6.3
Austria	—	23.3	23.3
Belgium	1.1	9.5	10.6
Canada	0.6	6.2	6.8
Denmark	0.0	8.4	8.4
Finland	0.2	3.3	3.5
France	11.1	29.3	40.4
Germany	0.5	18.3	18.8
Ireland	0.1	2.0	2.1
Italy	1.0	17.3	18.3
Japan	0.5	9.7	10.2
Netherlands	0.2	3.5	3.7
New Zealand	0.9	2.3	3.2
Norway	0.3	4.2	4.5
Sweden	0.5	5.1	5.6
Switzerland	3.0	11.8	14.8
UK	0.1	2.9	3.0
USA	1.2	11.3	12.5

Source: *World Health Statistics Report*, Vol. 21, No. 11.

frequency of cirrhosis of the liver are much more reliable, since alcoholism is by far the commonest cause of liver cirrhosis". Epidemiological evidence for the use of cirrhosis of the liver as an index of alcoholism is available from studies of the effects of prohibition in the United States. During the years of prohibition (1921-32), deaths from liver cirrhosis fell by 42.2 per cent from the 1910 base, while general mortality fell by 7.1 per cent (Piedmont, 1961).

International data for deaths from both alcoholism and cirrhosis of the liver are shown in Table 8. It will be seen that both figures are low in Ireland. On alcoholism deaths, Ireland comes out at sixteenth of eighteen countries, while on cirrhosis Ireland's position is eighteenth, and in the combined causes of death Ireland is again eighteenth.

It is possible to check these results by examining the statistics for alcohol consumption. These have been collected for twenty countries by the Canadian Alcoholism and Drug Addiction Research Foundation and are shown in Table 9. It will be seen that Ireland comes fourteenth among the countries and that alcohol consumption is comparatively low in Ireland.

Similar data is available for beer consumption in a number of countries (Corina, 1969) and to compare Ireland with Corina's countries the Irish beer

TABLE 9: *Statistics of Alcohol Consumption*

Country and year	Percentages			Gallons of alcohol per capita, aged 15 and over
	Beer	Wine	Spirits	
France (1955)	12.5	75.5	12.0	5.87
Italy (1957)	1.5	91.0	7.5	3.25
Switzerland (1950-55)	42.5	43.0	14.5	2.39
New Zealand (1957)	77.0	4.0	19.0	2.12
Australia (1957-58)	76.5	13.0	10.5	2.03
Belgium (1958)	98.0	0.5	10.5	1.83
Germany (West) (1957)	62.5	9.5	28.0	1.66
USA (1959)	48.5	11.0	40.5	1.61
Canada (1961)	62.0	7.0	31.0	1.59
Peru (1957)	14.5	2.0	83.5	1.44
UK (1958)	81.0	4.0	15.0	1.25
Denmark (1957)	75.0	12.0	13.0	1.13
Sweden (1958)	24.0	11.0	65.0	1.07
Ireland (1955)	71.0	4.5	24.5	0.96
Germany (East) (1953-56)	52.0	4.5	43.5	0.93
Netherlands (1958)	41.5	11.0	47.5	0.70
Norway (1958)	44.5	7.5	48.0	0.68
Finland (1957)	15.0	11.0	74.0	0.65
Iceland (1952)	15.0	5.0	80.0	0.59
USSR (part) (1948-50)	17.5	7.0	75.5	0.41

Source: *Statistics of Various Measures Related to Alcoholism and Drug Addiction 1951-61*, Alcoholism and Drug Addiction Foundation, Canada.

consumption has been calculated from the Revenue Commissioners' Report. The results are shown in Table 10 from which it will be seen that consumption of beer in Ireland is comparatively low.

TABLE 10: *Beer Consumption in 1967 (pints per capita)*

<i>Country</i>	<i>Pints per capita</i>
Germany (West)	224
Belgium	216
Austria	182
UK	164
Denmark	160
Ireland	102
France	72
Sweden	71
Italy	19

Another possible approach is to consider the incidence of convictions for drunkenness in different countries. It has not proved possible to collect much information on this subject, since many national statistics give police charges rather than convictions. However, what appear to be comparable results have been obtained for Ireland, Britain and Canada and are shown in Table 11. It will be seen that Ireland has only about two-thirds of the convictions of Britain. The figure mirrors almost exactly the Irish deaths from cirrhosis of the liver and alcohol consumption, which are also both about two-thirds of those reported in Britain. Thus there is a reasonably good degree of consistency from one statistic to another. The Canadian convictions for drunkenness are very substantially higher than the Irish.

TABLE 11: *Convictions for Drunkenness per 100,000 Population in 1965*

<i>Country</i>	<i>Rate per 100,000 population</i>
Canada	740.68
UK	154.32
Ireland	105.36

*Sources:* Canadian Alcoholism and Drug Addiction Research Foundation; British Annual Abstract of Statistics, No. 103, 1966; Statistical Abstract of Ireland, 1966.

Yet another approach to the problem has been taken by Walsh and Walsh (1970). It is sometimes suggested in Ireland that the Irish alcohol consumption may be exceptionally skewed in the sense that there is a comparatively large number of total abstainers together with a large number of fairly heavy

drinkers. Walsh and Walsh provide some limited evidence on this possibility by producing figures for the percentage of households who report buying alcohol in Ireland and the United Kingdom. The only comparable figures are for beer and cider and these show that 52 per cent of Irish households buy these products compared with 59 per cent of English. The difference may be interpreted as giving some support to the hypothesis, but it may be within the errors which would be expected from sampling and the known unreliability of household budget inquiries on alcoholic purchases. Whichever view is taken, this result gives little support to the theory that there is an exceptional proportion of teetotallers in Ireland.

A further contribution made by Walsh and Walsh is their calculation of national expenditures on alcohol as a percentage of total personal expenditure. Their results show that the percentage spent on alcohol in Ireland is high compared with that in other nations. However, it should be noted that the percentage of income spent on alcohol is affected by its price, and in Ireland the price is high because of heavy taxation. Another contaminating factor is the national *per capita* income. Ireland has a low *per capita* income among advanced Western nations and the people are consequently obliged to spend a high proportion of their income on staple commodities such as bread, potatoes, meat and so forth. It may well be that alcohol falls into this class and that proportional expenditure on it will fall to that of other advanced nations as *per capita* income rises. Hence these figures, while no doubt of interest from other points of view, have little bearing on our own problem. In any event, Walsh and Walsh present further data of their own on *per capita* alcohol consumption in several countries and their results show that consumption is the lowest in Ireland. This calculation replicates our own previous conclusion.

In view of the consistent appearance of Ireland as a country with a low consumption of alcohol and a low prevalence of alcoholism, how has the contrary belief come about? Two sources seem to be responsible. First, studies of first admissions to psychiatric hospitals and psychiatric departments of general hospitals; and secondly, results from Irish immigrants in the United States. Taking the psychiatric admissions' data first, Walsh (1969) has found that first admissions for alcoholism in Ireland are 42.5 per 100,000 of the population for men, as against 20.6 in Scotland and 3.6 in England and Wales, and the rates for women are also substantially higher than in Scotland or England and Wales.

These figures make the Irish rate appear high. However, the comparison only involves Britain, which is itself a country which other data indicates has a low prevalence of alcoholism by international standards. It has not proved possible to collect much evidence on first admissions rates from other countries, but results are available for France, Helsinki (Stenbach and Achte, 1964) and for Canada. All of these have higher first admission rates for alcoholism than Ireland. The results as a whole are shown in Table 12. The England and Wales figures seem very low by comparison with the other countries.

TABLE 12: *First Admissions for Alcoholism*

Place and Year	Alcoholism, first admissions per 100,000 population		
	Males	Females	Total
Helsinki (1960)	—	—	45.0
Canada (1964)	—	—	37.1
France (1964)	—	—	28.3
Ireland (1964)	42.5	6.2	24.5
Scotland (1961)	20.6	3.3	11.9
England & Wales (1959)	3.6	1.0	2.3

The second source of the belief in a high Irish prevalence of alcoholism lies in studies of various immigrant groups. Glad's (1947) results are shown in Table 13 as a typical example of such studies. However, it is doubtful whether too much weight should be placed on such results as far as alcoholism in Ireland is concerned. Any inference from these results to Ireland would rest on the assumption that immigrants from different countries are equally representative of their home countries. This is not necessarily the case but it must be admitted that the apparently high intake of alcohol among the Irish in America presents a puzzling contrast with the evidently low alcohol intake in Ireland. Whatever the explanation may be, our own interest is in Ireland, and the evidence reviewed seems to indicate that alcohol intake in Ireland is fairly low by international standards.

TABLE 13: *First Admission Rates for Alcohol Psychoses in New York per 100,000 of each ethnic group, (Glad. 1947)*

Nationality	First admissions per 100,000
Irish	25.6
Scandinavian	7.6
Italian	4.8
English	4.3
German	3.8
Jewish	0.5

This concludes our discussion of the reliability of the statistics. But it should also be pointed out that the very fact of the intercorrelation of the measures indicates that they have some degree of reliability. If they were totally unreliable, the significant intercorrelations would not exist, so that there is a high probability of the measures having some degree of reliability. No national statistics, needless to say, are perfect or exact measures of what they purport to represent. They are normally crude indices which serve their purpose as rough and ready indications of the underlying reality. This would seem to be the case with the conditions with which we have been concerned.

## APPENDIX 2. ULCERS, CELIBACY, HYPERTENSION AND MURDER

These four variables did not emerge as part of the anxiety factor and we consider here why this should be. In each case there is some evidence that the variable is affected by anxiety but there is also contrary evidence, so that the relationship is tentative.

### 1. *Gastric and Duodenal Ulcers*

The development of gastric and duodenal ulcers as a result of stress is one of the most well known of all psychosomatic illnesses. The positive loading of ulcer deaths on the factor indicates that such deaths tend to be more frequent in the high anxiety countries. However, the loading is a low one. Possibly the explanation for this is that anxiety is a comparatively minor factor in ulcer formation. Such a conclusion is indicated by the difficulty many investigators have found in demonstrating an association between ulcer formation and anxiety.

There are certainly a number of experiments which seem to have shown that anxiety can lead to ulcer formation. For instance, Sawrey, Conger and Turrell, (1956) have demonstrated the production of gastric ulcers in rats as a result of stress. The rats were kept for 30 days in a box in which they could only obtain food and water by crossing an electrically charged grill from which they received electric shocks. Seventy-six per cent of these rats developed gastric ulcers.

Similar results have been reported in monkeys by Porter, Brady, Conrad, Mason, Galambos and Rioch (1958). They strapped monkeys into seats and required them to press a lever every twenty seconds, to avoid an electric shock delivered to the feet. These sessions lasted six hours, alternating with six-hour rest periods. The first time this experiment was performed the monkey died from ulcers, and repetitions produced further ulcer formation in other monkeys.

While these results may suggest that stress induces ulcers there is evidence that ulcers develop as a result of excessive parasympathetic rather than excessive sympathetic activity. Further work by the team who carried out the monkey experiment described above is in line with this interpretation (Brady, Porter, Conrad and Mason, 1958). The investigators put the monkeys on the task for 18 hours, rather than the six-hour task alternating with six-hour rest periods. These 18 hour monkeys never developed ulcers. They concluded that only intermittent stress induces ulcers. To test this conclusion they took measurements of the stomach acid production, which is the immediate factor causing ulcer formation, and found that acidity rose during the rest periods. This is presumably a rebound phenomenon following the stress of the task. This result supports the interpretation of ulcer formation as primarily an effect of excess parasympathetic activity, since it is known that a period of sympathetic activity sets in train an increase of parasympathetic activity (Gellhorn, 1956).

This conclusion is supported by further physiological evidence. While the



physiology of ulcer formation is not fully understood, there is some measure of agreement that two mechanisms are involved in the control of hydrochloric acid secretion in the stomach which in excess leads to ulcer formation (Maclean, 1960; Magoun, 1963). One mechanism originates in the parasympathetic centre in the anterior hypothalamus, which transmits stimulation via the vagus to the stomach walls and releases the acid. The second mechanism is through the posterior hypothalamic release of adrenocorticotrophic hormones which stimulate the adrenal cortex; this releases cortisone, which in turn generates gastric acid secretion (Maclean, 1960; Magoun, 1963). In the first of these mechanisms the parasympathetic system plays an important part, so that it is possible that individuals who develop ulcers have excessive parasympathetic activity, not the excessive sympathetic activity which is the psychological basis of anxiety. The conclusion most consistent with the evidence would seem to be that anxiety plays some part in ulcer formation, but not a preponderant one. This would account for its low loading on the factor.

## 2. *Celibacy*

It has sometimes been suggested that the low level of nuptiality in Ireland is connected with the high prevalence of mental illness. The Commission of Inquiry in Mental Illness put this forward as a possibility (1966; p. 24). It has also been suggested by B. M. Walsh (1968) who noted the high incidence of mental illness among the unmarried and concluded that "the forces that contribute to the high role of celibacy in Ireland also contribute to the overall incidence of mental illness".

This seems a possible inference when one is considering subgroups within a country. Whether the same inference could be made in comparisons between countries is another matter. Since the thesis of this paper interprets national rates of mental illness as a function of levels of anxiety, the relevant question is whether national celibacy rates can be viewed as a function of anxiety levels in different countries.

It cannot be said that there are strong theoretical reasons to expect that national anxiety levels would effect nuptiality. If it is argued that marriage rates reflect the strength of sexual drives, such a thesis would demand that anxiety level and the strength of sexual drives are associated. There is no firm evidence for the existence of such an association. Indeed, anxiety is more commonly regarded as having an inhibiting effect on sexual drives and expression, following the theories originally proposed by Freud (e.g. 1936) and more recently by Wolpe (1958). This inverse relationship is to some degree supported by the fact the sexual activity is mediated by the parasympathetic system (e.g. Morgan, 1965) whereas anxiety is mediated by the sympathetic system, and these two systems, as we have seen, have reciprocally inhibiting effects on each other. These considerations might lead to the prediction of an inverse relationship between national anxiety levels and sexual activity, which might manifest itself in a high celibacy rate in high anxiety countries. This

would of course be the reverse of what is apparently the position in Ireland.

However, the absence of any appreciable loading of celibacy on the anxiety factor indicates that the low rate of marriage in Ireland cannot be attributed to the low anxiety level.

### 3. *Hypertension*

Hypertension has also sometimes been attributed to anxiety and been claimed to be more prevalent among anxious people. Essential hypertension is a state of permanent high blood pressure for which the cause is unknown. But in spite of much research on the possibility that anxiety may play a part, the hypothesis remains unproven. At the end of an extensive review of the literature on whether personality factors cause hypertension, McGinn, Harburg, Julius and McLeod (1964) conclude that "no direct evidence is available . . . and tangential studies offer conflicting results". Our finding that hypertension deaths have no appreciable loading on the anxiety factor is in line with this negative conclusion.

There is some evidence that stress induces a rise in blood pressure. For example, Alexander (1939) and Wolf, Pfeiffer, Ripley, Winter and Wolff (1948) reported that the blood pressure of their patients undergoing psychoanalysis rose during particularly disturbing sessions involving the discussion of unpleasant experiences. Pfeiffer and Wolff (1950) confirmed this effect with normal subjects discussing "threatening" topics. On the other hand, Innes, Millar and Valentine (1959) were unable to confirm these results.

Objective threats have also been found to induce increased blood pressure. For example, Graham (1945) reported that 27 per cent of a sample of soldiers who have seen active service in the African desert campaign in World War II had elevated diastolic blood pressure some months later. Two weeks after a tremendous explosion in Texas City, 56 per cent of a sample of survivors had high diastolic blood pressure (Ruskin, Beard and Schaffer, 1948). An ingenious investigation has been reported by Grimak (1959). He hypnotised parachutists and had them relive the jump under hypnosis. This seems as good an anxiety provoking situation as could be devised. He found that blood pressure went up when the plane took off, remained high during the flight, *fell* when the subjects jumped, and fell again when the parachute opened. This result throws some doubt on the theory that increased blood pressure is a straightforward monotonic reaction to increased anxiety. Another curious result has been reported by Marcussen (1950), who gives several cases in which symptoms of high blood pressure disappeared when the subject was exposed to extreme environmental stress, such as being a prisoner of war in a Japanese camp, but reappeared upon return to normal life. Nevertheless, the weight of the evidence does seem to suggest that stress normally induces a rise in blood pressure.

*Prima facie*, this would suggest that anxious people would tend to have high blood pressure. However, attempts to demonstrate a relationship between anxiety as a personality characteristic and hypertension have had little success. Hamilton (1942) used self-ratings and assessment by two friends to evaluate

the personality of young hypertensive subjects and concluded that they tended to be submissive, introverted, docile, unselfconfident, slow, lethargic, uninterested in the opposite sex, but not anxious. Harburg, Julius, McLeod, McGinn and Hoobler (1963) administered the Cattell 16 P.F. test to college men hypertensives and found that they were high on sensitivity and submissiveness, but not exceptional on anxiety. Cattell and Scheier (1959) have also found that there is no relation between hypertension and anxiety measured by the 16 P.F. Robinson (1959) has reported no relationship between blood pressure and Eysenck's neuroticism factor, which is largely a measure of anxiety. Thus although there is some evidence that stress raises blood pressure, the weight of evidence is fairly strong against an association between hypertension and anxiety as a stable personality characteristic.

#### 4. Murder

The last variable is the murder rate. The measure was included because there seemed a possibility that murderers would tend to be emotionally unstable and anxious individuals. However, little is known about the personality structure of murderers and the surmise that they would be abnormally anxious may well be incorrect. This is the conclusion indicated by the absence of any loading of the murder rate on the anxiety factor.

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