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MONOZYGOTIC TWINS

BROUGHT UP APART  
AND  
BROUGHT UP TOGETHER

# MONOZYGOTIC TWINS

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*An Investigation into the Genetic and  
Environmental Causes of Variation in Personality*

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## FOREWORD

For many years twins have been used to study the question whether some feature, in which human beings vary, has a basis in heredity; and for this purpose they can act as a sensitive indicator. If, for instance, a child is born with some anomaly which has not been seen before, we may be entirely in the dark about how it was caused. If, however, instead of a single individual we have a pair of 'similar' twins, both with the anomaly, then the presumption that heredity has played a part in causing it becomes a strong one. On this principle, there are many twin studies in the past which have provided evidence of the effects of heredity in disorders of body, intellect and personality.

However, twins may also be studied with a different and even more interesting end in view. We are now using them as a controlled experiment set up by nature to test the effects of the environment. Our attention is directed not to similarities but to differences between twins; and we are concerned especially with the so-called 'similar', monozygotic or one-egg twins, rather than with twins of all kinds. Since monozygotic twins have exactly the same hereditary equipment, there must be an environmental cause for any difference we find; if we look closely enough, we may get a clue to what it was.

It is work of this kind which is reported here. With the comparison of matched groups of monozygotic twins, one of them consisting of pairs separated in early years, the other of pairs who spent their childhood together, we are trying to measure the effects of a wide range of environmental factors. They include such things as the personality of the mother or mother-figure, the family structure, small to moderate differences in social and economic background, in fact all the common differences from family to family in England today which we can expect to react upon the personality and intelligence of the growing child. We can examine these effects with objective tests of intelligence and personality traits; but we must do much more, and compare not only two individuals but two life histories side by side. In such broad exploratory work, the old-fashioned retrospective case history and interview are essential tools of research.

Twins are uncommon, and monozygotic twins who have been separated from one another in early childhood are of great rarity. In the one systematic study of separated twins which has preceded this one, the American workers, Newman, Freeman and Holzinger, were only able to dispose of nineteen pairs. Mr. Shields' forty-four pairs represents therefore a major advance, and a mine of information which requires the length of a monograph for its exploitation.

ELIOT SLATER

## PREFACE

For permission to investigate the twins, I have in the first place to thank B.B.C. Television, in particular Dr. J. Bronowski, Mr. G. Noordhof and Dr. J. A. H. Waterhouse; Miss M. V. Ede, Sir Aubrey Lewis, Dr. L. Minski and Dr. M. Shepherd, through whom I obtained the other subjects; and the twins themselves and their relatives.

The work itself has been carried out in the Department of Psychiatry, Institute of Psychiatry (University of London).

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# PART I



## AIMS OF THE INVESTIGATION

### *THE TWIN METHOD*

In any investigation directed towards disentangling the effects of heredity and environment, the observation of twins provides an almost indispensable source of information. The logical basis for the use of twins is generally understood. Monozygotic (MZ) twins are derived from the two halves of a single fertilized egg-cell, which has divided into two at a very early stage of development. Each half contains the same complement of chromosomes and genes. The genes, which lie along the chromosomes, are the physical basis of biological inheritance and they continue to influence the development of the individual throughout life. Since MZ twins are genetically identical any difference observed between them must be due to factors lying outside the inherited constitution of the individual—in other words to the environment in the widest sense of that term. Differences can sometimes be due to the prenatal environment. More often they will be due to systematic or chance differences in the experiences of the twins arising after birth, and these can be either of a physical or a social kind. The observed characteristics of an individual are due to the interaction of genetical and environmental factors. The same environmental influences will not necessarily affect persons of different hereditary constitution in the same way, so these cumulative interactions are likely to be complex.

Of the two main methods of using twins to sort out the effects of heredity and environment, the first and more frequently used depends on the existence of the second kind of twin, the dizygotic (DZ) pairs. The latter, arising from the independent fertilization of two ova by two spermatozoa, are not identical in their hereditary equipment, but are on average no more alike in genetical make-up than sibs born at different times. As a general rule the investigator gives his main attention to dizygotic twins of the same sex.

Twins of both kinds are generally brought up in an environment which is similar for both members of the pair in a great number of important respects. From a comparison of the average resemblance between MZ and DZ twins in a particular characteristic one can tell whether or not heredity is of importance for that characteristic; and, subject to certain qualifications, one can sometimes estimate how important it is compared with general environmental conditions. Twin investigations on these lines have been carried out with interesting results in many medical and psychological fields, including those of intelligence, personality and mental illness (Kallmann, 1953; Shields and Slater, 1960). Generally, MZ twins tend to be more alike than DZ twins in many mental as well as many physical traits; but nevertheless differences between so-called identical twins are far from being negligible.

The second method, and the one with which we shall be more concerned here, consists of a within-pair comparison of MZ twins with a view to assessing the effect on them of observed differences in their environment. Twins often differ in their weight at birth; they do not always have the same illnesses; their parents occasionally favour one at the expense of the other; twins frequently come to differ in their occupations and in their adult domestic lives. MZ twins differing in any of these or other ways can throw light on the influence of specific environmental factors. However, this method is generally of rather limited value if one is interested in mental or physical characteristics of a kind liable to be moulded by influences acting early in life. Twins, as we have already noted, are usually brought up in the same social environment, in the same family and by the same parents. Furthermore, great importance is often laid on their being treated alike. Monozygotic twins, for whatever reason, tend to go around together and may be thought to influence one another in various ways. Thus by means of twin studies one is usually unable to observe differences in those environmental factors which many people consider most important for personality development. For example, size of family, place in family, social class, the ages and personalities of the parents and their general method of bringing up children will all be alike for both members of a pair of twins brought up together. Hence the very great value of MZ twins that have been separated in infancy or childhood and brought up in different homes. Such twins are rare. The largest single series published hitherto, and one obtained with considerable difficulty, is that of Newman, Freeman and Holzinger (1937), and consists of only nineteen pairs. The now classical work of Newman and his colleagues will be discussed in CHAPTER 2, together with some of the single case reports of separated twins that have appeared in the literature.

Before one can conclude that observed differences between twins brought up apart are due to differences in their respective homes one must be sure that these twins are less alike than twins brought up in the same home. It is therefore desirable in studies of this kind to compare MZ twins brought up apart with MZ twins brought up together. This has been done in the present investigation.

### *POSSIBLE BIASES IN TWIN RESEARCH*

Some mention must also be made of criticisms of the twin method. Like any other research method, this has limitations as well as advantages, and most of the criticisms levelled against it arise from these limitations, which are generally a consequence of prenatal and postnatal effects peculiar to twins, the exact significance of which it is difficult to assess. Though they complicate the picture they do not destroy the rationale of twin research.

Of late years the twin method has been subjected to much criticism from the biological and genetical side. Neel and Schull, for instance, after a reasoned critique (1954) conclude by saying that evidence on the magnitude of the biases to which the twin method is liable must be obtained, if we are to determine whether the method can properly be applied as a tool for the appraisal of nature-

nurture interaction. They point out that there are natal factors, such as the position of the foetuses *in utero*, special conditions of implantation, and order and manner of delivery, which may cause the appearance of non-genetical differences between twins. It is also possible that lateral inversions, sometimes called mirror imaging, act in the same way. On the other hand, if a mutual circulation develops between a pair of dizygotic twins, this might make them more alike than should be the case on the basis of their heredities. It is pointed out that even MZ twins reared apart have enjoyed the same prenatal environment in respect of birth rank, gestation and maternal age.

These considerations will clearly have to be borne in mind in interpreting the data obtained by twin investigations, but form no reasoned objection to the carrying out of such investigations. Differences between monozygotic twins can still be regarded as environmentally determined even when due to factors whose onset is natal or prenatal. The biases listed by Neel and Schull are on exactly the same footing as factors productive of differentiation whose onset is in postnatal life. On the other side twin theory has always taken into account the fact that similarities between dizygotic twins can be environmentally as well as genetically determined.

Objections to twin studies carried out in the field have also been raised by biologists, e.g., Norma Ford Walker (1957), on the grounds that diagnosis of zygosity is by biological standards often exceedingly inadequate. Just how apposite this criticism is will be made clear in CHAPTER 4. In defence of the field worker, however, there are arguments of a prosaic but compelling kind (Slater, 1957). The diagnosis of zygosity is, as a rule, the most objective and reliable of the judgements he will have to make. Possibilities of error are much greater in the diagnosis of mental disorder, traits of personality, presence or absence of specified environmental stresses, etc. Yet his task is to investigate material in which judgements of such a subjectively variable kind have to be made; and he cannot postpone this until the available scientific methods have been improved to the level of those used in the biological laboratory. If he makes use of twin material he is introducing a factor of greater objectivity and thereby improving the precision of his data. To be justified scientifically, it is only necessary for him to use the most objective and reliable methods available, and to apply them without *arrière-pensée*. Diagnosis of zygosity by the similarity technique will not prevent an occasional error, but provides the basis for a considerable level of confidence in the classification of a number of twins into two qualitatively distinct series. Misclassification there will probably be, but only in a small minority of cases, and with a statistical effect small in comparison with the observed differences between the two series in respect of characteristics under investigation.

The usefulness of twin studies in psychological genetics is sometimes dismissed by workers who wish to stress the importance of environmental or psychodynamic factors on the ground that the early environments of monozygotic and dizygotic twins brought up together are very different. Even the mother sometimes mistakes

identical twins for one another, they are dressed alike, similarities in behaviour are expected of them, they are often inseparable and they tend to identify with one another. Fraternal twins on the other hand are exposed to a more differentiated external environment in all these respects. Whatever the value of twins for investigating the genetic determination of physical traits and diseases the method is too misleading, so it is argued, for it to be applied in psychology or psychiatry or criminology. That this is not the whole story has been argued elsewhere (Shields, 1954a; Shields and Slater, 1960). Since the present investigation is not primarily devoted to the comparison of the two classes of twins a discussion of the argument is not appropriate here. The answer depends largely on the extent to which resemblances found between monozygotic twins in the character in question can justifiably be attributed to factors such as the influence of one twin on the other. The study of twins brought up by different parents, and with little or no motive or opportunity to copy one another, is a valuable method of investigating the force of the above criticism of the traditional twin method. The present study may therefore throw some light on the matter.

### *PERSONALITY*

When investigating twins it is generally wise to restrict oneself to a specific subject, such as mechanical ability, or tuberculosis, and to investigate it systematically. Twins brought up apart are, however, so rare and of such potential interest to many different branches of psychology, sociology and medicine that one is obliged to cast one's net more widely. This is so in deciding which twins to investigate and in choosing the subjects to cover in the investigation. The present series of twins is based in the first place on volunteers, a risky procedure in most types of research, but inevitable in this case. The topics investigated include most of those on which the life histories of the twins could throw some light. The chief aspect of investigation, however, is that of personality in a wide sense.

The term personality has been defined in a great number of different ways. It is generally used to refer to those characteristics of organized behaviour that distinguish one individual from another. Personality is shown in a wide variety of ways—in social attitudes and in personal relations, in tastes and interests, temperament and character, emotional stability and reactions to the stresses of life. According to Eysenck (1952) most attempts to measure personality tend to class people along two independent dimensions, 'extraversion-introversion' and 'neuroticism'. Most people come nearer the middle than either of the extremes of both dimensions. Tests can be designed to measure a person's position on scales of extraversion and neuroticism. The clinician, like the observant layman, makes his attempt along more intuitive lines. From observation of behaviour he tries to assess a person's relative position in a number of traits, such as anxiety, irritability, energy and sociability, and he makes use of his life story as recounted by the subject himself and by others. He tends to describe him by what appears to be his most distinguishing traits. Though most people have certain basic distinguishing

personality characteristics, personality does not manifest itself fully formed, and even in adult life is liable to alter or fluctuate according to the circumstances, manifesting itself sometimes in the forms of overt psychiatric illness.

Personality was assessed in the present study by means of life history data, including any history of psychological or psychosomatic illness, by impression on interview and by tests of extraversion and neuroticism. The intelligence of the subjects was also studied by means of tests.

### *HEREDITY AND ENVIRONMENT*

The importance, both on basic scientific and on practical grounds, of investigating the influence of nature and nurture on psychological variables such as personality and intelligence is one that need hardly be stressed.

Whereas in past decades it was the tendency on insufficient evidence to attribute to heredity a variety of social vices and virtues, in recent years the pendulum has swung the other way. With the spread of psychoanalytic doctrines and of cultural anthropology, equally extreme views of the importance of environment have been put forward in some circles. National character, it is said, is formed mainly by traditional methods of weaning and potting; the causes of behaviour disorder can be traced back to disturbances in early postnatal development or to the trauma of birth itself, but heredity can be ignored as having no relevance to schizophrenia (Bellak, 1948) or to mental deficiency (Sarason, 1953) or to personality (Masserman, 1946). So-called dynamic psychology has sometimes left out of account what may be the most dynamic factor of all, the genes. Today, however, most authorities, though their emphasis may vary with their point of view, at least pay lip service to both innate and acquired causes of variation.

It is the genes that are inherited, not finally formed physical characteristics or traits of behaviour. Occasionally single genes, such as those responsible for the blood groups or for colour vision, show consistent effects irrespective of almost any environment compatible with survival; but such traits are the exception rather than the rule. How a gene will manifest itself will depend to a considerable extent on the genetic constitution as a whole and on a variety of environment factors. Just because heredity may be important for a certain trait there is no reason to assume that the trait cannot be effectively influenced by environmental measures. Diabetes may be largely a genetically determined disease, but it can none the less be controlled by the administration of insulin. The genes as a whole can be regarded as a kind of built-in blue print determining development throughout life one way or another according to the environment it finds itself in. And, as a general rule, the effect of an environmental factor will vary to some extent according to the genetical constitution of the individual.

Attempts to analyse the parts played by heredity and environment in normal and abnormal psychological traits have been made by means of various kinds of population and family investigations, by the study of foster-children as well as of twins, and more indirectly by breeding experiments in animals. Some authorities

attempt to calculate a general figure as an estimate of the proportion of the variance of a specific trait, such as intelligence, that in a given population is due to heredity. Such is Holzinger's  $h^2$  statistic, and the reasoning behind Cattell's (1953) method of multivariate analysis is also on these lines. In favourable circumstances a much more rigorous procedure is possible, as for instance with the investigation of the inheritance and physiological mode of action of a specific gene, such as the gene for phenylketonuria. With such a global concept as human personality such rigour is not possible. It is hoped that the individual case histories and test results of the separated identical twins presented here will, despite their limitations, be a contribution towards the data required for the elucidation of some of these complex but important problems.

### CONCLUSION

The primary object of this research is, by means of a comparison of monozygotic twins brought up apart and monozygotic twins brought up together, to test the hypothesis that early environmental factors of the kinds that commonly differ from one family to another in Great Britain today are an important cause of variation in personality and intelligence. The plan of the research also enables us to make various observations on the psychology of twins which are possibly of interest in themselves and also of relevance to the interpretation of the result of genetical twin research in which the two kinds of twins are compared. Though primarily directed towards monozygotic twins, the investigation also includes a smaller number of dizygotic twins, some brought up together, others separately. Where relevant, the findings in these pairs of differing heredity are compared with those in the hereditarily identical pairs.

## PREVIOUS REPORTS OF MONOZYGOTIC TWINS BROUGHT UP APART

On account of their rarity, the international literature on separated identical twins is not large. Besides the classical investigation of nineteen pairs described in Newman, Freeman and Holzinger's book, there has been only a trickle of single case reports over the years. Some of these arose in the course of investigations into twins with mental or social abnormalities. The majority are psychological investigations of normal twins. Some of these pairs only learned of their twinship as a consequence of frequent mistakes of identity. In other pairs separation was not very extensive. Cases have been reported from various parts of the world, including Japan, Germany and the Mexican-U.S.A. frontier region. A survey of these scattered cases will show how different investigators have approached the subject and may perhaps reveal some common tendencies in the findings.

### *THE POPENOE-MULLER PAIR*

In 1922 Popenoe published a short report of a pair of twins brought up apart, based on an account supplied to him by one of the twins. The geneticist H. J. Muller, realizing the scientific value of systematic observations on pairs of this kind, investigated Popenoe's case more fully. He was able to establish monozygosity. He gave each of the twins a series of tests of intelligence and personality, which Helen Koch, a colleague at the University of Texas, was applying to a group of normal twins. These included the Otis Intelligence Test, the Downey Will-Temperament Scale, the Pressey Cross-out Test and the Kent-Rosanoff Word Association Test, all of which Newman and his colleagues were later on to give to their twins brought up apart. Some attempt is made to relate differences in test score to differences in the backgrounds of the twins and to assess the value of the tests themselves as measures of a genetic character. The introduction to Muller's paper (1925) gives an excellent outline of the rationale of investigations of this kind. His findings were as follows:

The twins, Jessie and Bessie, were separated at two weeks, first met at 18 and were aged 30 when examined. They were brought up in somewhat similar ranching and mining communities in Arizona and Wyoming respectively. Jessie's home was better off financially. Bessie had more moves and had only 4 years' schooling, while Jessie went through high school. In spite of this and other differences, the twins differed by only two points on both the 'Army Alpha' and the Otis intelligence tests, Bessie actually doing better than her sister. As children both are said to have been tomboys and voracious readers. Bessie had a successful and varied career as a secretary and had been to France in the First World War; she was still single. Jessie was a school teacher; she was married, with one child. Bessie wrote a more businesslike letter, Jessie a more homely one. They were very fond of one another and thought their similarities outweighed their differences.

'On casual observation they appear very similar in character', writes Muller, though he is cautious about taking his impressions on their face value. The twins seemed to be energetic and capable, more interested in practice than theory; they had similar tastes in books; both were active in Club work; and they were inclined to overdo things. Bessie had had a nervous breakdown in her late teens (no details given) and Jessie had nearly had one. Before her breakdown Bessie had shown signs of much religious fervour with leaning towards Catholicism. Both had had tuberculosis, and after her last illness Jessie became interested in Christian Science. Their similar reaction to the tests was also considered worth comment.

The personality tests gave results which were in striking contrast to those of the intelligence tests and to the general tenor of the other observations. Some of the differences were thought to be related to the environment. Thus Jessie's foster-mother was more 'worrisome' than Bessie's and Jessie crossed out more 'worries' and 'wrongs' than Bessie in the Pressey test. (However if it had been Bessie who had crossed out more 'worries' one could have plausibly interpreted this as a corollary of her nervous breakdown.) Bessie, the typist, scored more on a tapping test; but if Bessie's typing experience is the reason for the difference, the test is probably not a very meaningful measure of personality.

Muller's case is in many ways typical of later cases in the nature of the findings and in the difficulty of their interpretation. He emphasizes the need for more research in psychological genetics, including further intensive work on human identical twins brought up apart. Newman and his colleagues soon took up the challenge.

#### NEWMAN'S WORK

In 1927, H. H. Newman a specialist in the biology of twins, F. N. Freeman a psychologist, and K. J. Holzinger a statistician, decided to pool their resources in a study of twins, commencing with a comparison of fifty MZ and fifty DZ twins brought up together and attending school in Chicago. Slowly they accumulated cases of MZ twins brought up apart as well. The first nine cases were written up by Newman in different numbers of the *Journal of Heredity* between 1929 and 1934. The offer of a free visit to the Chicago Fair was sufficient inducement to persuade other pairs to attend for examination.

Newman, Freeman and Holzinger's well-known book *Twins—a Study of Heredity and Environment* (1937) presents the definitive analysis of their total group of nineteen separated pairs of monozygotic twins, together with their comparison of MZ and DZ twin schoolchildren. Though dating from the pre-blood-group era, establishment of zygoty is satisfactory. Indeed Newman's was pioneer work in America from this point of view. The twins brought up apart were for the most part young adults, although they included a number of children aged 11 or over. (It might have been preferable to have compared them with a group of the same age, since tests are not always equally applicable to adults and children.) In addition to various physical measurements, all the twins were given the Stanford-Binet and Otis intelligence tests, the Stanford Educational Age achievement test and the Woodworth-Matthews neurotic inventory. The twins brought up apart also did most of the personality tests which Muller gave to Jessie and Bessie. A handwriting analysis was also made. Of equal, if not greater, interest to us today



are the case histories of the twins, in spite of some inevitable gaps concerning the nature of the twins' experiences and the expression of their personalities.

Newman's twins are the only pairs brought up apart where statistical analysis of the findings has been feasible. It is hardly surprising in view of the nature of the traits and the methods of measuring them that height, weight, intelligence, educational achievement and personality each gives a different pattern of results. Findings also vary slightly according to whether adjustment is made for the effects of age, attenuation and test unreliability. Height and weight need not concern us here; the findings are discussed in CHAPTER 7. There is some discussion in CHAPTER 6 of  $h^2$ , Holzinger's statistic estimating the extent to which a trait is hereditarily determined. TABLE 1 shows the main results of the psychological testing of Newman's twins.

TABLE 1. NEWMAN, FREEMAN AND HOLZINGER: RESEMBLANCE OF TWINS IN INTELLIGENCE AND PERSONALITY

<i>Zygoty Brought up Number of pairs</i>	<i>MZ Together 50</i>	<i>MZ Apart 19</i>	<i>DZ Together 51</i>
<i>Binet I.Q.</i>			
Mean difference (uncorrected)	5.9	8.2	9.9
Corrected mean difference <sup>1</sup>	3.1	6.0	8.5
Correlation coefficient (uncorrected)	+0.910	+0.670	+0.640
Corrected correlation coefficient <sup>2</sup>	+0.881	+0.767	+0.631
<i>Woodworth-Matthews Neurotic Traits</i>			
Mean difference (uncorrected)	5.3	5.0	6.7
Correlation coefficient (uncorrected)	+0.562	+0.583	+0.371
Correlation coefficient (corrected for age)	+0.558	—	+0.365

<sup>1</sup> After allowing for test-retest difference (from Woodworth, 1941).

<sup>2</sup> The scores of the schoolchildren (i.e., twins brought up together, MZ and DZ) have been corrected for age; these are the correlations customarily cited. The distribution of the Binet scores of the MZ twins brought up apart was restricted; correlation has been corrected for attenuation according to a suggestion of McNemar, accepted by Holzinger.

In intelligence, MZ twins brought up apart were less alike than MZ twins brought up together but more alike than DZ twins brought up together. This was so for the Otis intelligence test as well as for the Binet. The difference between the two monozygotic groups is accounted for largely by the four separated pairs who differed most in educational opportunity. One twin had fourteen years more schooling than her sister and had an I.Q. 24 points higher. Newman, Freeman and Holzinger asked five judges to assess from the full case histories, in ignorance of the test results, the degree of educational and social advantage between the twins in each pair, out of a maximum possible difference of 50 points. When these differences were plotted against difference in I.Q. it could be seen that small differences in environment had little effect and that social advantage was not so closely

related to intelligence as was educational advantage. It is of interest that the Stanford educational tests were the only ones in which the separated monozygotic twins were less alike than the dizygotic twin schoolchildren. Intra-pair correlation coefficients for Stanford Educational Age (corrected for age in the case of the groups of children twins) were: MZ brought up together, 0.892; MZ brought up apart, 0.583; DZ brought up together, 0.696.

There was no tendency for differences between the separated twins in the personality tests to be associated with social or educational advantage. It was thought that the relation between environment and personality was of a different sort from that between ability and environment. However, score on the Will-Temperament Scale was correlated significantly with a physical and health rating. Resemblance between twins of all classes was less close in personality test score than in intelligence, and there was little difference between MZ and DZ pairs on the Woodworth-Matthews questionnaire. The twins brought up apart were actually a little more alike than those brought up together, so it would be unwise on the basis of Newman's results to say that heredity had no bearing on personality. Difficulties of measurement are much greater than in intelligence.

Some attempt was made in the individual case histories to relate personality differences to the environment. Though this was not entirely successful, it will be of interest to give some examples to illustrate the sort of thing that Newman found. Some histories bring out the force of the environment, others that of heredity.

CASE NO. 1. Age 19. Separated at 18 months. Alice brought up in London, Olive in Canada. Olive had a better education and a higher I.Q. Both were very interested in Church affairs and little interested in men. Alice was thought to be more restrained, in keeping with her more restricted environment.

CASE NO. 7. Age 13. Separated at 1 month. Richard was reared in the home of a somewhat shiftless, often unsuccessful man of various semi-skilled occupations, Raymond in the home of a well-to-do physician. Nevertheless, they were equally intelligent and very closely similar in behaviour. Richard seemed a little more self-reliant.

CASE NO. 8. Age 15. Separated at 3 months. Mildred was brought up in a prosperous and stimulating environment as one of a large family group. Ruth had a more depressing environment, was an only child and was not encouraged to grow up. Mildred had a bright and happy facial expression and a light in her eyes which contrasted with the dull eyes and rather unhappy expression of Ruth, who commented spontaneously, 'I feel people don't want me.' Ruth was more neurotic than her sister on the tests. An original difference in birth weight (Mildred 6 lb., Ruth 3½ lb.) might have contributed towards Ruth's lower vitality, but this was not so in the following example.

CASE NO. 17. Age 14. Separated at 2 years. One of the twins had many changes of domicile and his foster-mother died 4 years ago when he was 10. She had been mentally ill before her death. This twin was silent and glum compared with his more favoured brother and he had a more neurotic score on the tests.

CASE NO. 18. Age 27. Separated at 1 year. James was brought up by steady and industrious people in a small town, and he went through high school. Reece lived with a primitive family in the Tennessee mountains where the custom was to avoid regular work; he only went to school when he felt like it. While James has had a regular job and enjoys reading improving literature, Reece has had very few jobs. Working in a factory was 'too much like slavery'. 'It would not be fair', writes Newman, 'to recount in this place any of his less creditable occupations and experiences.' His Binet I.Q. was ten points lower than his twin's.

Nevertheless a remarkable similarity was noted in basic temperament which was quick, matter-of-fact, resistant to change. On the tests the twins were relatively lacking in neurotic traits, though they both had badly bitten nails. The profiles of their scores on the subsections of the Will-Temperament scale were similar and distinctive. 'These brothers, though brought up in widely different circumstances, are similar in manner and the measurable features of behaviour. However, their conduct, from the point of view of its direction and social significance, differs very widely. We might expect them to act with equal vigour, decision or persistence, but one to a socially constructive and the other to a socially destructive end.' It is suggested by the authors that there are different levels of behaviour, some of which are more and others less modifiable by the environment.

What general conclusions do the authors derive from their study? Expressing themselves independently, they differ somewhat in emphasis. As Woodworth (1941) points out, Freeman the psychologist considers it showed that 'human nature may be improved or debased to a degree that many have thought impossible'. Holzinger the statistician points out that 'relatively great environmental differences must be present to produce a noticeable effect'. Newman the biologist confesses to have been 'much more impressed with the very great intra-pair similarities after the twins had been exposed to all sorts of environmental differences' than he was with the differences between them. He would probably also lay more stress than his co-authors on prenatal factors and asymmetry reversals as a likely explanation of differences between monozygotic twins.

### *SOME SINGLE CASES*

While Newman was working on his twins, and in subsequent years, other pairs of twins brought up apart have been described. Already in 1929 there had appeared the German edition of Lange's (1931) well-known study of criminal twins. His sixth monozygotic pair, Ferdinand and Luitpold Schweizer, had been brought up apart from the age of 8. In spite of little contact after that age, these twins were alike not only in the fact that both have criminal convictions, but also in basic personality.

Their early home environment was not unsatisfactory except for the lack of a father. On their mother's death Ferdinand was less lovingly cared for than Luitpold at first, but he ran away to live with his lenient grandmother. At the age of 33 there is a big difference in social behaviour. Luitpold presents the picture of 'a respectable workman, a fireside hero who weeps in church', while Ferdinand is 'the restless fellow who is always being picked up drunk in the street and goes hawking in the company of a low female'. Lange points out that it is too superficial a view to regard the difference as being due simply to the educational influences of childhood. Their story shows that 'both are of exactly the same material . . . completely without will-power'. Both truanted from school when they had the chance. They became heavy smokers and drinkers and got into various exploits in bad company which showed them both to be capable of brutality. Each is the parent of a number of illegitimate children. Ferdinand has been sentenced for 'allowing his wife to misconduct herself in his presence and that of his little boy, while he was misbehaving with another female'. Luitpold spent his wedding night not with his wife but with a former mistress. Both did better under a strict discipline, Ferdinand when in the army, Luitpold when managed by his energetic and strongminded second wife.

In 1934 Saudek reported a British pair of identical twins brought up apart. These were normal young men of 20 who had been separated at 1 month and

brought up, one by their own parents, the other by their grandmother. They were reunited at the age of 9 years 9 months when the grandmother died, and they spent the rest of their childhood together. There was little difference in intelligence. In personality they are thought to have differed more in degree than in kind. The twin who had been with the parents all along was more extraverted and rather better adjusted according to the tests.

The investigations of Rosanoff and his colleagues into mentally ill twins brought to light two MZ pairs that had been reared apart. Their 1935 paper on manic-depressive syndromes describes a male pair, aged 23 when seen, who had been parted at a few months of age, one twin going to live with an uncle in more prosperous circumstances than his brother. They rarely met, and then only in later years. They developed rather similar psychoses at the age of 21 with emotional instability, aggressiveness and distractibility, and required admission to mental hospital. Each made a good recovery. Their monograph on mental deficiency in twins (Rosanoff, Handy and Plesset, 1937) describes a pair of twin girls who were adopted separately while still infants. Each got into trouble on account of sexual promiscuity and illegitimate pregnancy. They were admitted to the same institution at the age of 20 under different surnames. Only later, when their similarities in appearance and behaviour were remarked upon, was their twinship established. Both were considered to be feeble-minded.

In 1936 came an account by Bouterwek of two Austrian pairs of twins brought up apart. Again neither separation was complete. A male pair aged 19 were not separated until 7 but were still living apart. A female pair aged  $15\frac{1}{2}$  were parted shortly after birth and had no contact until the age of 9, when they came to the same foster-home. Bouterwek compares them with two pairs of twins brought up together, who 5 years previously had been closely alike in personality and were still living together. He considers that the personality differences between the separated pairs were no greater in degree or in kind than those existing between the twins brought up together when he followed them up. He attributes differences between monozygotic twins to innate asymmetries rather than to the environment.

Kallmann's (1938) book, *The Genetics of Schizophrenia*, based on work done in Berlin in 1929, refers to a pair of 22-year old illegitimate female twins, evidently monozygotic, who had been parted soon after birth. They were brought up by different uncles who were on bad terms with one another. Their mother was schizophrenic. Both were problem children, callous, indifferent and stubborn. Each had to be admitted to a mental hospital with catatonic schizophrenia, one after giving birth to an illegitimate child at the age of  $15\frac{1}{2}$ , the other 15 months later. Both were still in hospital when Kallmann examined them, but the illness of the former twin was initially more severe and had taken a more deteriorating course.

In 1940 Newman added the twentieth and final case to his series (Gardner and Newman). These twin girls of 18, parted at birth but now attending university together, are considered by Newman to be more alike physically, mentally and

temperamentally than any of the other nineteen pairs he had studied. The twin who had more grounds for worry on account of the insecurity of her foster-home status proved to be less neurotic on the tests.

1941 saw the appearance of another British pair in the literature (Yates and Brash). Like Saudek's pair, these twins came from Glasgow. P. E. Vernon was responsible for the psychological testing. These boys of  $16\frac{1}{2}$  had been adopted at three months by different couples; each was named John. J. J., brought up in a crowded urban environment, was inferior in weight, health and physiological age to his twin J. B., brought up in a semi-rural environment; only J. J. had a perforated duodenal ulcer. Rather surprisingly J. J.'s Binet I.Q. was 19 points higher than J. B.'s and he was better on tests of arithmetic; but J. B. did better on performance tests. In personality they were both somewhat inconspicuous and solitary lads, rather slow and cautious. They both showed some musical ability. Unlike other pairs, they were judged to be more alike in personality than in intelligence.

In 1941 an interesting case was reported in Japan by Yoshimasu as part of an investigation of criminal twins. Unlike Lange's separated pair, these twins were discordant for criminality.

Kazuo and Takau, male MZ twins of 32, were separated at birth. The weaker one, Kazuo, was kept by the parents. The father was a conscientious army engineer. The mother is described as nervous and weak-willed and she died of T.B. when Kazuo was 15.

Takau was brought up in a poorer district of the same town by neglectful alcoholic foster-parents. Takau had a stammer for which he was punished. He stole from his home at the age of 9. He later stole from his employers and up to the present he has had repeated convictions for theft and embezzlement. When in prison he contracted T.B. He is described as friendly, sensitive, good-natured but very easily influenced; resolutions to reform are short lived.

Kazuo has not been delinquent. The only evidence of instability in his case occurred when he ran away from home after his mother's death. A little later he developed T.B. Under the influence of his Christian stepmother he took a theological training and is now leading an exemplary life as a good-natured parson and family man. When preaching he occasionally stammers. Though no abnormality was observed, it was thought that he was somewhat weak-willed.

Yoshimasu stresses the significance of the environments for the big difference in social behaviour. Nevertheless he classifies both twins psychiatrically as 'weak-willed psychopaths'. The evidence for this is perhaps less strong than it was in Lange's pair described above.

### *BARBARA BURKS' WORK*

In 1942 there was published what promised to be the first of a series of identical twins reared apart described by Barbara Burks, whose work on adopted children is well known.

Adelaide and Beatrice were separated at 9 days, and placed in families of above-average socio-economic status. From the age of  $2\frac{1}{2}$  they lived in different American cities, with no knowledge of one another. They next met at  $8\frac{1}{2}$ , and from then they generally spent some

of the summer months together. They were first investigated at 12½ and followed up at 18. Zygosity is satisfactorily established. Adelaide's family had moved many times from place to place. Probably more important, family relationships differed considerably in the two families. Adelaide's foster-mother had thwarted ambitions to be a musician and she was frequently at cross purposes with Adelaide. Early on Adelaide showed a tendency to left-handedness and her left hand was repeatedly tied up. She had enuresis from the age of 4 to 9 and was spanked for it. Beatrice showed the same developmental deviations (left-handedness and enuresis) but was not punished or restricted in the same way. Her parents gave her more companionship. Both twins were nail biters, but this habit was more severe in Adelaide. Adelaide was very bossy and demanding; Beatrice also tended to boss other children and is described as very excitable. There was little difference in tested intelligence. At 12, Beatrice's school achievement was higher. They showed an impressive similarity in such things as their gait, their limp handshake and their tendency to look away when addressed. From this and other observations 'there seems to be common ground in a physical vitality that coloured their quick but non-adaptive reaction to immediate environmental stimuli'. They quarrelled a good deal with one another. 'Each carries a chip on the shoulder', says the Summer Camp director who knew them both well. At 12 Beatrice appeared to have reached a higher level of socialization. She was the less dominating of the two. By 18 Adelaide seemed to be moving towards greater social conformity. Their vocational interests were much closer then than they had been at 12.

The study makes use of previous history, personal observation, ratings by others, and psychological tests, both of the questionnaire type and the Rorschach. Terman, writing after Burks' death, called her analysis a 'masterpiece of finesse in ferreting out minor as well as major differences in personality'. Burks herself, like Muller, hoped her investigations would throw some light both on the nature of psychological traits themselves and on the degree of plasticity of the developing human organism.

After her death, information obtained by Burks on four further pairs of twins brought up apart was prepared for publication by Anne Roe (Burks and Roe, 1949). One of these pairs, to judge from the data given, was probably dizygotic in the present writer's opinion; there was a finger-print ridge-count difference of 118. In the three clearly monozygotic pairs plausible relationships could be seen between minor personality traits and differences in the twins' experiences. For example, a twin of I.Q. 96 who had been sent to college was unable to fulfil the occupational and social ambitions which he and his foster-parents had for him. He proved to be more reserved and less outgoing and trustful than his twin brother who was satisfied with a moderately paid job as a labourer. Traits noted as being alike in one or more of these pairs of twins include low intelligence, excitability, a tendency to pessimism and hysterical aphonia. Many similarities in health history, including eczema, were noted; but one pair differed in that only one of the twins had a mental illness. The nature of this illness is not clear, but it seems to have been associated with much physical ill health. The patient had two paralytic strokes. The hospital diagnoses are not very helpful. They were: 'Neurotic, intestinal spasm (always had nervous spells)'; later, 'Psychosis with psychopathic personality, with unformed psychotic reaction of paranoid-depressive nature, marked psychoneurotic admixtures'; and later still—after the strokes—simply 'manic-depressive'.

### SOME LATER CASES

Stephens and Thompson (1943) have added to the collection of twins brought up apart to appear in the *Journal of Heredity*. Despite little resemblance in their respective home backgrounds, these twins of 19, separated from birth and having only recently met one another, showed little difference in intelligence or general mental characteristics. Their profiles on the Downey test were very similar. Both had won boxing championships. One liked music, the other drawing. The New York City boy was rather more sophisticated than his Salt Lake City brother.

In a paper published in 1943 Sir Cyril Burt refers to work done before the war under his supervision on the intelligence of London twin schoolchildren. Of the pairs that 'appeared to be identical' fifteen 'had been reared separately', For these pairs intra-class correlation in Binet I.Q. was +0.77. For the total group of sixty-two identical twins it was +0.86 and for 156 non-identical pairs +0.55. These findings are comparable with those of Newman. No other information is given about the twins brought up apart.

The remaining separated twins whose cases have been reported so far relate to pairs where one or both twins has shown some social or psychological abnormality. Craike and Slater (1945) describe an interesting pair of twins, spinsters aged 51, who were brought up apart from the age of 9 months in homes of very different kinds. They first met at the age of 24 in connection with a legacy they were to share and they viewed one another with suspicion and dislike. In due course each developed a paranoid psychosis of a basically schizophrenic kind. They were also alike in some childhood neurotic traits, in life story, in personality and in symptomatology, each sister centring her delusions around the other. The twin from the poorer home had a more severe illness.

In 1952 Stenstedt published his family study of manic-depressive psychosis. One of his probands was one of probably monozygotic twins who had been brought up separately from the age of one. Each of them had a fairly similar depression, probably a manic-depressive psychosis in Stenstedt's opinion.

Gladys Schwesinger's (1952) case of a pair of young Mexican twins brought up apart is interesting, both on account of their story and of the problem of interpretation to which it gives rise.

Elvira and Esther, monozygotic twins, were parted at the age of 9 months. The former was first taken by a relative but soon returned to the home of the mother and stepfather. In time she acquired half-brothers and -sisters. Esther was placed with the husband's stepmother and remained an only child. When the twins were 9, Elvira moved to the town while Esther remained in the desert. There was a marked contrast between the personalities of the two 'mothers'. The twins' own mother, who looked after Elvira, was of an extremely warm and affectionate nature and was very lenient in discipline, while the foster-mother who looked after Esther was apparently very restrictive and Esther was required to do much hard work.

Relationships in the two homes were satisfactory until at adolescence friction developed in both. Elvira's stepfather drank heavily and finally turned Elvira out. Esther left her adoptive home, came to look for her twin, found her gone. Like Elvira she quarrelled with the stepfather and she too left the mother's home. Independently both twins 'took to the streets and became delinquent'. They were committed more than once to correctional

schools, at first to separate institutions and eventually to the same one. When studied at the age of 18, shortly before discharge, both had been social problems for at least three years and there seems to be little to choose between them in the severity of their disturbance. Elvira was the first to get into trouble, absconded more and was the last to be released. Her I.Q. was eleven points lower than Esther's. She was outwardly more aggressive. On the Rorschach she was the more emotionally labile and immature and less well adjusted. Esther, on the other hand, was generally found to be more tense and insecure and she had a poor score on the MMPI test. Various similarities were noted. Though quarrelling much, the twins seemed devoted to one another.

On leaving the institution they both went to the mother's home where Esther was welcomed. Esther married, Elvira planned to marry. A few months later Elvira appeared to be settling down, in spite of the failure, through no fault of her own, of her marriage plans. Esther, however, grew restless, left home and joined a group of adolescent drug addicts. One day her body was found in a strange hotel. She had died from morphine poisoning, probably self-administered.

What conclusion can be drawn from the story? Schwesinger says 'it points up the moral for parent-child relations; love, permissiveness, relaxation and emotional security are the stuff of which temperamental stability is made'. But surely this conclusion does not follow naturally from the evidence. In the first place, however much one may hope that Elvira has settled down happily, it is too early to be sure. Assuming that she has settled, the reason might equally well be a different one, such as the shock of the death of her sister or the changed attitude of the stepfather to which the report refers. In the second place, the conclusion does not take into account the important fact that both twins presented quite severe adolescent behaviour disorders of a similar kind, in spite of the very different attitudes of the mothers.

To the present writer the case underlines some of the difficulties involved in deciding what environmental factors are responsible for observed difference in twins. It also shows the importance of taking a balanced view of both similarities and differences. If Yoshimasu's classification of Kazuo and Takau as weak-willed psychopaths fails to do justice to the differences in their personality and behaviour, Schwesinger's conclusion does not appear to give sufficient weight to the important similarities in the history of Elvira and Esther.

Kallmann and Roth (1956) in their twin study of pre-adolescent schizophrenia, state that 'only 5 pairs have been reared apart, 1 one-egg and 4 two-egg'. The extent of their separation is not indicated but the proportion of twins brought up apart appears high, considering that the total material consisted of fifty-two pairs. In the monozygotic pair, one twin had developed schizophrenia by the time she was 15, her co-twin developed it at 18. The case adds to the number of endogenous psychoses in monozygotic twins brought up apart. It is interesting that the three schizophrenic cases are all concordant. A fourth case of this kind is reported in the present material [CASE S m 4].

### *CURRENT DANISH WORK*

The above pairs of monozygotic twins brought up apart are all those of any importance known to the writer, though there may be a few others. Omitting



Burt's fifteen pairs where the intelligence test correlation is all the information given, mention has been made of thirty-seven pairs. At the First International Congress of Human Genetics in 1956, Juel-Nielsen and Mogensen announced that they had begun an intensive study of Danish twins brought up apart. At that time eight monozygotic pairs had been investigated. Juel-Nielsen and Harvald (1958) reported on the E.E.G.s of these pairs and found practically complete concordance as regards normal qualities and abnormalities. The clinical and psychometric findings will be awaited with great interest.

The recent account of thirty-eight pairs given by the writer (Shields, 1958) is superseded by the present monograph.

### CONCLUSION

From what has been said, it seems clear that monozygotic twins frequently show important mental or behavioural similarities despite their having been reared under different home conditions. Their resemblance outside the intellectual field has not always been easy for the investigator to demonstrate. Voice, gait, vivacity, caution, sex-life, attitude to the tests and attitude to one another have all, on more than one occasion, been noted as being much alike in twins brought up apart. Interests and abilities are often similar, as for instance when both twins win a boxing championship, play a musical instrument or participate actively in clubs. More noticeable perhaps is the occurrence in both of the same abnormality. Schizophrenia, low intelligence, hysterical aphonia, enuresis and criminality have been reported as being concordant in twins brought up apart. Test results, though often showing differences or inconsistencies, can also be strikingly alike, e.g., the profile of scores on the Will-Temperament Scale.

The degree of similarity indicated above may be a little raised on account of selective factors. It can be argued that twins who are alike stand a greater chance of being investigated than those that differ. Thus the Gardner-Newman case came to light through the twins both entering university. In the report of this pair reference is also made to another pair of separated twins that had come to Newman's notice. One of these twins was anxious to have their case studied, but his brother 'is, we fear, somewhat of a hoodlum and refused to submit to examination'. This sort of error can perhaps be reduced by comparing twins brought up apart with a group of twins brought up together where the same selective biases might be supposed to operate. These biases would not of course affect all those traits in which similarities have been observed.

Differences must be given due weight. The precise nature, reliability and causes of those that have been observed are likewise difficult to interpret, except in a case like Yoshimasu's. Large educational differences generally affect Binet I.Q., but a few pairs, such as the Yates and Brash case and Schwesinger's case, show relatively large differences in intelligence that are difficult to account for, despite careful testing. Personality tests are less reliable and valid than intelligence tests. In any case they do not take the place of careful clinical history-taking by trained observers.

This aspect has been rather neglected in some of the pairs reported. In the individual case, personality differences can be associated with environmental factors with various degrees of plausibility. But to any one with knowledge of the extent to which monozygotic twins brought up together differ, the differences in pairs brought up apart, viewed as a whole, are not impressively large. Admittedly their environments have not as a rule been extremely different; but the usefulness of this kind of investigation lies not so much in seeing whether extreme differences have an effect on personality (which no one would deny) but rather in discovering how important are the smaller kinds of differences which frequently occur between one family and another within the same community.

Despite the difficulties—and many of them are common to other methods of psychological and psychiatric research—the study of monozygotic twins brought up apart must be judged of sufficient interest and importance for cases to be investigated and recorded in the literature whenever possible.

## SELECTION AND INVESTIGATION OF THE PRESENT MATERIAL

### *SOURCE OF THE MATERIAL*

The subjects of the present investigation are eighty-eight pairs of MZ (identical) twins, forty-four of them brought up in different homes, forty-four brought up in the same home. There are in addition thirty-two pairs of DZ (fraternal) twins of like sex, less systematically investigated. These will be referred to as the Separated (S), Control (C) and Dizygotic (DZ) Groups. Within S and C groups case numbers have been allocated in order of age at time of investigation, males and females being numbered separately. Thus Case S m 1 is the youngest of the male MZ twins brought up apart, C f 29 the oldest female MZ pair brought up together, there being fifteen male and twenty-nine female pairs in each group.

The source of by far the greater part of this case material was a B.B.C. Television programme entitled *Twin Sister, Twin Brother*, which was broadcast in November 1953 in the *Science in the Making* series. Dr. J. Bronowski and Dr. J. A. H. Waterhouse took part in the programme which was produced by Mr. George Noordhof. Any one who was a twin was asked to complete a questionnaire which appeared in the current issue of *Radio Times*. A special appeal was made during the programme for identical twins brought up apart to come forward in the interests of scientific research.

Altogether some 5,000 twins filled in the questionnaire. The names of some of these twins have been supplied to other scientific workers interested in twins. Question 5 of the questionnaire read: 'Were you and your twin brought up together? (Yes or No).' The organizers of the programme were good enough to pass on to the writer at the Genetics Unit, Institute of Psychiatry, Maudsley Hospital, particulars of all those twins belonging to pairs of like sex who answered 'No' to this question, together with a batch of letters from twins brought up apart giving more information about themselves than that asked for on the questionnaire. From this source forty-one pairs of MZ twins brought up apart have finally been investigated. To these were added three pairs from other sources, making forty-four investigated MZ pairs in all. In addition there are eleven DZ pairs of the same sex brought up apart, nine of them from the television programme, on whom we have obtained some information regarding personality. It was also on the response to the same programme that we relied for the names of the twins brought up together.

*HISTORY OF THE INVESTIGATION*

In February and March 1954, letters were written to all twins brought up apart, thanking them for sending in their names and asking them whether they would be willing to take part in our investigation. A form was enclosed asking, among other information, for the name, address and occupation of the twin partner, the age at separation, reason for separation, who brought them up and where, whether the twins were reunited during childhood and whether they were so much alike as to be mistaken for one another. From the replies received some cases had to be excluded as unsuitable [see pp. 24–25]. Twins who, without personal examination, could be clearly shown not to be monozygotic were not always asked to complete the investigation. In some cases, for instance, dizygosity could be established by statements as to build, colouring, features and by inspection of photographs. When a co-operative reply was received and it seemed possible that the twins might be monozygotic, a further letter was then sent to the twin partner of the original volunteer, asking for his co-operation. In many cases the second twin had no idea that the first had sent in their names. Nevertheless, in all but three of these cases the second twin proved co-operative, too.

In two cases an attempt was made to discover what had become of a twin brother or sister whose existence had been suspected only because a time of birth was recorded on the birth certificate of a person who had later been adopted. In both cases it could be established through the General Register Office at Somerset House that these persons had in fact had twins of the same sex as themselves. It was possible to trace the other twin and to reunite and examine one of these pairs [PLATE 1], but in the other there was insufficient information to find out what had happened to the co-twin. Two similar cases were investigated later as the result of publicity arising from the successfully reunited pair. In one of these it was established that the co-twin died at the age of  $5\frac{1}{2}$ , before either had left the Children's Home where they were brought up. In the other the volunteer turned out not to be a twin. He was born in Scotland where the practice (unlike that in England and Wales) is for the time of birth to be recorded in the register of births not only of twins but of single-born infants as well.

A brief account must be given here of how the twins were investigated. In view of the scarcity of twins brought up apart and their great value as research material it was thought that the plan of the investigation should be sufficiently flexible to include all pairs where reasonably reliable, if not complete, information could be obtained about both twins. I therefore offered to visit the twins in their homes, and in a few cases where one of the twins was inaccessible to me personally I arranged for him to be examined by a colleague. If I had not done this a significant proportion of the material would have had to be excluded, resulting not only in loss of size but possibly in a selective bias. However most of the twins were seen personally at The Maudsley Hospital [see p. 27].

Before examining the twins I sent each of them a booklet for completion. This asked for further information about their history and included a self-rating personality questionnaire which can be scored for extraversion and for neuroticism. Besides the interview and the tests to establish zygosity, the twins, when seen, were given a verbal and a non-verbal intelligence test.

PLATE 1



CASE S f 9. Madeline (upper) and Lilian, age 36, on the day on which they were reunited. They were considered to be quite as alike in personality as they were in appearance. (See Case History on p. 200.)

By October 1954 about half the cases had been investigated, when the research was interrupted by the illness of the writer. All outstanding cases who had promised their co-operation were informed that there would be some delay before they could be seen. In 1956 I attempted to complete the investigation of these pairs, but it was no longer possible to offer to visit all of them. As a consequence of the delay, the investigation of six pairs could not be completed; but in three of these we already had their booklets, including the results of the psychological tests, so that these pairs were not entirely lost to the investigation.

In 1957-8 a control series of twins brought up together was studied. Before discussing how they were investigated further details must be given about the booklet and the interview and about the selection of the twins brought up apart.

### *THE BOOKLET AND THE INTERVIEW*

Before the twins were interviewed I had before me their completed booklets. These objective personal documents were useful in a number of ways. They saved time by giving factual details about such matters as the composition of the family in which the twins were brought up, their various occupations, their illnesses, their age on marriage and age of spouse, religious denomination, etc. Answers to questions about interests, pastimes, social activities and ambitions, gave a number of useful points on which the twins could be compared. They were also asked to mention the principal ways in which they thought they were alike or different from their twin.

Besides the self-rating questionnaire with its extraversion and neuroticism scores [see CHAPTER 9], the booklet included a supplementary questionnaire (Normal Personality Traits), the answers to which were sometimes used during the interview as an aid in eliciting essential points of similarity or difference. This questionnaire, designed by the writer, consisted of fifty pairs of contrasted traits such as 'shy—makes friends easily' and 'looks on bright side—looks on gloomy side.' The subject was asked to underline in each pair whichever word or phrase he thought described him better than the other. If either word described him well he was asked to underline it twice. He was invited to omit items, or add to or alter the words if he wished. It was intended that the replies should give a rough rating on a four-point scale of various traits. Double underlinings might indicate outstanding traits, differences between a pair of twins of more than one point on the scale—e.g., one twin underlining 'shy' twice the other underlining 'makes friends easily' once—might indicate a significant personality difference. The significance of the twins' responses could be assessed by further inquiry on interview.

The booklet was also useful in other ways. There was plenty of scope for the subject to add remarks to his replies. The manner in which a pair of twins filled it in offered various points of comparison, e.g., of their handwriting, the fullness of their replies, sections omitted (such as the one on income group), the sections they thought it worth while to comment upon, and the nature of their comments,

which often tended to be similar. The booklets could reflect educational level, attitude to topics such as health, social life and the twinship, and traits such as pedantry, carelessness, reserve.

Details of the outline history obtained from the booklet were filled in on interview, and the personal contact with the twins gave many further opportunities for assessing their personalities. One noted, for instance, their rapport, their motives in co-operating, their attitude to the various parts of the investigation such as blood tests and intelligence tests, and their attitude to one another. While the nature of the interview was left flexible, the most usual procedure when the twins were seen together at The Maudsley Hospital was something as follows. After personal introductions and a brief explanation of the investigation, the physical comparison of the twins was usually made first. This included PTC tasting, finger-prints, photographs and blood groups [CHAPTER 4]. During this, various points about the twinship would generally emerge. There would then be further discussion with the twins together of family history, childhood history and some aspects of their adult lives. There would then follow an explanation of the Dominoes non-verbal intelligence test, and while one twin did this in a separate room, the other would be interviewed. Topics of a more personal nature could then be discussed with each twin separately. The twin's view of the main points of similarity to and difference from his co-twin were elicited, and where necessary, a check was made of some of his replies to the second personality questionnaire described above. After the second twin had been seen, and the first twin had finished the Dominoes, the vocabulary test would be given, followed by any further discussion that might be necessary. In counteracting any biases in the statements made by one twin, the views of the other were often a help. The interview and tests usually took about 4 hours for the separated twins, including lunch at the hospital, and 3 hours for the controls. When appropriate, the information from booklets and interview was supplemented by school or medical reports, and when available other relatives such as parents, spouse or another sib were seen.

#### *ANALYSIS OF THE B.B.C. TWINS BROUGHT UP APART*

On the main B.B.C. list of twins said to have been brought up apart there were sixty-two names which were forwarded to the writer. One twin brought up apart was included in a list sent to Dr. A. W. Frankland, who was interested in asthma and hay fever, and another was discovered by chance in 1957 among the list of married female twins. Twenty-seven letters from separated twins were also read. The writer of one letter supplied the name of a second set who had been brought up apart. This material, consisting of ninety-two names, provided the forty-one monozygotic B.B.C. pairs that were finally investigated. Reasons for elimination were as follows:

##### *Duplications and Exclusions (nineteen)*

Three sets were included both in the list of names from the questionnaire and in the letters. There were four instances where both members of the same pair had

replied (in three of these the twins sent in their names independently). Twelve pairs had, on further inquiry, to be excluded. One was not a twin but was brought up apart from his brothers who were twins. In one case the twin partner of a man of forty-six died before reaching adult life. In three cases the twins were of opposite sex and hence not monozygotic. In six cases the twins were not brought up apart as children. (In two out of these six pairs the twins went to different boarding schools, in two the twins were separated on leaving school, and the other two had apparently filled in the questionnaire incorrectly.) A pair of girls aged three who had been separated only between the ages of nine months and nineteen months was also regarded as unsuitable. With the deduction of these twelve pairs and the seven duplicated names we were left with seventy-three possibly suitable cases.

#### *No Replies (ten)*

In ten cases no reply was received either in response to the first letter sent to the person whose name was on the list or to a reminder. In one of these a friend had sent in a name of a lady stated to have been separated from her supposedly identical twin but not until the age of 10. In another a twin had already written to Dr. Bronowski doubting whether his twin could be persuaded to co-operate. According to the questionnaires at least one was probably dizygotic ('never mistaken'). For reasons of economy in time and money no further attempt was made to contact these ten pairs in 1956. It was thought unlikely that many of them would have co-operated satisfactorily and probable that a number would have been unacceptable on other grounds. It should be mentioned that all those twins and co-twins who expressed willingness to participate did so in response to the first letter sent, with only one exception.

#### *Refusals (five) and Incompletely Investigated Cases (four)*

In only two cases was a direct refusal received from the twin whose name had been sent in. One of these was from a girl of 15 who was stated to be one of identical twins. In a letter it was reported that they had been adopted by different families when a few months old. They were now attending grammar schools in different towns and both had hay fever. The other refusal was from a male pair of about 40. In this case their names had been sent in without their knowledge by a neighbour and they politely declined to take part in the research. There were a further two cases where the twin partner of a co-operative index case failed to reply to three letters and the matter was not pursued further. In addition one male partner who was at the time in the services stated he was unable to take part.

There was one case, already mentioned on p. 22, where the twin partner could not be traced and may in fact not have lived. To these may be added three of the cases where, as explained above, investigation could not be completed in 1956. (We have anecdotal information in two of these pairs [see p. 245] but almost nothing at all about the third.) Distance from London appeared to be the factor which most often prevented completion of the investigation. In one pair both twins had married Americans and emigrated.



*Dizygotic (thirteen)*

In thirteen of the remaining fifty-four pairs dizygoty could be established.

*SEPARATED TWINS FROM OTHER SOURCES*

In addition to the volunteers from the B.B.C., three MZ and two DZ pairs from other sources were investigated. Two of the MZ and one of the DZ pairs were discovered in the course of a systematic inquiry into all twins treated for psychiatric illness in one of two hospitals in the London area, The Bethlem Royal and Maudsley Joint Hospital and Belmont Hospital, Sutton. The other MZ pair became known to Professor Sir Aubrey Lewis in 1931, neither twin at that time having had psychiatric treatment. The remaining DZ pair was brought to our notice by a psychiatric social worker, Miss Margaret Swann, after she had kindly assisted in the investigation of one of the B.B.C. pairs which was inaccessible to the writer; a point of particular interest here was the fact that both these twins had tuberculosis. In the analysis of the MZ twins the two pairs whose names were obtained because one of them was psychiatrically abnormal [S m P 4 and S m P 9] are for most purposes counted separately from the others who were volunteers and not selected on psychiatric grounds; but Professor Lewis's pair [S f 14], whose parents had volunteered the information about them, are included along with the pairs from the B.B.C.

The origin and the degree of investigation of the forty-four MZ separated twins included in the research can be summarized as follows: forty-one from B.B.C. lists (including three investigated by means of the booklets only); three from other sources (including two ascertained by reason of psychiatric abnormality in one of the twins).

*EXTENT OF CO-OPERATION*

The failure rate varies according to how the DZ pairs, the partially investigated pairs, and the pairs not obtained through the B.B.C. are counted. If we deduct from the total the nineteen duplicated or excluded cases, the proportion of definitely DZ or investigated MZ pairs is fifty-nine out of seventy-eight (75·6 per cent.).

*EXTENT OF INVESTIGATION*

The separated MZ group consists of three pairs with written information only [S f 2, 4 and 6] and forty-one more fully investigated pairs. Both members of these forty-one pairs were interviewed either by the writer or by a colleague with only one exception: one of the co-twins [CASE S f 28] was seen briefly by a colleague in Canada while her twin from the North of England, though not interviewed, supplied a great deal of useful information by letter. Recent photographs in this case gave no reason to doubt that they were MZ twins and the quality and interest of the information obtained was such as to justify the inclusion of the case in the series.

In work of this kind where a subjective element enters into the assessment of personality, it is desirable in the interest of uniformity of judgement for as

many persons as possible to be seen by the same person. Of the eighty-two individuals from pairs where an assessment of personality resemblance was made by the writer, seventy-four (or 90 per cent.) were interviewed personally by him. Seven of those not accessible to him were kindly seen by colleagues. These included three persons living overseas [S m 10, S f 19 and 28] and three in Scotland [S m 1, both twins; S f 10]. A further three DZ twins were also investigated by colleagues.

It was possible in twenty-eight pairs (68 per cent.) to see the twins together. This is of considerable help in deciding whether a pair is monozygotic or not, and it also makes it easier to recognize small similarities and differences in their personalities, for instance in their expressive movements, their attitudes to the same topics and their relationship to one another. In almost all these cases the twins could be interviewed on their own as well as together. Thirty-two individuals were visited in their own home or that of their twin; of these, eight were also seen at the hospital. Although the majority came to the Maudsley, the total number of pairs would have been much smaller if this had been insisted upon as a prerequisite.

### *DEGREE OF SEPARATION*

The ages at which the twins were parted, the circumstances and duration of their separations, and how the separation worked out in practice, are described in CHAPTER 5. Most of them were parted within the first 6 months of life and not reunited before leaving school. Without exception they were brought up in different homes for at least five years during childhood.

### *SEX, AGE AND GEOGRAPHICAL DISTRIBUTION*

We have nearly twice as many women as men among the separated twins. There are fifteen males and twenty-nine females in the investigated MZ pairs. What is more, the males include the two who were discovered because they were undergoing psychiatric treatment, three of them were youngsters whose names were sent in by their parents, and at least two were pressed into volunteering by their womenfolk. Of fourteen probably MZ pairs where co-operation was blocked by one of the twins, seven were male. Thus it seems clear that women are generally more ready than men to offer to take part in this kind of research. This is probably a matter of their different interests. Women may watch television more and so might be more likely to have heard of our interest in twins in the first place. Moreover men may be less able to spare the time to participate. Although we offered to refund travelling expenses we were not able to compensate the subjects for time lost through absence from work.

The youngest pair was aged  $8\frac{1}{2}$ , while the oldest investigated MZ pair was aged 59. A DZ pair aged 62 was also studied. At the time of investigation, the age distribution of the forty-four MZ pairs was as follows: 0-9 years, one pair; 10-19, three; 20-29, two; 30-39, seventeen; 40-49, twelve; 50-59, nine. They were considerably older as a group than the twins in Newman's series, of whom

fourteen out of nineteen were under the age of 30. Most of the twins in the present series were in their 30's or 40's. A number of those under 30 were in some way atypical. We heard of the youngest pair through a schoolteacher not through the family, a pair aged 22 was one of the psychiatric cases, and a pair aged 23 was one of those where investigation could not be completed. Apart from the possibility that many younger people may not have watched a scientific programme on television, it seems that the younger twins were less ready to take part in the research. It is unlikely that twins under 30 have been separated during childhood less often than twins over that age. There must be a number of pairs who became more or less permanently separated at a young age as a result of evacuation during the war, but none of them came to our notice. Again, any young twins who were parted on account of their home being broken up through the depression of the early 1930's would have been about 20 in 1953; but we have no pairs where this happened. Some young separated twins who did not co-operate may have been influenced by parents or foster-parents who resented the investigation. Further, persons of maturer years can perhaps look back on their childhood with greater objectivity.

The twins come from all parts of the country. The North and Midlands seem well represented in the material and Wales was the country of origin of at least five MZ and two DZ pairs.

The numbers are too small to be compared usefully with population statistics and their selection must have been influenced by the extent of television coverage of the country in 1953. It seems possible that fewer London people volunteered than might have been expected. Excluding the three non-B.B.C. MZ pairs, eleven out of thirty-eight co-operative MZ twins who sent in their names came from Greater London, and only one of these lived within the area of the London County Council. It is not clear why Londoners should have been less easily moved than others to send in their names in response to an appeal on television, unless it were by reason of over-sophistication; there is no evidence to suggest that Londoners might be less likely to bring twins up apart than people in other parts of the country.

A large proportion of the unsuccessfully investigated pairs came from the areas more remote from London.

In nearly one-half of all pairs the twins were living in different regions.

### *SELECTIVE FACTORS*

Our separated group thus contains a relative scarcity of men, of young people and of those living some distance from London.

It is difficult to assess the effect of these and other selective factors. In the first place there is no way of estimating how many twins are brought up in different homes. This cannot be calculated from the known number of fostered and adopted children and the proportion of twins born, as there is a strong and widespread feeling that twins should be kept together.

In the course of a systematic inquiry into twins in this Unit we have come across fifteen pairs, at least nine of them dizygotic, where separation occurred under the age of 10 and for at least 5 years. This is out of a total of 1,003 pairs, or one in sixty-six. This is no doubt an over-estimate of the rate in the general population. The great majority of these came to our notice through one of the twins being a patient in a psychiatric hospital. The family background of many of these patients was a disturbed one of a kind that might result in a broken family life and hence a high proportion, among the twins, of those brought up apart. One of the twins brought up apart was referred to the hospital on account of our known interest in twins. This number of cases does suggest nevertheless that the forty-four pairs studied here make up only a small proportion of all twins in the population that have been brought up in different homes. Of those responding to the B.B.C. questionnaire it appears that about one in sixty-two was a twin who had been brought up apart from his partner, but this high rate must be the result of the special appeal which was made for separated twins.

Based primarily on volunteers, our group of twins is self-selected and for this reason probably not a representative sample. A number of them stated that they would not have sent in their names to the B.B.C. had it not been stressed that twins brought up apart were very rare and their study of value to others. This is a fact in favour of our sample of twins brought up apart being more representative than that of the general run of twins who answered the questionnaire. Nevertheless, it might well be thought that persons responding to a broadcast appeal of this kind might form a rather colourful group. They might include, for instance, a high proportion of people with exhibitionist traits or with special problems. If the sample contains rather many people with unusual personality traits, minor abnormalities and physical illnesses, as may be the case, this could be the result of selection rather than of any tendency for twins brought up apart to be unusual people or of any bias on the part of the writer towards classifying people as abnormal. There are, for example, among the twins volunteering, two epileptics; one person with congenital dislocation of the hip; four persons referred for psychiatric treatment and many others who might well have been referred; two men with gastric ulcers and many women who have had multiple internal operations. However, our control group of twins brought up together (also volunteers) was in some respects a more homogeneous and less abnormal group.

It is not to be regarded as a misfortune that our twins contain such a wide variety of types: it is in fact an advantage, adding to the value and interest of a small material. The only danger would be if there were a tendency for pairs who were alike in personality to volunteer, rather than those who differed. This would lead to an over-estimation of the importance of heredity. This possibility cannot be excluded, but it is not thought to be a very likely one, at any rate in the separated group. Against it is the fact that those pairs where the twins did not know much about one another turned out to be just as alike as those where they knew each other well. Further, some of the twin subjects made a point of stressing

differences rather than similarities. On the other hand selection could favour twins who were not like each other in personality. If some of the volunteers sent up their names on account of special motives, as is probable, and these motives resulted from unusual circumstances peculiar to them, then one might perhaps find bigger differences between them and their co-twins than one would in a random sample of twins. One of the epileptic pairs [S m 3] is a case in point. If this has happened it would lead to an over-estimation of the importance of environment.

Turning to less imponderable factors, the excess of females already mentioned probably does not affect the findings. There was no general tendency for male twins to be either more or less alike than female twins. The relative lack of adolescent and young adult twins excludes a group where the difference in childhood environment might have been studied without the added complication of environmental difference occurring during adult life. This is in some ways a pity. However, the older twins offer a compensating advantage. If twins in middle life are nevertheless alike, in spite of differences in childhood, occupation and marital history, there will be all the more reason to attribute their similarity to their hereditary make-up.

#### *THE CONTROL TWINS: SELECTION AND INVESTIGATION*

We must now describe how the control group of MZ twins brought up together was obtained and studied. In selecting the controls it was fortunate that there were available classified lists of many of the 5,000 other twins who like most of the twins brought up apart had filled in the questionnaire in the *Radio Times*. In taking our controls from these lists we were probably controlling most of the selective factors which arose from our dealing with a group of volunteers. Both groups saw (or heard about) the same television programme about twins and, what is more, they thought it worth while to send up their names to the B.B.C.

We were also able to control factors arising from the rather unusual age and sex distribution of the separated twins. The two groups are very closely equated in these respects. Thus a separated male twin of 30 is matched by a control male of approximately the same age. When the separated and control twins are listed in parallel columns in order of age when first interviewed, thirty-six out of the forty-four pairings differ by no more than one year in age last birthday, while in seven pairs there was a difference of two years and in one pair a difference of five years. The total age of the forty-four controls was greater by only 4 years than that of the forty-four separated twins.

For reasons of economy we were unable to match the two groups for place of residence. Only names and addresses of twins living in London, Middlesex, Kent, Essex, Surrey, Sussex, Hertfordshire, Buckinghamshire and Bedfordshire were copied from the lists; and, when writing to subjects of suitable age, preference was given to those living within easy reach of London. Nor was it possible in the first instance to offer to visit the control twins in their homes or to have them seen by colleagues if they lived too far away to come to the hospital.

In most other respects the investigation of the two MZ groups was comparable. The same tests were used. The booklet sent to the twins brought up together was the same as that sent to those brought up apart, except that in place of the page asking for information about foster family there were questions about birth weight, size in childhood, attachment to one another, leadership and age when they first began to live apart.

On account of its geographical limitations it may be that the control twins form a more homogeneous group than those brought up apart. There is however no reason to think that twins from South-East England are any more alike in personality than those, say, from Lancashire. Nothing was known, at the time of writing, about the personality of the twins concerned.

When replies to our letters came in it was found in a number of instances that the twin partners of the original volunteer lived too far away to be seen personally. Such cases were not necessarily rejected if there was a chance of obtaining satisfactory information by means of correspondence with both twins and interviews with one only. Our controls include some pairs brought up together but now living far apart. There are twin partners living in Rhodesia, Canada, Ireland and Scotland. This is appropriate, since the separated group includes pairs where one twin lived in England, the other in South America, Canada, Germany, or Scotland. If we had restricted ourselves entirely to pairs where the twins were living near one another and both were willing to come, we might have introduced a bias in favour of twins who were alike in personality. This we hope has been avoided by the attempt to make the extent of investigation similar in the two series.

The S and C groups each consist of fifteen male and twenty-nine female pairs matched for age. Of the eighty-eight individuals in each group seventy-four S and seventy-seven C were seen by the writer personally. In three S and two C pairs information was by questionnaire only. In each group both members of a pair were blood-grouped in thirty-seven out of forty-four pairs. Passing on to the psychological tests and ratings (and omitting the two male S pairs ascertained through the psychiatric illness of one twin), ratings of personality resemblance were made in thirty-nine S and forty-two C pairs. Extraversion and neuroticism scores were available for both twins in forty-two S and forty-three C pairs, Dominoes intelligence scores in thirty-seven S and thirty-four C pairs, and vocabulary test scores in thirty-eight S and thirty-six C pairs.

Between the television programme and the investigation of the controls there was a lapse of some four years. It was expected that this might lead to some difficulty in securing their co-operation, particularly that of the males. The males were approached first and proved surprisingly amenable. Female MZ twins were more difficult to obtain; but this was mainly because of the way in which the lists had been compiled from the answers to the *Radio Times* questionnaire.

In the case of the males, the B.B.C. had listed only those twins who had stated that they were so alike in appearance as to be mistaken by acquaintances; hence most of them turned out to be monozygotic. In the case of the females, however,

the answer to the above question was not indicated on the list supplied to the writer, but only the answer to the question whether the twins were ever mistaken by members of the family. Only a minority of MZ twins are as alike as this. Among those answering 'No' to this question there were naturally a large number who were never so alike as to be mistaken for one another at all. Thus many of the female twins turned out to be dizygotic. It is probable that a large number of those who did not reply were also dizygotic and did not answer for that reason. It is therefore difficult to compare the extent of co-operation in the two groups.

Although it had originally been decided not to include DZ twins in the plan of research, advantage was taken of the fact that some DZ pairs were readily available. If there was a likelihood that the twin partner of these DZ twins might also co-operate then both twins were sent booklets to complete. In this way we obtained information about twenty-one pairs of DZ twins brought up together.

The amount of information obtained from dizygotic pairs, including the eleven who were brought up apart, was as follows: extraversion and neuroticism scores in eight S and seventeen C; Dominoes in five S and three C; vocabulary tests in four S and three C; personality ratings comparable to those in the MZ pairs as regards the amount of information on which they were based, eight S and five C; ratings based on booklets completed by both twins (not interviewed), three S and twelve C; and a further four C ratings based on information supplied by only one member of the pair, bringing the total number of DZ pairs to thirty-two. With the exception of one S and one C pair, the DZ twins were all female.

When forty-four MZ control pairs of suitable age and sex to match the twins brought up apart had been obtained, no further twins were approached. 132 names from the lists, twenty-five males and 107 females, had to be written to before this number could be obtained.

Eleven letters were returned 'not known' by the post office; in thirty-one instances no reply was received; in three the proband was unable to come; in twelve the twin partner was dead, unco-operative or lived too far away. There remained 155 names on the lists of twins who were not approached.

In the case of the females, 107 out of 167 names had to be written to. Of those not approached twenty-three lived in the remoter parts of the Home Counties. The female pairs thus represent a high proportion of available MZ twins. The names of ninety-five male twins remained not written to. Thirty-three of them were too young, most of them having been children when they volunteered in 1957.

The list of female twins had already been selected for age, since it had originally been compiled in the interests of Dr. Ian Wickes who was making an investigation of lactation in twins and therefore excluded children and persons known to be single. The scarcity of young women on the available lists was the reason why a separated pair aged 23 had to be matched with one aged 28. It is not thought that selection in favour of married control twins can have had much influence. Only three of the adult separated female probands were single, as indeed was one of the controls. For a control pair to match the separated twin girls of  $8\frac{1}{2}$ , whose names

had been sent in by a school teacher, we asked another school teacher to select a pair of identical twin girls of about the same age. The list of male twins was not selected for age or marital status.

The control twins as a group turned out to be more intelligent than the separated twins and they also differed in other ways. These differences are quite as likely to be genuine ones as to be due to sampling methods. This is because many twins brought up apart are separated on account of unfortunate social circumstances. These differences between the two groups will be discussed later. They are not considered to have seriously affected the intra-pair differences.

### *SUMMARY*

The main source of forty-four pairs of monozygotic twins brought up apart during childhood was a large group of normal twins who had volunteered their names after a television programme. Females and the middle age-groups are over-represented and the investigation of some pairs living some distance from London could not be completed. Besides the establishment of zygoty [CHAPTER 4] the standard investigation of a pair consisted of a personal interview with the writer, a verbal and non-verbal intelligence test, and a self-rating questionnaire of extraversion and introversion; this last was part of a longer questionnaire (the booklet) which covered various points of the personal history and was returned by post before the interview. On the basis of all the information obtained, various ratings of resemblance were made. The extent of investigation varied slightly from case to case. Seven individuals were seen by colleagues only, and three pairs are included where information is from booklets only. A control group of the same number of monozygotic twins brought up together, obtained from the same source and matched for sex and age, was investigated in the same way and to a similar extent. However, it was not possible to match the groups for domicile, the controls coming mainly from the Greater London area, and none of the controls were seen by colleagues. In the course of the investigation information was obtained in a less systematic way about thirty-two pairs of dizygotic twins, eleven of them brought up apart. Some selective factors have been discussed.



## ESTABLISHMENT OF ZYGOSITY

The confidence one can place in any conclusions drawn from research on twins depends in the first place on the accuracy with which the twins are classified as being monozygotic or dizygotic. In view of the criticism, discussed in CHAPTER 1, that the value of twins for research is more limited than is generally supposed on account of errors in classifying twins according to their correct biological group, it is appropriate to give in some detail the methods employed and the results obtained in the present investigation.

### *THE SIMILARITY METHOD*

There is no single criterion which can establish zygosity for all pairs. Even accurate information, if it were available, on the state of the placenta when the twins were born would be insufficient, and information on this point is often neither available nor reliable. Although all certainly monozygotic twins are thought to be monozygotic, not all MZ twins are monozygotic. The generally accepted procedure, known as the similarity method, is to classify the twins as alike or different in a number of characteristics known to be highly determined by heredity. These should, so far as possible, be stable characteristics and independent of one another, and to avoid circular reasoning they should not include the subject under investigation. A clear difference between a pair of twins in any one purely hereditary character, such as one of the blood groups, will be sufficient to show that the pair must be dizygotic. With the possible exception of a successful skin graft or reliable evidence of a single chorion, no similarity in a single trait has so far been shown to be sufficient on its own to prove that a pair is monozygotic. It is theoretically possible for the most identical-looking pair of twins to be dizygotic, even if the probability is in some cases very remote. The onus is thus on finding some feature that will establish dizygosity. If this cannot be done after careful investigation a pair can be classified as monozygotic with only a small likelihood of a mistake. In a series of twins examined in this way only a correspondingly small proportion is likely to be misclassified.

In theory the probability can be calculated that a given pair of twins in which no critical difference has been found is nevertheless dizygotic. For each trait separately one calculates, from theoretical or empirical figures as appropriate, the probability that a pair of twins alike in this trait or differing only by a specified amount will be dizygotic. These probabilities can then be multiplied together to give a combined probability which, if a large number of independent traits is used, will in most cases be extremely low.

In practice it is not very realistic to attempt to estimate an overall probability for each pair in this way, except perhaps in the case of the blood groups. The most easily observed criteria, and those most often used to establish zygoty, such as height, weight, hair and eye colour and similarities in build and features, are in various ways inadequate for an accurate determination of probabilities. Height, for instance, is not entirely determined by heredity; pathological factors such as diabetes insipidus (Komai and Fukuoka, 1934), pituitary tumour (Lewis, 1936), poliomyelitis (Herndon and Jennings, 1951) or renal insufficiency (Milne, 1951) can bring about large differences between MZ twins, and it is difficult to draw a line at any point and say that twins differing by more than this amount must be dizygotic. The same objection applies even more strongly to weight which is liable to fluctuate in a way that height does not. Eye colour, when measured against standard scales, is subject to a large amount of experimental error in assessment (Grieve and Morant, 1946). Hair colour and texture, especially when the matter is gone into carefully, are not absolutely identical in MZ twins, even if allowance is made for the effect of exposure to sunlight or artificial tinting of the hair. Hair and eye colour are not independent of one another, so their probabilities cannot simply be multiplied without making allowance for this. To make accurate anthropometric measurements of the skull or other parts of the body is a specialized job of its own and exactly how to apply this in twin diagnosis has not been established. Nevertheless, the similarity method can be applied clinically with a fair degree of reliability.

When pairs of twins can be examined side by side, superficial appearances alone will enable one to distinguish a very high proportion of the dizygotic pairs. Attention is paid to the colour, texture and distribution of the hair, the colour of the eyes, the shape of the features, especially the nose and ears, the teeth, the size and shape of hands, fingers and finger-nails, as some of the most important bodily characteristics. Comparison on the spot enables one to make observations of similarities and differences in particulars which, though obvious to the eye, are not easily recorded in words. Furthermore, a total impression has its own value, especially in picking out the MZ pairs. Though the method is to some extent subjective, it is fairly reliable, tallying closely with findings in the blood groups (Race and Sanger, 1958). It is interesting to note that Tanner (1953), in discussing the measurement of body build, regards anthroposcopy, or inspection, as being as reliable a method of classifying habitus as the measurement of separate parts of the body. The practical value of this *Gestalt* of similarity is also seen in the fact that a history of a pair of twins having been so alike that they were frequently mistaken for one another weighs more heavily in favour of monozygoty than any other single item of evidence (Waterhouse, 1955; Cederlöf *et al.*, 1961; Dencker *et al.*, 1961).

Comparison by means of photographs or by written descriptions is less reliable, but will still permit classification with only a low rate of error. The probability of misclassification is, however, sufficiently high to be disturbing in the individual case. There are some DZ pairs who are remarkably alike; and it is not infrequent

for MZ pairs to come to differ in the course of a lifetime, whether by health or habitual expression, to such an extent that the observer is tempted to think that they could not be 'identical'. It is therefore highly desirable to bring in reliable objective tests, even though these too cannot provide a final answer, as they leave a certain proportion of dizygotic twins unrecognized.

Of such tests the blood groups are by far the best. They remain stable with age and are not influenced by the environment. The various blood group systems, ABO, Rh, etc., are independent of one another and of other criteria; and their genetics, including gene frequencies, are known. (The same advantages may apply in lesser degree to the ability to taste a standard solution of phenylthiocarbamide.) If we have no information about the genetic constitution of the parents, as is generally the case, we can say that only about 5 per cent. of a large random sample of pairs of sibs will be alike in all of eight independent blood groups. By blood groups alone, therefore, we can hope to recognize as such 95 per cent. of the DZ twins we encounter, the remaining 5 per cent. being undifferentiated from the MZ pairs. Assuming the use of two serum groups as well as blood groups, Juel-Nielsen, Nielsen and Hauge (1958) calculate that an exact diagnosis of dizygoty can be made in about 98 per cent. of all DZ pairs. Smith and Penrose (1955) have provided a method of calculating the probability that a particular pair of twins, alike in any specified combination of blood groups, will be dizygotic.

Another useful objective measurement is that of the number of ridges found on the tips of the fingers and the type of pattern they form, such as arch, loop or whorl. The finger-prints remain unchanged throughout life and their patterns are highly determined by heredity (Cummins and Midlo, 1943; Holt, 1952). They do, however, differ a fair amount in MZ twins, much as they do between the two hands of the same individual. There is in fact a good deal of overlap between the resemblance found in the finger-prints of the two kinds of twins. But in a useful proportion of pairs the finger-prints provide information which is of critical importance in deciding whether a given pair is MZ or not (Slater, 1953; Nixon, 1956; summary in Holt, 1961).

When a search for critical differences in appearance is combined with an examination of the finger-prints, the blood groups and the ability to taste PTC, the chances of misdiagnosing the zygosity of a pair will be fairly remote. This was the plan of investigation in the present research. The majority of the male pairs were further tested for colour-blindness, a hereditary characteristic which is fairly common in males.

#### *LIKELIHOOD OF ERRORS IN CLASSIFICATION*

The error that could most easily affect the present research on MZ twins would be the classification as MZ of pairs that were really DZ. In order to make some kind of estimate of the likelihood of this occurring in a fully investigated case let us suppose in the first place that the writer is liable to misclassify one pair in twenty in this way, judging solely on appearance and not taking blood groups and finger-

prints into account.\* Any such misclassified pair which was then blood-grouped would fail to be correctly reclassified in about one case in twenty [see above]. The combined chance of error would be about one in 400. As a conservative estimate one DZ pair out of three differs in finger-prints more than any observed MZ pair. If finger-printed, the chance of error would then be something of the order of one in 600, or perhaps one in 700 if PTC was also given to the twins.

The chance of error in the opposite direction, that of calling a pair DZ when it is in fact MZ, is more difficult to estimate. Of the seventy-four blood-grouped pairs in the present research that have been classified as MZ, only one would have been misdiagnosed had blood groups, finger-prints and photographs not been available. (In this case the twins were not seen together and they differed more than usual in height and weight.) The other twins would have been classified as MZ in the first instance with varying degrees of subjectively felt confidence. In only three or four cases were there serious doubts before the results of the blood groups came in.

### RESULTS

THE BLOOD-GROUPED TWINS were tested on the ABO, MNS, P, Rhesus, Lutheran, Kell, Lewis and Duffy systems by Dr. R. R. Race, or Dr. Ruth Sanger, of the M.R.C. Blood Group Research Unit at the Lister Institute.

Blood groups were identical in all seventy-four MZ pairs tested. Those not blood-grouped are the five pairs where personality assessments were not made and which therefore contribute little to the total findings of the investigation, six other pairs where both twins could not be seen and three pairs, visited in their homes, who could not be persuaded to go to their doctor for the blood test. There are no serious reasons for supposing that any of these pairs are dizygotic [see p. 42].

For each pair alike in all its blood groups the total chance in favour of the twins being dizygotic has been calculated according to the method of Maynard Smith, and Penrose mentioned above. To estimate this, the relative chance of dizygosity is first obtained by multiplying together the independent relative chances of twins alike in each of the eight blood groups being dizygotic, the initial odds in favour of DZ twins at birth ( $= 2.333:1$ ) and the chance that dizygotic twins will be alike in sex ( $= 0.5$ ). The relative chance that a pair of MZ twins will be alike in all these characteristics is of course 1. The total chance that the twins in question will be dizygotic is therefore obtained by the formula

$$\frac{p_{DZ}}{1 + p_{DZ}}$$

\* One of the control twins was thought probably to be MZ until blood groups and finger-prints proved the contrary. The other thirty-one DZ pairs in this research can either be shown on examination to be DZ on some critical point or else are reported as being not the least alike in appearance. During work in this Unit ninety-five pairs of twins have so far been shown to differ in their blood groups. In only three of these pairs might the twins have been classified as probably MZ had blood groups and finger-prints not been available. The above estimate of one error in twenty may therefore be too high.

It will be clear that the value of the total chance for a given pair depends on its particular combination of blood groups. Pairs who happen to be alike in the commonest groups such as group O and Rh positive (CDe/cde) will have a higher chance of being dizygotic than pairs belonging to the rarer groups. For pairs alike in the eight blood group systems on which these twins were tested, but not taking into account other information such as blood groups of the parents (which was not available) or differences in height or in finger-prints or in facial resemblance (which are considered separately), it is theoretically impossible on this method for the chance of dizygosity to exceed 10.79 per cent. Chances of less than 1 per cent. will be uncommon and none were observed in this sample. TABLE 2 shows the distribution of the chances of dizygosity in the two groups of twins that have been classified as monozygotic. There is no reason to have less confidence in the correctness of the classification in one group than in the other.

TABLE 2. BLOOD-GROUPED PAIRS

Blood-grouped twins classified as MZ	<i>Number of Pairs with Total Chance of Dizygosity in Given Range</i>					Total
	0.01–	0.03–	0.05–	0.07–	0.09–0.1079	
Brought up apart	2	10	13	5	7	37
Brought up together	3	12	6	9	7	37
Total	5	22	19	14	14	74

Distribution of the individual total chances in favour of dizygosity in the absence of parental data (Smith and Penrose method) for same-sexed twins alike in eight blood group systems.

Nine DZ pairs were also blood-grouped. Two of them were alike in all their groups with total chances of dizygosity of 0.051 and 0.079; but they can be shown to be clearly dizygotic on finger-prints and other criteria [see p. 44]. The fact that as many as two out of nine DZ pairs were alike in blood groups is probably a chance occurrence. Of the seven pairs that differed, one did so in five groups, one in four groups, one in three groups, two in two groups and two in only one group. (These last two pairs were tested on ABO and Rhesus only.)

PTC (PHENYLTHIOCARBAMIDE) was given in all pairs where both twins were interviewed. In addition to the standard solution No. 6 (Harris and Kalmus, 1949) which satisfactorily classifies the majority of persons as either tasters or non-tasters, the twins were also tested as necessary with solutions Nos. 1, 3 and 9 in order to establish roughly the threshold at which they began to taste PTC as bitter.\* They were also asked if they could distinguish between PTC and the boiled tap water in which the PTC crystals had been dissolved. The great majority of twins

\* Solution 1 is obtained by dissolving 1.3 g. PTC in 1 litre of boiled water. Solutions 3, 6 and 9 are obtained by diluting solution 1 in 3, 31 and 255 parts of boiled tap water respectively.

classified as MZ showed a close resemblance in their responses to the various solutions. In no instance was one twin classified as a taster, the other as a non-taster.

Of seventy-four MZ pairs, where both twins were tested with PTC, in three S and three C pairs the twins differed in taste threshold (three pairs, 6-9; two pairs, 1-3; one pair, 1-0). In a further sixteen pairs there were slight inconsistencies in the responses or an apparent slight subjective difference in taste. These differences might have disappeared with more refined testing methods, though as Dencker, Hauge and Kaij (1959) point out, MZ pairs do occasionally show clear, genuine differences on this test. Verkade, Wepster and Stegerhoek (1959) have made similar observations. Even when the complete method of Harris and Kalmus is used, testing for PTC taste-threshold relies ultimately on the not completely reliable subjective judgement of the taster, and it appears that not all variation in taste sensitivity is genetically determined (cf. Merton, 1956). It is not considered that the differences found cast any serious doubt on the classifications of zygosity. Of the 148 individuals forty-six (or 31.1 per cent.) were non-tasters which is in good agreement with expectation.

Of nine DZ pairs tested with PTC, three were found to differ in their response to solution 6 and a further pair (one of those who were alike in blood groups) probably tasted at different thresholds.

The majority of the male pairs were tested with the Ishihara tests for COLOUR-BLINDNESS. In two pairs both twins were found to be colour-blind. No differences in colour vision were found.

The FINGER-PRINTS of both twins were taken in thirty-nine S, thirty-five C and eight DZ pairs. From the differences in ridge count, values of  $L$  were calculated [TABLE 3].  $L$  is the linear discriminant devised by Nixon (1956). Pairs with negative

TABLE 3. VALUES OF  $L$  (NIXON'S FINGER-PRINT DISCRIMINANT)

	<i>Negative Values</i>						<i>Positive Values</i>						<i>Total</i>
	-5.0-	-4.0-	-3.0-	-2.0-	-1.0-	-0.0-	+0.0-	+1.0-	+2.0-	+3.0-	+4.0-	+5.0- 9.9	
MZ Separated		4	6	7	11	6	1	3	1				39
MZ Control	1	5	8	6	8	3	4						35
DZ Pairs					1	2	1				1	3	8

$L$ -values tend to be monozygotic, those with positive values dizygotic. According to Nixon one might expect about 10 per cent. of MZ pairs to be misclassified by this discriminant, seven out of the sixty-nine MZ pairs on which he based his discriminant having positive  $L$ -values. In our S group we find 13 per cent., in our C group 11 per cent. misclassified in this way. Two S pairs, claimed to be MZ, had  $L$ -values exceeding 1.65, the highest value found by Nixon. Though there is no reason to suppose this is a maximum, very careful consideration must clearly be given to these two pairs before they are accepted as monozygotic. Reasons for thinking this to be

the correct classification are given on p. 42. If, however, these two pairs were to be regarded as dizygotic on the basis of finger-prints, we should have no fewer than four out of eleven blood-grouped DZ pairs alike in all eight blood groups—a finding which would be highly suspect.

APPEARANCE. The majority of the MZ twins completed the questionnaire in the *Radio Times*. Those who did so all claimed that at some stage in their lives they had frequently been mistaken for one another by acquaintances and, in many instances, by members of their own family too. When seen, one could understand by their likeness in build, features and colouring how this could be so. They were not now all as alike as this, however, though frequently it was by such externals as different hair styles that the women were most easily told apart. Sometimes the distribution of moles, scars or other blemishes on the face had to be noted in order to make certain who was who. There were generally small differences in features, often difficult to describe accurately. One twin would often appear to be a little fatter in the face than the other, which made it easy to distinguish them when they were seen together. In a few pairs these differences, perhaps accentuated by the illness of one twin or by differences in habitual expression, gave rise to some initial doubt as to whether they were monozygotic or not. Yet taken feature by feature no critical differences were observed and similarity in blood groups clinched the diagnosis. Photographs of full face and profile were taken from about 4 ft. distance by a flash-light camera. Though the results are not of professional standard, the prints not only acted as an aid to the memory but frequently showed up points of striking similarity.

HEIGHT, and more especially WEIGHT, should really not be used as an aid to establish zygosity in the present research, since we intend to investigate the possible effect of environment on these variables. Though a few MZ twins showed moderately large differences, these as a group resembled one another more closely in height and weight than did the DZ twins, as CHAPTER 7 shows. It is only where allegedly MZ twins differ by more than 2 inches in height or 2 stone in weight that one begins to wonder whether the diagnosis is perhaps mistaken. Pairs with differences as large or greater than these arbitrary values are discussed below.

### HANDEDNESS

Differences between twins in right- and left-handedness are most conveniently considered here.

In the booklet the subjects were asked to state in what activities they were left-handed. When interviewed their replies were checked. Where some degree of left-handedness was indicated, both members of the pair were asked, in all but four of the MZ pairs, to complete an adaptation of Blau's Questionnaire for Preferred Laterality. This test lists forty activities, including writing, kicking a ball, holding a hammer, waving good-bye and putting the key in the keyhole. The subjects are asked to say for each whether they use their right (R), their left (L), or either (E) hand or foot.

Though no subject scored forty R or forty L, the majority were easily classified as either right-handed or left-handed. Six individuals were regarded as ambidextrous. Counting L responses as one, E as one-half and R as nil, those regarded as right-handed had scores of seven or less, the ambidextrous scores of between nine and eleven and a half inclusive, while the left-handed had scores of fifteen or over, all but two of them over twenty.

There is a raised incidence of left-handedness among both MZ and DZ twins. Wilson and Jones (1932) state that 6.15 per cent. of the single-born are left-handed. In the total MZ group eighteen out of 176 individuals (10 per cent.) were left-handed. For DZ twins the figure was six out of fifty (12 per cent.). This is consistent with the findings of Wilson and Jones and previous work from this Unit. 17 per cent. (fifteen out of eighty-eight) MZ and 28 per cent. (seven out of twenty-five) DZ pairs differed in handedness. The difference between the two groups is not statistically significant. Though handedness is commonly genetically determined, MZ twins differing in handedness are thought to do so by reason of asymmetry reversal, in much the same way as the two sides of one individual come to differ. It is sometimes thought that embryos of twins differing in this way must have divided at a later stage of development than usual. However, the relatively high incidence of left-handedness in both sorts of twins suggests the possibility of intra-uterine factors. Some clinicians have attributed this kind of difference in MZ twins to psychological mechanisms, one member of the pair reacting in a negative way to the situation of finding himself one of 'identical' twins. The very similar distribution of handedness differences in twins brought up apart (seven out of forty-four) and twins brought up together (eight out of forty-four) lends no support to this idea. DZ twins may differ in handedness on account of intra-uterine factors or by reason of their differing heredity.

Though Slater (1953) did not find any association between left-handedness and mental illness, Shields (1954a) found a slight tendency among twin schoolchildren differing in handedness for the left-handed member to be the smaller, the less intelligent, the more submissive, and the more liable to have neurotic traits and Slater (1961) found the left-handed twin predisposed to hysteria. In the present material the tendency for the left-handed twin to be smaller than his right-handed partner was supported in both MZ and DZ pairs. While the DZ left-handed twins were usually more neurotic than their co-twins and submissive to them, the MZ pairs did not show this tendency, nor could any association between handedness and intelligence be seen. The number of pairs differing both in handedness and in these other variables are too small in the separate groups of twins for any findings of statistical significance to be expected. But if we combine MZ and DZ twins from this investigation with those from the study of twin schoolchildren we find that in twenty-three out of thirty-three pairs the left-handed twin was the lighter at birth ( $\chi^2$  [Yates] = 4.364) and in twenty-six out of thirty-eight the shorter now ( $\chi^2$  [Yates] = 4.448). In each case  $\chi^2$  with 1 D. of F. is significant at the 0.05 level. There is no apparent sex difference as might be expected on Bouterwek's



hypothesis (1936). We are not in a position to offer any explanation for this tendency for the left-handed twin to be the smaller member of the pair, unless it be that asymmetry reversal and unequal division of the maternal circulation are in some way related. Schiller (1937) in her study of Stuttgart twins did not find any tendency for the left-handed twin to be the lighter born except among MZ males.

### CASES OF DOUBTFUL CLASSIFICATION

Some discussion is required of those allegedly MZ pairs where, on account of incomplete investigation or unusually large differences, some doubt might arise as to the correctness of their zygosity classification. It should again be emphasized that in all these pairs the twins were reported as having been so alike that they were frequently mistaken for one another. Indeed eighteen out of the twenty-seven pairs which come into consideration in this section claimed that they were mistaken by members of their family. The odds are therefore initially in favour of their being monozygotic (Cederlöf *et al.*, 1961).

The five pairs [S f 2, 4, 6; C f 10, 22] included in the investigation solely on the basis of their replies to the questionnaire booklet should properly be regarded as ' ? MZ'. Information about size and colouring, however, was consistent with their own claim to be 'identical' twins. Since these pairs contribute little to the total findings, an error here would be of less consequence than in any of the other pairs.

There were seven further pairs in which both twins could not be seen by a qualified observer [S f 28; C m 4; C f 6, 15, 21; C m 9, 15]. But the more detailed histories obtained in these cases, including inspection of photographs, makes their classification as MZ more reliable than that of the five pairs mentioned in the previous paragraph, and in C m 9 further confirmation came from blood groups and finger-prints.

There are three further pairs in which both twins were not blood-grouped. In two [S m 5, 15] they were examined side by side and in the other [S m 8] seen by the writer separately on the same day. Striking similarity in appearance and the finger-print findings give no grounds for suspecting any of them to be DZ pairs.

Four pairs, classified as monozygotic, have finger-print differences which give an  $L$ -value of  $+1$  or more. Since about 7 per cent. of MZ pairs differ by as much as this according to Nixon, it is only to be expected that such pairs should occur here. In all four cases the twins were alike in blood groups. In S m 7 ( $L = +1.264$ ) and S m 14 ( $L = +1.126$ ) the difference is not great enough to raise much doubt, there being no other grounds to suspect dizygosity. In S m 7 there is the additional point in favour of monozygosity that both twins are colour-blind. Cases S m 3 ( $L = +1.809$ ) and S f 12 ( $L = +2.405$ ), in which  $L$ -values were higher than any occurring in Nixon's sixty-nine MZ pairs, require more detailed consideration.

In these two cases there are features about the prints themselves which indicate that they are perhaps not so different as would appear. If, instead of  $L$ , we use the simpler measure of finger-print size which Holt (1952) has shown to be determined by heredity, we note that S f 12 has a ridge-count difference of twenty-three,

and S m 3 one of seven. Looking these ridge-count differences up in the table provided by Maynard Smith and Penrose, we find that a difference of from twenty-three to twenty-seven occurs in 5.77 per cent. of MZ twins and in 5.94 per cent. of like-sexed sibs. A difference of from three to seven ridges occurs in 26.92 per cent. of MZ twins and in only 3.96 per cent. of like-sexed sibs. Thus according to this simpler (if generally less sensitive) method pair S f 12 is equally likely, on the evidence of finger-prints alone, to be MZ or DZ, while in S m 3 the odds would favour a diagnosis of monozygosity.

Apart from the finger-prints, the evidence supports the view that these are both MZ pairs. The S f 12 twins had the same coloured blue-grey eyes with a touch of green or brown around the pupil. Both had straight dark-brown hair, Sally's being a little greyer. Ears were strikingly alike in their almost complete absence of lobes. Both had very moist hands and rather high colouring. They had very similar features, but Sally's face looked a little more solid. From their appearance they appeared to be a typical pair of MZ twins. Blood groups were identical, with a total  $pDZ$  of 0.027.

CASE S m 3 presented more difficulty, largely on account of the fact that Russell was an epileptic of many years standing while Tristram had never had a fit. E.E.G.s of both twins were done and in spite of their different histories both records showed some 'spike and wave'. This can perhaps be regarded as evidence in favour of the twins being MZ without begging the question, though it is of course not conclusive. Russell differed from Tristram in that he had a slight stoop, a spotty complexion and a rather puzzled facial expression. He was extremely slow in his movements. In spite of the resulting difference in appearance, colouring was identical, the features taken separately were very similar, head measurements (taken in connection with the E.E.G.) corresponded very closely, and when seen together they were thought by the writer probably to be monozygotic. Two experienced colleagues (Dr. J. M. Tanner and Dr. N. Juel-Nielsen) on inspecting the photographs thought the same. Both twins were left-handed. Blood groups turned out to be the same, with a total probability of dizygosity of 0.106.

CASE S m P 9 differed by  $3\frac{1}{4}$  in. in height and by 62 lb. in weight, Alfred and Harry being 5 ft.  $2\frac{1}{4}$  in. and 5 ft.  $5\frac{1}{2}$  in. tall, respectively, and weighing 8 st. 10 lb., and 13 st. 2 lb. They were interviewed separately and at first thought probably to be dizygotic. Though colouring was the same, Harry's excess fat made it difficult to evaluate the similarity. However the evidence of blood groups ( $pDZ = 0.054$ ), of finger-prints ( $L = -1.010$ ) and of photographs, made it necessary to revise this opinion. When they were 14 the twins were so alike that even their father once mistook them. At various times each has shown a tendency to put on weight. From photographs in their 20's Alfred appears to be a little fatter in the face than Harry. The difference in height can perhaps be explained by the fact that the smaller Alfred was neglected in infancy and brought up in poorer circumstances than Harry. It is not clear why Harry should have put on so much weight during the past 5 years. The possibility of a glandular disturbance comes to mind.

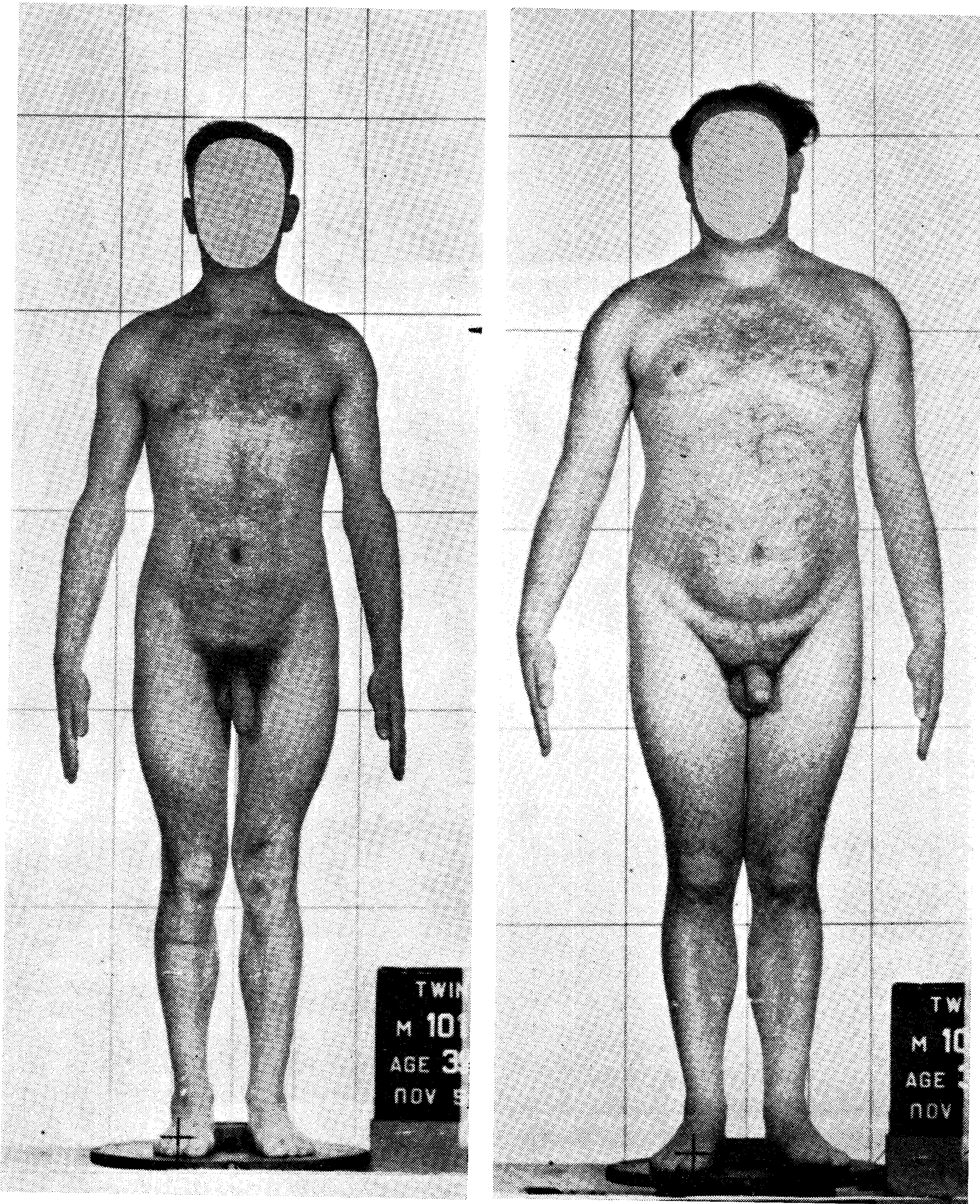
As a consequence of our research, Harry decided to come to London to meet Alfred, for the first time for over 20 years. The opportunity was then taken to have somatotype photographs taken by Dr. J. M. Tanner at St. Thomas's Hospital. These brought out further striking similarities, including distribution of body hair, despite Harry's excess fat [see PLATE 2]. This confirmed the decision that the pair should be regarded as monozygotic.

Apart from the above case, three supposedly MZ pairs differed by 2 inches or more in height and five differed by 2 stone or more in weight, but none of these is likely to be dizygotic. In S m 10 (stated difference of 2 inches) measurements are uncertain; in the opinion of one of the twins they do not differ by as much as this. Both are colour-blind; though not seen together, they have been mistaken by members of the family; blood groups and finger-prints support MZ. Differences in size could generally be related to physical conditions in one of the twins. The heavier twin in a pair that differed by 44 lb. [S f 13] was 6 months pregnant while her sister was underweight, probably by reason of a psychogenic loss of appetite. In C f 19, the twin who was lighter by 36 lb. had a cerebral atheroma; in S f 23 the twin who was lighter by 31 lb. had disseminated sclerosis; in C m 12 the twin who was lighter by 29 lb. had had a duodenal ulcer; in S m 10 the taller twin had recurrent rheumatic fever and the same may be true for S m 13. In the latter case the taller twin was extremely emaciated and he may have some other underlying physical condition (? cardiac). Although there is a difference of  $3\frac{1}{2}$  inches these twins could hardly have been more alike in colouring or in their unusual cast of features. They had the same deformity of the finger-nails. Blood groups and finger-prints both favoured monozygosity. Although the difference in weight between the C f 4 twins was 31 lb. the lighter twin was already nearly 12 stone at the age of 30. In the C f 27 twins, Ida was always heavier than Daisy, who weighed only  $2\frac{1}{2}$  lb. at birth, but they were very much alike in appearance and blood groups ( $pDZ = 0.052$ ) supported clinical opinion. Ida was taller by  $2\frac{1}{4}$  inches. Finger-prints were not helpful in this case.

These, then, are the pairs where one might most expect to find a misclassification. In the writer's opinion the great majority of them can be regarded with reasonable confidence as monozygotic. In the light of the information given, the reader may, if he wishes, bear in mind those pairs where he has serious doubts and make due allowance for this in interpreting the main findings. If the number of pairs showing a large difference in one or other particular seems excessive, the point can be made that the greater the number of criteria used and the more detailed the investigation, the greater will be the chance that a pair of twins will show a relatively large difference in at least one respect.

The pairs classified as dizygotic could all be shown to differ in such a way that monozygosity could be excluded. The two DZ pairs who were alike in all blood groups should perhaps be specially mentioned. D c 1 (total probability of DZ according to blood groups, 0.051) had differently coloured eyes, one had straight, the other curly hair, and their finger-prints were very different— $L = + 4.584$ ,

PLATE 2



CASE S m P 9. Somatotype photograph of Alfred (left) and Harry, age 39, illustrating a large difference in weight occurring in a pair of monozygotic twins.

six pattern type differences, total ridge count difference of 131 (or thirty-five if only the larger of the two counts is taken in the case of whorls). D s 7 were even less alike: probability of DZ on blood groups 0.079;  $2\frac{1}{2}$  inches difference in height and 12 lb. in weight; one light brown, the other grey eyes; finger-prints— $L = 9.841$ , seven type pattern differences, ridge count difference of 182 (seventy single counts).

### SUMMARY

In this chapter the rationale of the similarity method of distinguishing monozygotic and dizygotic twins has been discussed. The tests used in this study include full blood-grouping, the ability to taste phenylthiocarbamide, colour-blindness, finger-prints and anthroposcopy. The findings are reported, and those cases in which there might be serious doubts as to the correct zygosity have been discussed individually. It is considered that the classification, while not necessarily free from error, is among the most reliable of the judgements made in the study.

There was to be a tendency for the left-handed member of a pair differing in handedness to be smaller than his twin partner.

## ENVIRONMENTS OF THE TWINS BROUGHT UP APART

This Chapter describes how the twins brought up apart came to be separated and in what ways the homes in which they spent their childhood tended to differ. We shall refer to the total group of forty-four monozygotic pairs. The table on p. 160, preceding the Case Histories, shows for each of these pairs the age at and duration of separation, and who took the twins, besides giving intra-pair differences on the principal tests. The experiences of the dizygotic separated pairs were not essentially different.

### *Age at Separation*

Thirty pairs were separated during the first year of life. This is a slightly higher proportion of early separations than in Newman's series where seven out of nineteen pairs were separated at under one year. Twenty-one of these thirty pairs are reported to have been separated at birth, i.e., probably by the first month or two at the latest; indeed one twin [S m 7] was taken by an aunt before the mother had given birth to the second twin. Three, four and two pairs are reported as having been separated at 3, 6 and 9 months, respectively.

Six pairs were separated at ages between 12 and 24 months, four of them before 18 months. Two were separated at about 2 years and two at about 4 years. One pair was separated at each of the following ages—5, 7, 8 and 9 years. Only one of Newman's cases was separated after the age of 5. We did not reject these late separated pairs, since it is interesting to discover whether they are any more alike than those separated in infancy.

### *Pairs Reunited*

For similar reasons we did not reject eight pairs that were reunited at some time during childhood. Two of them were separated at birth and reunited at 5. If the experiences of the earliest years are of the most importance for personality development, as some claim, these pairs should differ as much as any of the others. The twin who was taken by an aunt before his twin brother was born was returned to the parental home at 9. Five other pairs were reunited at 11 or 12, having lived apart for at least 11 years of childhood. Two of these reunited pairs were separated again at 16 or 17.

### *Reasons for Separation*

These can be summarized as follows:

Mother unable to manage both twins	20
Death of mother in childbirth	10

Illegitimate	7
Father dead, unemployed or sold one twin to settle his debts	5
Twins taken into care by Poor Law Authorities on account of home conditions	2

The commonest reason was thus the real or imagined inadequacy of the mother. The mother's poor health or the frailty of one of the twins, the mother's youthful age, the already large size of the family, or the disinclination of a prospective stepfather to have both twins were among the reasons why the mother was persuaded to part with one of the twins. A contributory factor in some cases was economic hardship. It was usually a grandmother, often maternal in two senses, or a childless aunt, who stepped in and relieved the mother of the responsibility for one of the infants; and what was sometimes originally intended to be only a temporary arrangement became a permanent one. The other categories in the above list are self-explanatory.

*Who looked after the Twins?*

This was as follows:

TWINS BROUGHT UP IN UNRELATED FAMILIES (14).

Different Children's Homes, 2; adopted—adopted, 5; father—adopted, 1; mother—adopted, 3; maternal grandmother—adopted, 1; paternal aunt—adopted, 1; paternal uncle—distant maternal cousin, 1.

TWINS BROUGHT UP IN DIFFERENT BRANCHES OF SAME FAMILY (30).

Mother—maternal grandmother, 8; mother—paternal grandmother, 3; mother—uncle or aunt, 12; father—paternal uncle, 1; aunt—aunt, 6.

It can be seen that in most pairs the mother or some other member of the family kept one twin; but in five illegitimate pairs the twins were adopted into families unrelated either to them or to each other. In all, fourteen pairs were looked after by parents belonging to different families, as the list shows. The remainder were brought up within the same large family network, though 'parents' were not necessarily blood relations, e.g., where one twin was taken by father and step-mother, the other by a maternal aunt. Aunts or uncles stepping in were as often paternal as maternal. In the list 'mother' does not imply that the father was not also present, but whenever 'father' is listed the mother was not in the home—there was generally a stepmother. Only in a few pairs was a legal adoption order made. Some twins heard of their family background only when a birth certificate had to be produced on starting work and this showed a different surname from that by which the twin was known.

In some cases the experiences of the twins were more complicated than indicated above. Thus a twin might have one or two temporary homes before settling down with the foster-parent shown; or, as happened in one pair over part of their childhood [S f 25], the parents took first one twin for 6 months, then the other,

the twin not with them going to stay with grandparents in the country, where the twins would meet only in the summer holidays. Soon, however, the grandparents kept one of the twins over a period of years. In all pairs the twins grew up to have different parent figures. Thus a pair separated only until the age of 5 continued to feel differently towards their mother and their aunt, each feeling closer to the one who had reared her at the start [S f 15].

### *Contacts between the Twins*

It will be clear that this also varied from case to case. The pairs with least contact were these:

S f 9, aged 36: since separation at 16 months never met until the day they were investigated; had only just heard they had a twin.

S f 19, aged 42: never met since separation at 4, lived in different countries, first learnt of each other's whereabouts at the age of 35.

S f 8, aged 35: separated at birth, have never met since age of 3 on account of disagreement in the family.

Other pairs first met at 24, 19, 17 (two pairs) and 16 years of age. Four others first met between the ages of 7 and 11. Knowledge of having a twin was generally related to age at first meeting.

At the other extreme, the twins with the greatest opportunity for contact in childhood were fourteen pairs who most of the time attended the same school.

### *Cultural and Social Differences*

Geographical separation varied all the way from twins brought up in different countries down to twins living next door to each other, brought up by different aunts.

The twins who were brought up, the one in South America, the other mostly in Scandinavia [S f 19], offer one of the largest contrasts in cultural background. The 'father' of the first was a successful doctor of medicine, of the second an unstable ship's carpenter. The first married a Frenchman in South America, the second married an Englishman and came to England.

Another pair showing a wide cultural contrast between the respective families is S m 4. They are one-quarter Chinese. One twin lived in a Chinese district of London with his English grandmother and her second husband, a Chinaman who was a cook. His twin brother lived in an outer, middle-class suburb where his adoptive father was a builder with his own business.

Large differences in social class do not occur often, however, in the present material. While the social and cultural level of two branches of a family tend to be similar, the same is also generally true of adoptive parents who obtain children from the same Children's Home. Nevertheless, some important differences in parental occupation were observed, among them the following: foreman tailor—quarryman; shopkeeper—miner; master-baker—agricultural labourer; clerk—



carter; carpenter (own business)—jobbing gardener; schoolmaster—builder. Even if the twins had been adopted into different homes at random, less than 1 per cent. of Social Class I–Social Class V differences would be expected, given the frequency of these social classes within the country. A distinct difference between the homes in religious persuasion (Roman Catholic–Church of England) occurred in only two pairs. In eleven pairs there was an urban-rural difference between the homes.

### *Family Structure*

One of the commonest differences was size of family and this was sometimes considerable. In ten pairs there was a difference of between four and nine in size of sibship. In twenty-seven pairs one twin was brought up as an only child, the other having at least one sib or foster-sib in the home. In twenty pairs there was a difference of ten years or over in age of the 'mother', in sixteen of these the difference being one of nineteen years or more. In at least eight pairs there was no 'father' in the home of one of the twins.

### *Family Relationships*

More often than not quite a marked contrast could be inferred between the homes of a pair of twins in respect of patterns of child-rearing or the emotional atmosphere of the home. Even when cultural background was similar, the personality of the respective parents often differed considerably. Thus a grandmother's ideas were generally described as more old-fashioned than those of a mother. One twin was sometimes more 'spoiled' than the other. Some homes differed in that one set of parents had frequent rows, while the parents of the other twin got on amicably. Sometimes one home, but not the other, contained a parent with a considerable degree of personality abnormality. In some pairs the roles of the parents differed, the father of one twin being the disciplinarian, the mother of the other. The two families sometimes differed in their attitude to one another. Thus the homes in which the two members of a pair of twins were brought up frequently differed considerably in the kind of interpersonal relationships existing between the various members of the family.

### *Outcome of Separation*

In view of the nature of the twins' experiences and the widely held belief that twins should not be parted, it may well be asked how the separations worked out in practice. In most of those cases where the twins knew of each other's existence from an early age, they appear to have accepted the situation and the reasons given for it. Many of the subjects claimed they had not thought it odd that their twin should be brought up by an aunt or grandmother, perhaps under a different surname. As mentioned above, the twins usually preferred their respective 'parents'. Foster-aunts were generally addressed as 'Mum'. Sometimes, however, a twin brought up as an only child said he missed the companionship of brothers

and sisters. Though meetings with the twin and occasional holidays in the twin's home were usually enjoyed, permanent reunion with the twin in childhood was not longed for. More than one twin had only to be threatened by his aunt with return to his own mother and he would do what he was told. Reunion during childhood, when it did occur, generally brought difficulties of adjustment with it, as did separations occurring at a relatively late age.

Although in most cases separation cannot be said to have been positively harmful, there are a significant number of pairs where it led to considerable difficulty on account of family disagreements.

In CASES S m 7, S f 8, S f 13, S f 23 and S f 28 there were attempts by the mother to secure the return of the second twin from an aunt or grandmother who did not want to part with the child she had brought up from an early age. (In one case, S m 7, the attempt was successful, in another, S f 13, only partially successful, in that the twin soon left the parental home again; in the remaining three cases it met with failure.) In three of these pairs relations between the twins are very bad. In S f 8 one twin longed to meet her sister and was thwarted in her attempts to do so. The other twin had no wish to meet her sister, having been led to believe as a child that she would be kidnapped if she met her twin and her family.

In S f 1, the twins were adopted by separate families in the same town. They met by accident and they formed an extremely close association which was resented by one set of parents but not by the other. In CASES S m 3, S m 9, S m 11 and S f 14, and probably in other pairs too, there were a good deal of mutual invidious comparisons made by the two families. In some pairs one of the foster-parents was unable to face the fact that she was not the child's real mother. This was the case, for example, in S m 9, where the aunt never admitted to Harry that he was not her child, even at the age of 39, though she knew he knew the truth. Complex foster-mother-child relations were also in evidence in S f 5 and S f 8. In S f 19 one of the twins has to play a complicated game of make-believe with her adoptive mother, who will not accept the situation that the twins now know of one another's existence and correspond frequently in intimate and affectionate terms.

It is probably not a chance coincidence that of the thirteen instances of difficulties mentioned in the above two paragraphs, only one relates to a pair where one twin was looked after by the mother and the other twin by a maternal relative.

### *Adult Experiences*

The fact that some of the twins brought up apart had close contact as adults does not detract from the value of the material as a method for investigating the effects of childhood environment. Their adult environments were certainly not more alike than those of the twins not separated in childhood.

It has already been mentioned in CHAPTER 3 that about half the twins were living in different parts of the country at the time of the investigation. In sixteen pairs the twins have had little or no contact during adult life. Besides pairs that had never

PLATE 3



CASE S f 1. Jessie (upper) and Winifred, age 8, the youngest of the twins brought up apart. They were adopted into different families living in the same town. In order that they should not be taken for twins, Jessie's adoptive mother had Jessie's hair permed.

met since separation, CASE S f 28, now aged 59, can be mentioned where one twin emigrated to Canada at 17. The twins of CASE S m 9 had not met for 22 years: thanks to the investigation, one of them visited his brother with happy results. More typical of this subgroup is S m 13, aged 51, who had not met for 9 years and since leaving school had seen little of one another; they did not get on well, partly because of family differences dating from childhood, but also because they were both somewhat explosive and unsociable characters.

Various combinations of geographical distances or proximity with close, remote or hostile feelings for one another can be found in the material, the majority of twins, however, getting on well together. There are five pairs where contact as adults has been very close for some considerable period and these should be mentioned briefly. In S f 21 the twins have long been as inseparable as any brought up together. In S m 5 they are in business together as window cleaners. In S m 15 they live near one another in the same village. In two pairs where the twins first met only at the age of 24 [S f 22] or 16 [S f 17] they later kept house together for a while and remained closely attached to each other. From what is known of S f 9 and S f 19, who have not or have only just met, one can perhaps predict that a similar very close relationship will develop in these pairs also, given the opportunity. S f 5 is another pair who first met after childhood and formed a close tie, though they have never lived near one another for long.

When twins first meet after long separation it is sometimes reported that among the first things they like to do is to dress-up in each other's clothes. This was so in S m 3 at the age of 7 and S f 17 at 16; and S f 19, when they first corresponded at 35, exchanged articles of clothing and locks of hair. The pair that was reunited through the investigation at the age of 36 [S f 9] bought themselves identical dresses when they next met, as if they wanted to make up now for the pleasures of twinship which had been denied them. The twin partner is sometimes looked upon as a mirror image of the self. Thus Alfred [S m P 9], when he saw his twin approaching whom he had not seen for over 20 years, said 'it looked like myself walking towards me' (this in spite of over 4 stone difference in weight!).

Where there is a close adult relationship between twins separated in childhood this may be based on a pre-existing similarity in personality. Mutual influence in adult life has probably been a relatively minor factor making for any resemblance found. The youngest pair, S f 1, who became attracted to one another without realizing they were twins, gave rise to the reflection that there might be a biological basis for the frequently observed close attachment of monozygotic twins. Cattle twins, when reunited after segregation, can pick out one another from others in the herd, as shown by their fondness for grazing together (Edwards, 1953; Lush, 1954).

However, as we have already noted, this close attachment is not always present. Innate narcissism does not necessarily overcome the effects of different kinds of family conditioning towards the other twin (S f 8 was an extreme case) or traits of an aggressive or unsociable kind (as in S m 13). The pair S f 10 illustrates how a difference in personality can affect the twin relationship. These twins first met

at the age of 19, but their attraction for one another was not mutual. One had high standards, was very critical of herself and others and seems to have seen, in her twin, traits that she disliked in herself. Her twin partner, however, was a less complicated person and would have liked to see more of her newly-found sister. Identical twins brought up together can also of course be very antagonistic towards one another. Repeated fighting was the main reason why the pair S m 8 were put into separate Cottage Homes when they were 2 and had to be kept apart. Even as late as the age of 20 they came to blows if they met.

The present group of twins brought up apart, most of whom are now married adults, have been exposed to a variety of experiences, occurring since their upbringing and more or less unrelated to it, which may have influenced their present personality. Among these are accidents of health, occupation and marital life. Some features of the twins' adult lives may of course be related to differences in their home backgrounds. Thus the twin from the economically better-off home tended to marry a husband who was better off than her twin's husband. Sometimes choice of marital partner seemed to be related to traits in which the twins differed. One of the mutually aggressive pair mentioned above [S m 8] had a stammer and married a woman who took pity on him and probably protected him from some of his failings, while his twin partner is less reliable and has led a more irregular domestic life.

### *Conclusion*

The picture obtained of the degree and kind of childhood separation experienced by this group of twins is one of considerable variety. Some were parted at birth, others not until considerably later. Some lived in different towns and knew nothing of their being one of twins until they were grown up. Others went to school together, being brought up by relatives in the same town. Varying degrees of contact in adult life were found. There were many contrasts in family structure and in emotional relationships between the two homes in which a pair of twins were brought up. The material therefore offers opportunity for many internal comparisons of pairs within the separated group [CHAPTER 13]. The less extreme separations offer theoretical advantages. In them, but not in the most widely separated pairs, other factors besides heredity, such as social class and education, are controlled, thus enabling variables such as size of sibship and personality of the mother to be more easily studied.

Whatever variety there may be within the separated group, the essential difference between it and the control group remains. In particular, the separated twins experienced over many years of their growth the care of different parents in homes which must have differed in innumerable small respects besides the more obvious ones mentioned; and opportunities of one twin influencing the other were less than they would have been had the twins been brought up together.

## COMPARISON OF THE SEPARATED, CONTROL AND DIZYGOTIC GROUPS

In this and the following four chapters we report the quantitative comparisons of the Separated, Control, and Dizygotic groups in respect of height and weight, intelligence test scores, personality test scores and the writer's ratings of personality resemblance. The individual scores of the subjects will be found in PART II.

By comparing within-pair differences it is possible to test hypotheses concerning the relative importance of early environment and the genetical constitution for the traits in question. On the environmental hypothesis the C pairs should be more alike than the S pairs and there should be little difference between MZ and DZ pairs. On the genetic hypothesis MZ twins should be more alike than DZ and there should be little difference between S and C groups.

In these chapters, after describing the measurements used, intra-pair resemblance in the various classes of twins is given in terms of (1) mean intra-pair difference, (2) the distribution of intra-pair differences and (3) the intra-pair correlation coefficient. As recommended by Fisher and other authorities the intra-class correlation coefficient is used. The formula is as follows:

$$r = \frac{\Sigma(x - \bar{x})(x' - \bar{x})}{ns^2},$$

where  $x$  and  $x'$  are the scores of a pair of twins,  $n$  is the number of pairs tested and  $\bar{x}$  is the mean score of all the individuals tested, or  $\Sigma(x + x')/2n$ , and  $s^2$  is the variance of  $\bar{x}$ .

### *ESTIMATES OF EXTENT OF HEREDITARY AND ENVIRONMENTAL DETERMINATION*

No attempt is made in the following chapters to calculate a numerical value for the extent of hereditary or environmental determination of the traits measured, as such measures have little meaning.

Holzinger (1929) devised the statistic  $h^2$  (or  $H$  as Neel and Schull call it) as a measure of the proportion of the variance of a trait in a given population that is due to heredity as opposed to environment. The formula is:

$$h^2 = \frac{r_{MZ} - r_{DZ}}{1 - r_{DZ}},$$

where  $r$  is the intra-class correlation coefficient for MZ or like-sexed DZ twins. Such a comparison minimizes the variation due to birth rank, age of mother and sex. But it does not take into account interfamily environmental variation; it assumes that the environments of MZ and DZ twins can be regarded as equivalent;

and it does not take into account any interaction between heredity and environment. The significance level of a given value of  $h^2$  is difficult to assess. In spite of these limitations it has the merit of simplicity, compared, say, with Cattell's (1953) multi-variate design, and it has been fairly widely used in the absence of anything better. It is, of course, applied extensively in Newman, Freeman and Holzinger's work.

As a measure of the differential effect of the environment of MZ twins brought up apart, Newman, Freeman and Holzinger suggest using the variance of the intra-pair differences of twins brought up apart and together. In their work values for various traits are given of

$$\frac{\sigma^2\text{S differences} - \sigma^2\text{C differences}}{\sigma^2\text{S differences}}$$

where S and C stand for the separated and control twins. They do not lay much emphasis on this statistic, however. It can probably be criticized on the ground that the intra-pair differences are not normally distributed (they tend to be J-shaped) and the SD therefore has little meaning. In the present investigation the SD of the differences has not been calculated for this reason.

As Neel and Schull (1954) point out, the logical extension to separated and control MZ twins would on Holzinger's thesis be the statistic

$$E = \frac{r_C - r_S}{1 - r_S}$$

where  $r$  is the intra-class correlation coefficient of MZ twins brought up apart (S) and together (C).  $E$  would measure the proportion of the variance ascribable to the effects of differing environments on the same genotype. It would have advantages and drawbacks analogous to those of  $H$ . Like  $H$  one would normally expect it to be bounded by zero and  $+1$ ; but negative correlations and higher correlations for S than for C twins (or for DZ than for MZ twins) can result in values of  $E$  and  $H$  that are negative or exceed 1. If S twins are more alike than C, as sometimes happens, then

$$E = -\frac{r_S - r_C}{1 - r_C}$$

For the sake of completeness and in order to compare the present findings with those of Newman, Freeman and Holzinger, values of  $H$  and  $E$  have been calculated for height, weight, intelligence and tested personality. These are presented in TABLE 4.

$H$  has been calculated from the correlations of the control MZ twins even when these are lower than those of the separated twins. If a combined  $r_{MZ}$  were to be calculated,  $H$  would in those cases be a little higher. (In the case of height and weight,  $H$  is based on the female DZ pairs brought up together. Otherwise the total DZ correlations have been used.)

TABLE 4. ESTIMATES OF HEREDITARY (H) AND ENVIRONMENTAL (E) DETERMINATION

	<i>Newman, Freeman and Holzinger</i>	
	<i>H</i>	<i>E</i>
Height	+0.808	-0.544
Weight	+0.775	+0.272
Intelligence	Binet I.Q. +0.678	+0.639
Personality	Woodworth-Matthews Neurotic Questionnaire } +0.304	-0.057

	<i>Shields</i>	
	<i>H</i>	<i>E</i>
Height	Females +0.893	{ Males +0.889 Females +0.667
Weight	Females +0.568	{ Males -0.615 Females +0.683
Intelligence	Combined Dominoes and Vocabulary tests } +0.531	-0.043
Personality	Extraversion +0.504 Neuroticism +0.303	-0.328 -0.357

The negative values and the inconsistency of the results, especially in the case of *E*, stress the very great need for caution in interpreting these estimates, particularly when dealing with small samples or not completely reliable tests. They do not add anything of importance to what can be concluded from the more general discussion of the findings to be reported in CHAPTERS 7 to 9.



## HEIGHT AND WEIGHT

Comparing MZ twins brought up apart with those brought up together, in respect of height Newman failed to reveal any environmental effect. Indeed his separated twins were more alike than his controls as measured by the correlation coefficient. In respect of weight, on the other hand, Newman's separated twins were less alike than his controls. Further, the resemblance between twins was less than in height and the value of  $h^2$  a little lower. The conclusion generally drawn from this work is that weight is less heritable and more environmentally labile than height.

Inspection of intra-pair differences in height suggested in the present investigation that the differential environment might have had some effect. 11.6 per cent. of the S twins compared with 2.3 per cent. of the C twins differed by  $1\frac{1}{2}$  inches or over. 41.9 per cent. of the C twins compared with 20.9 per cent. of the S differed by under  $\frac{1}{2}$  inch. In respect of weight, however, there was less indication of a difference between the groups, although the only two pairs to differ by 3 stone or more were both in the S group. As expected, large differences in both height and weight were more frequent among DZ than MZ pairs [see TABLE 39]. The data can be represented most simply by the mean differences.

TABLE 5

	<i>Mean Difference in Height</i>
41 MZ control pairs	0.51 in.
39 MZ separated pairs	0.81 in.
25 DZ pairs	1.77 in.
	<i>Mean Difference in Weight</i>
41 MZ control pairs	10.4 lb.
37 MZ separated pairs	10.5 lb.
25 DZ pairs	17.3 lb.

Some of the intra-pair correlation coefficients (sexes separately) are shown in TABLE 6, which also compares the present findings with those of Newman, Freeman and Holzinger. Though the difference between S and C groups is clearly not significant, it is in the expected direction except for weight in the small male group. The MZ/DZ contrast, however, is more striking, though it is worth noting that the female MZ twins brought up apart ( $r = 0.37$ ) were less alike in weight than the female DZ twins brought up together ( $r = 0.56$ ,  $n = 25$ ).

The C pairs tended as a group to be a little taller and heavier than the S pairs (this was so for males more than for females), and all C measurements had a slightly greater spread around their means. The small size of the subgroups and the lack of accuracy of much of the data make unnecessary any detailed statistical analysis of the generally small differences in these respects.

TABLE 6

	<i>Newman: Height</i>			<i>Newman: Weight</i>		
	<i>Brought Up Together</i>		<i>Brought Up Apart</i>	<i>Brought Up Together</i>		<i>Brought Up Apart</i>
	<i>MZ</i>	<i>DZ</i>	<i>MZ</i>	<i>MZ</i>	<i>DZ</i>	<i>MZ</i>
Mean difference Correlation	1.7 cm. +0.932	4.4 cm. +0.645	1.8 cm. +0.969	4.1 lb. +0.917	10.0 lb. +0.631	9.9 lb. +0.886
	<i>Shields: Height</i>			<i>Shields: Weight</i>		
Mean difference Correlation: males females	1.3 cm. +0.98 +0.94	4.5 cm. — +0.44	2.1 cm. +0.82 +0.82	10.41 lb. +0.79 +0.81	17.3 lb. — +0.56	10.5 lb. +0.87 +0.37

Some of the presumed causes of large differences in height and weight found among the MZ twins were discussed in the section on zygosity [pp. 43–4]. They were often associated with physical illness. In one of the cases mentioned there, child neglect in the early years was thought to be largely responsible for a difference in height of  $3\frac{1}{4}$  inches. One further case can be mentioned [S f 18] where there was a difference in height of  $1\frac{7}{8}$  inches. The mother died in giving birth to the twins. The smaller girl was brought up as one of a large family by an inexperienced older sister until the father remarried when she was 2. The taller twin was probably better cared for in infancy and she has enjoyed better health. However, no overall association could be shown within the S group between differences in nature of early environment and present height or weight of the twins.

In conclusion, we are unable to demonstrate an unambiguous effect of childhood environment, but the direction of the small differences observed between the S and C groups favours the view that early environmental differences do have an effect on bodily development.

## INTELLIGENCE

### *THE TESTS: SELECTION AND DESCRIPTION*

In choosing tests of intelligence for administration to the twins we were limited by certain practical considerations. They had to be such that they could be easily given at home and this ruled out the use of apparatus. To leave plenty of time for history-taking and zygoty testing they could not take more than 30–45 minutes. On theoretical grounds there are advantages in using tests of more than one kind. The combined results might be expected to give a better picture of a person's intelligence as a whole than any one type of test on its own. Thus verbal and performance scores are combined in the Wechsler-Bellevue. Further, a vocabulary and a non-verbal test might be expected to measure respectively the best intellectual-cum-cultural level that a person has attained and his present capacity for intellectual activity. This is the rationale behind Raven's use of the Progressive Matrices Test with the Mill Hill Vocabulary Scale. It might therefore be expected that a non-verbal intelligence test might be a good measure of innate capacity in twins, while any intellectual differences due to cultural or educational environment might show up more readily on the verbal intelligence test. On the other hand, Blewett (1954), Thurstone, Thurstone and Strandkov (1953) and Vandenberg (1956) have all applied more than one kind of intelligence test to MZ and DZ twins and according to the findings of these workers it can be said that the genetical component in intelligence generally shows up more clearly in a verbal type of test than in any other. This may perhaps be because verbal tests of intelligence are at present the most reliable ones. For our purpose two short tests, one verbal, the other non-verbal, seemed to be what was required.

After discussion with Professor Eysenck it was decided to use the Dominoes Intelligence Test and the Synonyms section (Set A) of the Mill Hill Vocabulary Scale (Form B, 1948). The Dominoes was preferred to the Progressive Matrices, partly because it has been less widely used. Some of our subjects might well have already done the Matrices when in the Services and this might have introduced a practice effect. But the Dominoes was considered to have other advantages besides.

The Dominoes is a timed (20 minutes) non-verbal test of intelligence, also (like the Matrices) developed by psychologists working for the Services Departments during the Second World War. The subject is told it is a test of observation, five items are worked through with him and he is told the time limit. His task is to fill in (in numerals on the answer sheet) the number of pips which should appear on the top and bottom of a given blank domino in order to complete the logical

pattern formed by the other dominoes in the item. There are forty-eight items arranged in ascending order of difficulty and one point is scored for each correct answer. Like the Matrices the scores can be grouped into six grades, the boundaries of each grade being those of the tenth, twenty-fifth, fiftieth, seventy-fifth and ninety-th points of the equivalent Matrices score. A score of 28 corresponds to I.Q. 100. Reliability is 0.92 (Matrices = 0.88). It correlates highly with the matrices (0.74) but has a higher *g* saturation (0.86) and no visuo-spatial element. It is referred to by Vernon (1950).

Raven's Mill Hill Vocabulary Scale (1948) is well known. In the 'Synonyms' section, for each given word in large type the subject has to select one of a group of six other words as having the same meaning. The four subjects under the age of 15 used the Junior Scale, the others the Senior Scale. The 'Definitions' section of the test was not given. Raw scores were used (i.e., number of items marked right after the example given). These can be converted into expected total scores (Synonyms plus Definitions) from Raven's tables, and this in turn can be converted into percentile points for different age groups, and if need be into conventional I.Q. A score of 19 would be about I.Q. 100. However, for our purpose there did not seem to be any advantage in transforming the scores in any of these ways.

### *Administration*

One control subject refused to work at the Dominoes for more than 9 minutes. Two subjects (one S, one C), though not mentally defective, seemed completely unable to get the hang of the Dominoes and scored only 1 point in it. The scores of these three subjects and their twin partners were omitted from the calculations, as were the two psychiatrically ascertained pairs. A few subjects who did not appear to have done themselves justice on the Dominoes were retested or allowed extra time. However, it was their score after 20 minutes on the first attempt which was used in order to ensure objectivity. It will be recalled that some were tested on quite separate occasions. Some did the test (supervised) in the same room. But in most cases they were tested separately on the same occasion. While one was being interviewed the other did the Dominoes in another room. The Mill Hill was generally done by the twins together, but supervised to avoid their comparing notes during the testing. All but six individuals tested were tested by the writer.

The Dominoes test was given to both members of seventy-six MZ and eight DZ pairs. After excluding the two psychiatric cases and the three clearly unreliable cases, we are left with thirty-seven S and thirty-four C MZ pairs and eight DZ pairs for analysis. For the Mill Hill we have thirty-eight S, thirty-six C and seven DZ.

### *RESULTS: GENERAL*

Before reporting the intra-pair resemblances in these tests it should be mentioned that the test scores were distributed fairly normally. Although some of the middle-aged women did not appear to do themselves justice on the Dominoes, there was no excess of low scorers. There was no evidence of association between score and age

on the Mill Hill, and the expected decline with age on the Dominoes was not impressive. Mean scores and standard deviations were as follows:

TABLE 7. INTELLIGENCE TESTS: MEAN SCORES

	<i>Dominoes</i>		<i>Mill Hill</i>	
	<i>Mean Score</i>	<i>Standard Deviation</i>	<i>Mean Score</i>	<i>Standard Deviation</i>
Separated	24.4	9.0	16.1	5.7
Control	28.0	8.4	19.0	4.0

It will be seen that the S pairs are less intelligent than the C. This is consistent with the slightly higher social level of the latter and was shown by both males and females. The S pairs also showed a slightly greater variation in score. Intra-pair differences however were not associated in any general way with mean score, nor were differences clearly related to sex, age or social class.

As expected there was a positive association between score on Dominoes and score on Mill Hill. This was about  $r = +0.48$  over the whole material, being higher in females and Controls than in males and Separated twins. (Matrices and full Mill Hill Vocabulary intercorrelation is 0.60 for persons under 30, 0.44 for persons over 50.) Besides treating the tests separately it was useful to have an estimate of general intelligence by combining the tests. Since the spread of the Mill Hill scores is about half that of the Dominoes, the Mill Hill score was doubled before being added to the Dominoes score to obtain a total score.

### INTRA-PAIR DIFFERENCES AND CORRELATIONS

The simplest comparison of the S and C twins in intelligence is obtained by combining the Dominoes and Mill Hill scores as described above and calculating the intra-pair differences. The small dizygotic group has been treated in the same way. [Findings for the tests separately are given in TABLES 37, 38 and 39.] It will readily be seen from the distribution of these differences that small differences of under 5 points are a little more frequent in the C than in the S group and large differences of 15 points or over are more frequent in the S than in the C group.

TABLE 8. COMBINED INTELLIGENCE TEST SCORES

	<i>No. of Pairs</i>	<i>Distribution of Intra-pair Differences</i>			
		<i>0-4 points</i>	<i>5-9 points</i>	<i>10-14 points</i>	<i>15 points or more</i>
Control	34	44 per cent.	21 per cent.	23 per cent.	12 per cent.
Separated	37	32 per cent.	30 per cent.	14 per cent.	24 per cent.
DZ	7	14 per cent.	14 per cent.	14 per cent.	57 per cent.

DZ twins are less alike than either S or C. These S/C differences may perhaps show the differential effect of early environment. The much greater MZ/DZ differences, which are consistent with those of other twin studies, remind us that by controlling heredity we are controlling an important variable. The mean differences in total intelligence test score bring out the same thing, but S and C correlation coefficients are practically the same.

TABLE 9. TOTAL INTELLIGENCE SCORE

	<i>No. of Pairs</i>	<i>Mean Intra-pair Difference (points)</i>	<i>Intra-class Correlation Coefficient</i>
Control	34	7.38	+0.76
Separated	37	9.46	+0.77
DZ	7	13.43	+0.51

The intelligence test results, like the findings in height and weight, suggest that the differences in early environment found in this sample might have had an effect on intelligence, especially on verbal intelligence [see TABLES 38 and 39], but this effect cannot be conclusively demonstrated. The importance of heredity for intelligence is confirmed. Such S/C difference as there might be is less than that found by Newman [see TABLE 1]. This may be because Newman's sample included more pairs than ours that differed widely in schooling and cultural background.

### CAUSES OF DIFFERENCE

To investigate the possible causes of the observed intra-pair differences in tested intelligence, we have listed in TABLE 10 all pairs that differed by fifteen points or more in combined score and also those pairs that differed by at least nine points on the Dominoes or six points on the vocabulary test. For these twenty-four pairs the most likely reasons for their differing have been entered under a number of headings, relating to physical, social or psychological factors. In most pairs more than one factor seemed to be implicated.

Physical causes of intellectual differences appeared to be relevant in nine cases. There was one instance each of epilepsy [S m 3], disseminated sclerosis [S f 23], birth injury [S m 7], concussion [C f 7], and high blood pressure (S f 27, affecting Dominoes only) and four cases of general physical inferiority (fairly marked difference in size or general health). In one case [S f 10] it was unexpectedly the more intelligent twin who had congenital syphilis and partial blindness, though the co-twin did not seem to have been affected. Left-handedness was not consistently related to intelligence.

Social or educational factors in childhood, sometimes combined, were more numerous. Six pairs have been listed where the more intelligent twin had longer or less interrupted schooling. In two cases only one twin had higher education, one starting a medical course [S f 10], another a social science training [S f 19],

TABLE 10. PAIRS DIFFERING MOST IN TESTED INTELLIGENCE

Case No.	Scores			Suggested Causes of Difference					
	Combined Difference (Dominoes and 2 MHV)	Dominoes Difference	MHV Difference	Physical	Childhood		Adult Environment	Personality	Psychometric or Other
					Educational	Social			
S f 3	(39)	(27)	6			+	+		+
S f 10	30	14	8		+		+	+	+
S m 7	25	9	8	+		+			
S f 19	24	12	6		+	+			+
S f 14	23	9	7	+	+	+	+	+	
S m 3	23	7	8	+	+		+	+	
C f 26	23	7	8				+	+	
S f 23	22	10	6	+				+	
C f 3	22	12	5					+	
S m 12	20	6	7		+	+	+		
S f 17	17	11	3		+	+			
S m 11	16	6	5					+	
C m 11	15	7	4	+				+	
C f 9	15	15	0						+
S m P 9	(15)	(15)	0	+		+			+
S f 22	14	2	6				+		+
C f 7	13	11	1	+				+	+
C f 18	10	12	-1						+
S m 1	10	10	0						+
C f 12	8	4	-6				+		
C f 11	6	10	-2					+	
S f 27	5	9	-2	+					+
S m 15	1	9	-4						+
C f 27	(1)	(9)	-5	+			+		+
Total				9	6	7	9	10	12

Scores in brackets relate to pairs where one twin scored only one point on the Dominoes and which were not counted in the statistical analysis. A minus sign before MHV scores indicates that the twin who did better on the Dominoes did worse on the MHV.

while their co-twins left school at 14 or 15. In S f 17, one twin went to Grammar School, the other to Elementary School, though the difference on Dominoes of eleven points seems exaggerated. In S f 14 one twin, already apparently more intelligent, stayed on a little longer at school than her co-twin. In S m 3 and 12, one twin had frequent changes of school.

A more advantageous social background was noted in seven of the more intelligent separated twins, the major advantage being higher social status of 'father' in three cases and a more stable home in four cases.

Better test performance is likely to be due sometimes to the adult keeping his mind alert through his job or domestic contacts. This seems to have occurred in some of those pairs who had had longer at school, but also in other cases. For

example, one twin [C f 26] was more studious than her sister and took up clerical work in a solicitor's office. Several years later she married the chief clerk. She had a total score twenty-three points superior to her twin who was a shop assistant and later married a commissionaire. Adult social factors usually appear to be of a secondary contributory nature. In several instances better social circumstances did not seem to affect intelligence.

In twenty pairs psychological factors of one kind or another appear to have influenced the test results. In ten pairs it seemed possible that superior performance on the test was associated with personality traits in which the twins differed consistently. These were:

- S f 10 }  
C m 11 } Higher score associated with more drive and ambition.
- C f 3 }  
C f 11 } The less intelligent twin, who just guessed most of her Dominoes responses, had a tendency not to persevere at unpleasant tasks.
- C f 26 More intelligent twin more studious and serious.
- C f 7 More intelligent twin more obsessional.
- S m 11 Less intelligent twin more anxious, although he has been more successful in life.
- S f 14 Less intelligent felt inferior to twin; as a child truant from school; lacked confidence doing the tests.
- S m 3 Less intelligent twin is pathologically slow owing to epilepsy. Allowed extra time to compensate for his slowness, he achieved a Dominoes score equal to that of his co-twin, slightly above average.
- S f 23 Less intelligent twin has disseminated sclerosis and personality disorder and was only with difficulty persuaded to do the tests.

In the remaining pairs, it was thought that for various reasons the tests were not completely reliable:

- S f 22 Both Welsh speaking; the more intelligent on the tests has the better English.
- S f 3 }  
S m P 9 } Unable to understand the Dominoes instructions. { Not tested by the writer.  
C f 27 } { Recent hysterical illness.  
{ Resented being tested.
- S m 15 Both dull; heavy drinkers; puzzled by tests (Dominoes and MHV differences cancel each other out).
- S m 1 These boys of 14 appear to have worked too fast on the Dominoes. It is suspected that they did not grasp the instructions equally well and that the difference in intelligence, if any, is exaggerated. The more intelligent on the Dominoes came from a much poorer social background—psychotic mother, father very deaf. Neither tested by the writer.
- S f 27 In this pair the duller twin on the Dominoes suffered from high blood pressure. She was not tested until the age of 58, 3 years after her sister, during which time there may have been some intellectual deterioration.
- S f 10 }  
S f 19 } One twin was tested by a colleague, the other by the writer.
- C f 9 }  
C f 12 } It remains unclear in these pairs why one twin did so much more poorly on the  
C f 18 } Dominoes than one would have expected from the history and clinical impression.



One of the most frequently observed environmental differences within the separated pairs is where one twin is brought up as an only child, the other as one of a larger family. The negative correlation between intelligence and family size which has been found in the population by many investigators has sometimes been attributed to environmental factors such as the greater intellectual stimulation by adults of only children and children from small families. In our material, however, there was no clear tendency for the twin brought up as an only child to do better on the tests than his twin partner.

### *SUMMARY*

The reasons for giving the Dominoes and Mill Hill Synonyms tests are discussed. In order to obtain a best estimate of intelligence the scores in the two tests have been combined. The twins brought up apart proved as a group to be less intelligent than those brought up together.

As measured by the intra-class correlation coefficient, the monozygotic separated pairs were no less alike than the controls. The intra-pair differences, however, were consistent with a small early environmental effect. Findings in the dizygotic pairs confirmed the importance of genetical factors for intelligence.

An analysis of the presumptive causes of difference in those monozygotic pairs which differed most, suggests that physical, social and psychological factors can be responsible, often in combination, for variation in intelligence. Some subjects seemed not to do themselves justice in the Dominoes test.

## PERSONALITY TESTS

### *THE SELF-RATING QUESTIONNAIRE*

Personality is more difficult to measure by means of tests than is intelligence. Nevertheless we considered it essential to include some sort of personality test in the present study. It is true that the personality tests used by Newman on his twins were less informative than his battery of intelligence and achievement tests and his account of the life history of his twins. However, the science of psychometrics has developed considerably since Newman's twins were tested in the early 1930's, our series is larger, and we have better matched Separated and Control groups. The advantages of using tests are (1) that they give results which can be treated quantitatively, and (2) the scores are objective in that they are not affected by the judgement of the writer.

Tests of the questionnaire type probably remain the most valid single objective measures of personality we have yet. They have the added advantage of being easily administered. It is true that a person's answers to the items in a self-rating questionnaire may not be true on their face value. They are clearly liable to error of many kinds—misunderstanding the question, exaggeration, wishing to show oneself in a favourable light, among others. But statistical analysis of many test items has shown which questions are the most reliable, which answers are correlated with one another, and how groups of persons, such as neurotic patients and normal controls, differ in their mean scores. They are therefore of value pragmatically. It is admitted that many disadvantages remain. Applied to the individual case, a score on a single test is subject to a good deal of unreliability. Consequently the secondary measure in which we are particularly interested, namely the difference in score between two twins, will be liable to considerable error of a statistical kind. Further it is not known how far personality tests succeed in measuring personality viewed as a constitutional predisposition (whether innate or acquired) towards certain kinds of behaviour, or how far the score of an individual is liable to vary according to the mood of the moment. According to Bartholomew and Marley (1959) the temporal reliability of the Maudsley Personality Inventory (a test similar to the questionnaire used in the present study) is quite high, being in the neighbourhood of 0.7 for both extraversion and neuroticism after at least eighteen months.

The Self-Rating Questionnaire (SRQ) which we used was specially devised for us by Professor H. J. Eysenck from the results of Guilford's factor analysis of many hundreds of questionnaire items so as to yield the greatest amount of information compatible with its shortness. The items associated most reliably with the personality factors discovered by Guilford have been selected and combined in the

approximate proportions in which these factors themselves contribute to the higher order dimensions of personality, extraversion-intraversion and neuroticism. The test consists of thirty-eight items. Twenty-two items contribute to a score for extraversion and twenty-two items towards a score for neuroticism, six of the items being common to both dimensions.

The test is constituted as follows:

<i>Number of Items</i>	<i>Name of Factor</i>	<i>Example of Question and Answer</i>
<i>Extraversion</i>		
6	Ascendancy	Do you let others 'run over you' more than you should for your own good?—No.
4	General Drive	Can you turn out a large amount of work in a short time?—Yes.
6	Rhathymia	Are you more interested in athletics than in intellectual things?—Yes. Are you inclined to stop and think things over before acting?—No.
6	Sociability	Are you inclined to keep in the background on social occasions?—No. Do you enjoy getting acquainted with most people?—Yes.
<i>Neuroticism</i>		
4	Depression	Do you often have the blues?—Yes.
4	Emotionality	Do you day-dream frequently?—Yes.
4	Introspection	Are you inclined to analyse the motives of others?—Yes.
4	Nervousness	Can you relax yourself easily when sitting or lying down?—No.
6	Social Shyness	Same questions as for Sociability, but with 'No' answers counting towards a neuroticism score where 'Yes' counted towards extraversion, and vice versa.

The questions are arranged in a random order. The subject is told that there are no right or wrong answers, that he should not ponder too long over each question and that he should not ask help from others. Whenever possible 'Yes' or 'No' answers should be given, but there is also provision for answering '?' if necessary. Each response contributing to extraversion or neuroticism was scored as one point. '?' responses and any items inadvertently omitted were scored as half a point each.

#### *Administration*

As already stated, the SRQ was included in the booklet which the twins were asked to complete before interview and return by post. It is thought that in most instances the subjects carried out the instructions conscientiously and filled in their questionnaires independently of one another. Often one twin completed his booklet before the other twin was sent his copy and only rarely did the booklets come in by the same post. But the possibility of the twins comparing notes could not always be excluded. In three cases [S f 21, S f 22, C f 29] it was suspected from the closeness of the replies to individual test items that there had been collusion between the twins. These three pairs turned out on interview to be extraordinarily

alike and it is not thought that any attempts of the twins to copy their answers in fact made the test results any less reliable—perhaps the reverse; for their copying was not always quite accurate, so that in one pair the twins differed by one point in neuroticism and in another pair by  $1\frac{1}{2}$  points in extraversion when no doubt they had intended to put down the same answers. One of these pairs said they had filled in their booklets together and put down the same, since they knew they were exactly alike in everything. The other two pairs not altogether convincingly denied working together, although one admitted they had compared notes afterwards. These two pairs were retested. After an interval of 2 years S f 21 (previously differing by one point) had the same difference on retest, though their number of identical responses had dropped from thirty-seven to thirty-two out of a possible thirty-eight. The other pair (S f 22) who had previously given identical answers had a difference on retest after a few months of  $3\frac{1}{2}$  points in extraversion and one-half in neuroticism, with twenty-nine same responses.

Another twin, Susan, of case C f 11, asked her twin's help in completing her SRQ. Her twin had recently returned her booklet but thought she remembered most of her replies. Susan deliberately put down the opposite for many of her answers. This is in keeping with some facetious comments she made in her booklet and with her view of herself (probably true) that she is 'aggressive to cover inferiority'. She does not normally see eye-to-eye with her twin. This pair differed by  $6\frac{1}{2}$  points in extraversion and 14 points in neuroticism, the largest total difference occurring among the MZ pairs. While Susan is apparently less extraverted and more neurotic than her sister, the test difference is clearly exaggerated.

In the case of the two pairs of small girls aged 8 and 9 [S f 1, C f 1] the parents rated the twins on the test. The others are all self-ratings.

In two young pairs [S f 1 and S m 2], the adoptive parents of both twins were given the SRQ as well as the twins themselves. There was no tendency for the twins to resemble their 'parents' more closely than they resembled each other.

Many other comments could be made on the SRQs. There are some obvious unreliabilities. Some apparently striking similarities in subgroup scores (general drive, emotionality, etc.) were observed, but statistical analysis of this point seems hardly worth while. There were some cases where the SRQ and clinical findings agreed closely and others where they obviously did not. Some of these will be noted in the case histories and an overall comparison between the author's personality ratings and SRQ differences is given in CHAPTER 10. But since one of the principal reasons for using the SRQ was to have an objective measure independent of the writer's clinical estimate of similarity or difference, it seemed advisable to use the SRQ scores as originally received, uncorrected in the light of later knowledge. Besides, some writers believe that the response to a simple well-designed postal questionnaire is more predictive of future behaviour than clinical assessment based on a series of personal interviews (Kelly and Fiske, 1951).

Only one SRQ could not be scored. Instead of encircling his replies, one twin [C m 12]—the one who would not complete his Dominoes—crossed out various

'Yeses' and 'Nos'. It was not possible to discover from other evidence whether he had meant to cross out what did not apply or to mark his intended answers. He had himself forgotten and felt little inclination to complete another booklet. He was probably inconsistent in the way in which he marked his booklet, much as his twin was seen to be inconsistent when filling in the handedness questionnaire. (His twin was observed to encircle 'R' when he said 'Left'. He had underlined his SRQ answers.) Such cases were the exception.

The separated schizophrenic twins [S m P 4] were not given an SRQ. The scores of the hospitalized hysterical twin and his partner [S m P 9] are not counted because of the difference in the mode of ascertainment. (They actually differed by two in extraversion and one in neuroticism.) There remain SRQs from forty-two S and forty-three C pairs and twenty-five from various DZ pairs, eight brought up apart and seventeen brought up together.

## RESULTS

Mean scores for neuroticism lay between 8.2 (C males) and 11.9 (S females) and for extraversion between 11.2 (S males) and 13.8 (C females). The C group was consistently more extraverted and less neurotic than the S group, and the males less extraverted and less neurotic than the females. The scores appeared to be fairly normally distributed.

The under-20's were more extraverted, less neurotic and more alike than the adults. There was a very slight tendency for extraversion score to decrease with age, but for extraversion differences to increase. However, S/C differences were not affected by age.

There was a negative correlation between extraversion and neuroticism, i.e., an association between neuroticism and intraversion, in all groups, ranging from  $r = -0.06$  in C males to  $-0.63$  in S males. This may partly be due to the way in which the test was constructed.

## INTRA-PAIR DIFFERENCES

### *Extraversion*

The extraversion scores do not reveal any influence of the early interfamily environment. The distribution of intra-pair differences, the mean intra-pair differences and the correlation coefficients all agree in showing the twins brought up apart to be, if anything, a trifle more alike than those brought up together. This was the case in both males and females. The correlation coefficients of  $+0.61$  (S group) and  $+0.42$  (C group) are both significantly different from zero at the 0.01 level. We can therefore say that MZ twins, whether brought up apart or together, show a significant resemblance in extraversion as measured by this test. Sixty-two out of eight-five MZ twins differed by under four points on the extraversion scale, while only twelve out of twenty-five DZ pairs differed by this relatively small amount. A  $\chi^2$  test shows this difference to be significant at the 0.05

TABLE 11. EXTRAVERSION

*Distribution (in percentages) of Intra-pair Differences*

	No. of Pairs	Twins Differ by			
		0-1.5 points	2.0-3.5 points	4.0-5.5 points	6 points or over
Control	43	49 per cent.	19 per cent.	18 per cent.	14 per cent.
Separated	42	45 per cent.	33 per cent.	12 per cent.	10 per cent.
Dizygotic	25	28 per cent.	20 per cent.	24 per cent.	28 per cent.

TABLE 12. EXTRAVERSION

	No. of Pairs	Mean Intra-pair Difference (points)	Intra-class Correlation Coefficient
Control	43	2.71	+0.42
Separated	42	2.52	+0.61
Dizygotic	25	4.72	-0.17

level ( $\chi^2$  [Yates], 1 D of F, = 4.384). Heredity is therefore revealed as an important determination of extraversion.

*Neuroticism*

The neuroticism scores do not behave in quite the same way and differences tend to be a little larger than those in extraversion. The distribution of the differences and the mean intra-pair differences in the S and C groups are perhaps consistent with there being a small early environmental effect; but as the case in the intelligence tests this is not supported by the correlation coefficients.

TABLE 13. NEUROTICISM

*Distribution (in percentages) of Intra-pair Differences*

	No. of Pairs	Twins Differ by			
		0-1.5 points	2.0-3.5 points	4.0-5.5 points	6 points or more
Control	43	35 per cent.	40 per cent.	14 per cent.	11 per cent.
Separated	42	33 per cent.	36 per cent.	12 per cent.	19 per cent.
Dizygotic	25	36 per cent.	20 per cent.	16 per cent.	28 per cent.

The latter, though still significantly different from zero in both S and C groups are a little lower than those for extraversion. There is also less contrast between the MZ and DZ mean differences. Sixty-one out of eight-five MZ pairs differed by

less than four points on the neuroticism scale, compared with fourteen out of twenty-five DZ pairs.  $\chi^2$  did not reach statistical significance ( $p < 0.10$ ). These findings suggest that the environment may have more effect on neuroticism as measured by this short test than it has on extraversion.

TABLE 14. NEUROTICISM

	<i>No. of Pairs</i>	<i>Mean Intra-pair Difference (points)</i>	<i>Intra-class Correlation Coefficient</i>
Control	43	2.97	+0.38
Separated	42	3.10	+0.53
Dizygotic	25	4.04	+0.11

Our results are not very different from those of Newman who used the Woodworth-Matthews Neurotic Questionnaire, except that his DZ twins (brought up together) were more alike than our DZ pairs. As already noted, Newman's nineteen twins brought up apart were, like ours, a little more alike than his fifty MZ control pairs.

#### SUMMARY

The Self-Rating Questionnaire has been described and the scores analysed. The most important finding is the significant resemblances between MZ twins in both extraversion and neuroticism. The failure of the test to discriminate between S and C twins will be discussed later in the light of observations on the possible causes of personality differences in the two groups of twins. The test results support the view that heredity is an important determinant not only of body build and intelligence, but also of personality as measured by tests.

## AUTHOR'S RATINGS OF PERSONALITY RESEMBLANCE

From the results of the objective tests of intelligence and personality described in CHAPTERS 8 and 9, we come to a comparison of the resemblances between S, C and DZ twins in total personality, assessed on more clinical and subjective lines but on the basis of all available objective evidence from the life histories of the twins and their behaviour on interview.

The possibility was considered of asking outside observers to rate the degree of resemblance in personality shown by the twins on the basis of descriptions and histories provided by the writer. None of the psychiatrists or social workers with whom I discussed this felt able to do so. The consensus of opinion was that personality ratings were best made by someone who knew the twins personally. The clinical ratings to be described in this chapter are therefore those made by the writer. These are assessments of the degree of resemblance, taking both similarities and differences into account. They are based principally on the booklets which were described in CHAPTER 3 and on information obtained from the interviews with the twins. Though the manner in which the booklet was completed gave many clues to personality, the intra-pair differences in extraversion and neuroticism score were not considered in order to keep the author's rating of personality independent of SRQ differences. When appropriate, the information from booklets and interviews was supplemented by medical reports or school reports, and when available other relatives, such as parents, husbands, or another sib, were seen.

### *THE RESEMBLANCE GRADES*

Before the control group of twins had been investigated the writer had already, for the purposes of a provisional communication (Shields, 1958), grouped the twins brought up apart into four categories, Grade I being those that were most alike in personality and Grade IV those that were least alike. The cases showing extreme similarities and differences selected themselves, and the further divisions were made where it seemed most natural. In Grades I and II the similarities were considered to be more important than the differences, while in Grades III and IV this was not so. The largest group was Grade II where striking resemblances in some aspects of personality could be seen but where there were also important differences. This has been subdivided into Grades II (a) and II (b), the differences being more marked in the latter but still not large enough to overshadow the similarities.

Since these ratings were made, further information was obtained about some



of the twins brought up apart and the whole group of twins brought up together was investigated. These pairs were divided into the same categories by a process of internal comparisons. The resemblances found in the separated twins were used as a yardstick for rating the control group. Except for a few minor adjustments which seemed called for in the interests of consistency, the grades of the twins previously assessed were not altered. The comparisons within the whole group of twins, which this rating system involved, approximate to a ranking of all pairs in order of resemblance. A complete ranking was impossible because the twins resembled or differed from each other in such a variety of ways. However, for any one pair there were usually one or two others with which it seemed natural to compare it.

Theoretically, all cases in Grade I should be more alike than those in Grade II (a), those in II (a) more alike than those in II (b), and so on, although in practice there are bound to be borderline cases where it is difficult to decide the most appropriate grade. On reviewing the material after the ratings were made, the only possible exceptions to the above gradual decrease in degree of similarity from grade to grade seem to have occurred in assessing those pairs where both twins were not interviewed personally by the writer. It will be recalled that this was the case in six S pairs where at least one of the twins was interviewed by a colleague and in six C pairs where only one twin was seen. In these cases it was more difficult than in the others to assess the significance of the similarities. If these were not clearly apparent, the twins tended to be put into Grade III. If the importance of reported differences (in the setting of considerable likeness) was not quite clear they were classified as II (b) rather than II (a).

### *FACTORS ENTERING INTO THE RATINGS*

The ratings were so far as possible made on the basis of observed or inferred personality traits, without taking into account the background history or presumptive causes of the similarities or differences. Any aspect of personality was liable to be taken into account if it appeared to be important in the individual case. Thus a pair might be distinctive by reason of resemblance or difference in any of the following characteristics:

- Liability to psychiatric illness;
- Marked traits of an anxious, hysterical, depressive or obsessional kind;
- Outstanding interests or abilities,
- Social characteristics, as revealed by dress, speech, habits, attitudes;
- Mannerisms, gestures, facial expression, but not purely physical characteristics such as build;
- Sexual adjustment, if information on this was available;
- Relationship between the twins and their attitude to the twinship;
- Rapport on interview.

Though it is true that all pairs were not investigated thoroughly in all traits or

aspects of personality, generally when information on one particular point was obtained from one twin comparative information was also available from his co-twin.

It would be extremely laborious to describe in detail how these characteristics were assessed and how much weight was given to each aspect of personality. It would also be difficult to say precisely how much weight was given to past history and how much to impression on interview. In the majority of the pairs a fairly clear and consistent picture emerged. The case histories themselves will give some further indication as to how the ratings were made and what they signify. This holistic method of assessing personality resemblance has some points in common with the more intuitive aspects of zygosity determination, in that it is difficult to give it scientific precision. It is hoped it is equally valid.

### *AUTHOR'S RATINGS AND PERSONALITY TESTS*

The writer's estimates of personality resemblance were made independently of intra-pair difference in SRQ score. It is therefore of some interest to compare these two methods of assessing personality. In the eighty pairs where Author's Ratings and SRQ scores are available, the mean extraversion and neuroticism differences in the five resemblance grades were as follows:

TABLE 15. AUTHOR'S RATINGS

<i>MZ Twins</i>	<i>Resemblance Grade</i>				
	<i>I</i>	<i>II (a)</i>	<i>II (b)</i>	<i>III</i>	<i>IV</i>
Number of pairs	16	21	19	18	6
Mean intra-pair difference in SRQ score:					
Extraversion	1.03	2.76	3.11	3.39	2.50
Neuroticism	1.63	2.64	4.24	3.17	4.25

TABLE 16. AUTHOR'S RATINGS

<i>MZ Twins</i>	<i>Personality Resemblance Grade</i>					<i>Total</i>
	<i>I</i>	<i>II (a)</i>	<i>II (b)</i>	<i>III</i>	<i>IV</i>	
Separated:						
Observed	8	6	10	11	4	39
(Expected)	(7.7)	(10.1)	(9.1)	(8.7)	(3.4)	
Control:						
Observed	8	15	9	7	3	42
(Expected)	(8.3)	(10.9)	(9.9)	(9.3)	(3.6)	
Total	16	21	19	18	7	81

$\chi^2$  (after grouping III and IV) = 4.842; 3 D of F;  $p < 0.20$ .

A moderate degree of association can be seen. Since the tests measure a narrower if more precise aspect of personality than the global ratings of the author, and each method has its own sources of unreliability, a closer association was hardly to be expected. That some degree of association has been found is encouraging: the two methods give each other mutual support.

### OVERALL RESULTS

TABLE 16 gives the number of S and C pairs in each of the five resemblance grades and compares this with the number that would be expected if there were no difference between the two groups of twins. All pairs were rated except the three S and two C pairs where information was from booklets only. The two psychiatrically ascertained S pairs have been omitted from the table. These pairs belong to Grades I and IV. Their inclusion would have made the S group more variable but would not have affected the S/C difference.

Approximately the same proportions (about 20 per cent.) of S and C pairs fall into the most similar group. The contrast between the two groups shows up most clearly in the excess of Group II (a) among the control pairs. In both groups Grades I and II are more frequently represented than Grades III and IV. The latter are relatively more frequent among the twins brought up apart (38.5 per cent.) than among those brought up together (23.8 per cent.).

The statistical significance of this difference was tested by the  $\chi^2$  test. On account of smallness of numbers, Grade IV was grouped with Grade III. In the resulting  $4 \times 2$  table  $\chi^2 = 4.842$  with three degrees of freedom. The probability lies between 0.10 and 0.20, being nearer the former than the latter. This is a long way from the conventional level of significance of 0.05. The difference between S and C groups can thus easily be attributed to chance.

### SUBDIVIDING THE MATERIAL

In order to discover whether the presence of any class of pair might have obscured a real difference between S and C groups, the material was analysed by age, sex and degree of personal investigation.

When pairs aged 45 and over are excluded there is a significant S/C difference. Thirteen out of twenty-four S pairs under the age 45 fall into the more alike Grades I to II (b), compared with twenty-five out of twenty-nine C pairs ( $\chi^2$  [Yates] = 5.158,  $p < 0.05$ ).

The simplest explanation would seem to be that the accumulation among the older pairs of personality differences due to fortuitous occurrences in adult life has diluted the effects of early environment. There are, however, some difficulties in this interpretation. The association between rating and age is not consistent; nor was it apparent in any of the tests described in CHAPTERS 7 to 9.

It was also found that when females were treated separately from males a significant difference in intra-pair resemblance appeared between the S and C groups.

Nine out of twenty-six female S pairs fall into Grades I or II (a), compared with seventeen out of twenty-seven C pairs ( $\chi^2$  [Yates] = 4.259,  $p < 0.05$ ). This might perhaps be accounted for in a similar way to the age effect noted above. For, since women are subjected to the vicissitudes of adult life in less variety (though not perhaps in lesser degree) than are men, the effects of early environmental differences might show up in them more clearly.

When pairs in which both twins were not examined personally by the author were excluded, there was only a very slight shift towards a greater S/C difference than in the material as a whole.

Analysis by sex also showed that males were less alike than females in both S and C groups. In the combined material the sex difference was significant. Fifteen out of twenty-eight males (S and C combined), compared with forty-one out of fifty-three female pairs, fall into Groups I to II (b) ( $\chi^2$  [Yates] = 4.854,  $p < 0.05$ ). This could be accounted for by the greater biological and social variability of the male; but it is possible there has been a systematic difference in method of rating the sexes. In some respects the males were a less colourful group than the females both as regards similarities and differences. This made them a little more difficult to assess. In cases of doubt they would be classed as Grade III rather than II (b).

### *DIZYGOTIC PAIRS*

The DZ twins were not investigated so thoroughly and systematically as the others [see p. 32]. An attempt was nevertheless made on the basis of all available information to place all thirty-two pairs in their most likely resemblance grades. The findings in the groups with different amounts of information are consistent, and there is no clear difference between those brought up apart and the remainder.

The number and percentage of DZ pairs in the different resemblance grades was as follows: Grade I, nil; Grade II (a), three (9.4 per cent.); Grade II (b), six (18.8 per cent.); Grade III, eight (25.0 per cent.); Grade IV, fifteen (46.9 per cent.).

No DZ pair was sufficiently alike to be placed in Grade I, into which 20 per cent. of all MZ pairs fell. The degree or kind of resemblance qualifying for inclusion in this grade may therefore be something peculiar to monozygotic twins. Nearly half of the DZ pairs are classified as Grade IV, compared with under 10 per cent. of all MZ pairs. The grouping in MZ and DZ pairs is thus clearly different. Some of the statements on which these Grade IV ratings are based, such as 'Twins not the least alike in appearance or character' and 'Totally different in nature', are possibly exaggerated. No doubt some family resemblance would come out if one went into the matter more thoroughly. If one compared these DZ twins with pairs of persons taken at random, resemblances would probably stand out in clearer focus. However, the present ratings must be regarded as relative, not absolute. Crude though this rating of the DZ twins is, the findings support the view that dizygotic pairs tend to be considerably less alike in personality than monozygotic pairs. This is in accord with the findings of Lange (1931),

Kranz (1936) and Stumpfl (1936) who studied the personality of criminal twins, and of Slater (1953) who studied neurotic and psychotic twins. It is also borne out in some psychological work on twins, such as that by Eysenck and his school (Eysenck and Prell, 1951; Eysenck, 1956). It was certainly the experience of the present writer when he studied a group of normal twin schoolchildren (Shields, 1954a). In that study, personality resemblance was rated on a four-point scale. 36 per cent. of MZ twins, but no DZ twins, were regarded as being qualitatively 'completely concordant' in personality, while in the least alike grade ('discordant') there were 17 per cent. MZ and 69 per cent. DZ pairs.

### *SUMMARY*

The method used to rate total personality resemblance has been described. There was some positive association between author's ratings and personality resemblance as assessed by the SRQ test. Female pairs tended to be more alike than males.

The MZ twins brought up apart were on the whole less alike in personality as assessed by the writer than the MZ twins brought up together; but instances of the closest resemblance were equally frequent in S and C groups and the differences observed in the whole material can easily be accounted for by chance. However, statistically significant S/C differences were found in the female pairs and in those under the age of 45.

Considering psychological tests and author's ratings together, it cannot be convincingly shown that the early environments of the separated monozygotic twins, unlike though they were, were sufficiently different to make these twins less alike in personality than the control group. Both S and C twins showed significant resemblance in personality and were more alike than DZ twins.

In conclusion, evidence for the importance of genetical factors in personality is very strong, while the differential effect of early environment is more difficult to demonstrate in the setting of the present investigation.

## PRESUMED CAUSES OF PERSONALITY DIFFERENCES

In spite of the somewhat equivocal findings of CHAPTERS 9 and 10 so far as the influence of early environment on personality is concerned, it is *prima facie* extremely likely that the different environmental experiences of the separated pairs have had some effect on their personality. The case histories can throw light on this in two complementary ways. On the one hand we can look at all pairs in which a specific environmental difference has occurred and see, for instance, whether those twins who were brought up as only children differ in any consistent way from their partners who were brought up with other siblings in the home. On the other hand we can examine those pairs that differ most in personality and see from our knowledge of each case what environmental factors appear most likely to have caused the observed differences. The present chapter employs this second means of approach, which is similar to the analysis in CHAPTER 8 of differences in intelligence.

### *THE LESS ALIKE S PAIRS*

We shall deal first with those S pairs that differed most in the author's rating of personality resemblance. We shall omit from consideration pairs rated as Grade I or II (a), where differences were slight in relation to the total picture of resemblance. We are left with twenty-six pairs (including S m P 9) in Grades II (b), III or IV. For each of these it was recorded which of a number of causes, physical

TABLE 17. TWENTY-SIX S PAIRS IN GRADES II (b), III AND IV

<i>Nature of Environmental Difference</i>	<i>Presumptive Causes of Personality Differences</i>		
	<i>Number of Pairs in Which Environmental Factors May Have Caused Twins to Differ in Personality</i>		
	<i>As Main Cause</i>	<i>As Contri- butary Cause</i>	<i>Total</i>
Early physical	2	5	7
Twin relationship	2	7	9
Early home background	12	7	19
Later physical	1	8	9
Later social	4	11	15
Other	2	1	3

or social, operating early or late, seemed to have brought about the intra-pair differences in personality. Since we were looking specially for the effects of the different upbringings, the analysis may be weighted in that direction. Nearly always more than one cause had to be recorded. Although it was sometimes difficult to say which was the most important of these causes in an individual case, an attempt was nevertheless made to note this in all but three pairs. The results are shown in TABLE 17.

While early home background could be related to personality in the majority of cases, a great deal of the difference observed appeared to be due to other influences. It may be of interest to describe under each heading of the table some of the ways in which it seemed that the environment had caused personality differences to develop.

### *Early Physical Factors*

Early physical factors were a major cause of personality differences in S m 3 (Grade IV), where epilepsy was without a doubt related to Russell's slowness and eventual unemployability. In S m 7 the history of a prolonged and difficult birth in one twin was probably related to the general inferiority of that twin compared with his partner in ability and energy. Other early physical factors which may have been important as contributory causes were rheumatic fever [S m 13], congenital syphilis [S f 10], deafness [S f 29] and general physical inferiority [S f 14, 18]. The effect of these conditions on personality was generally indirect, for example, through their influence on later health and energy.

### *Twinship*

The fact that these twins were brought up apart does not necessarily mean that their being one of twins and their relationship with their co-twin were never important influences on the formation of their personalities. The twinship itself is particularly likely to be important in pairs separated relatively late or reunited early. Thus in S m 2 (brought up next-door) and S f 24 (reunited at 5) the twin relationship was thought to be a likely reason for their differentiation. It is often difficult to discriminate between the twin relationship as such and other factors, such as differences in size or rate of development, which might encourage the formation of dominant-submissive relationships or other kinds of polarity in twins. This is discussed later in the chapter in connection with the control twins. A combination of factors such as birth weight and inter-twin and parent-twin relationships may be present in S f 11, 12, 13 and 15, while jealousy of the twin's circumstances may have been a factor in S m 13 and S f 14.

Even in S f 19 early factors such as these, besides later cultural ones, may have contributed towards the differences. These twins were not separated till the age of 4, by which time Herta was said to be the bigger and more aggressive of the two. Today she is still the more demonstrative and outgoing of the pair.

Two of the pairs listed under "Other" in TABLE 17 may be mentioned here.

In S f 28 Vera's enforced return to her parents and twin sister, in whose home she was not happy, is probably connected with the difficulty she experienced later in life in forming satisfactory interpersonal relations.

In S m 8 the fact that the twins quarrelled so frequently in infancy was the reason why they were kept apart. However, the big difference in their later outlook is probably an indirect consequence of one only of the twins having a bad stammer. The cause of the stammer in the first place is not known.

### *Home Background*

In twelve pairs dissimilarity in home backgrounds appeared to be the principal reason for the difference, and in a further seven it probably contributed towards it. Various aspects of the home background are involved; some of the relationships are more conjectural than others.

In S m P 9 (IV) the harsh attitude of Alfred's stepmother, together with the effects of child neglect in the first 2 years, would seem to be an adequate explanation for the big difference between the twins in personality and behaviour. Alfred was consistently more anxious and paranoid than his more fortunate twin brother.

S f 19 is another case with a large environmental difference. The contrast between Berta's well-to-do and over-protective home background and Herta's more chequered early years, under the influence of a psychopathic father, is in keeping with Berta's outwardly quieter life and ambivalent tie to her adoptive mother and with Herta's more demonstrative behaviour.

Family influences are also seen in S f 14 (IV) and S m 13.

The mother, who kept Edith [S f 14], seems to have been an inconsistent woman in the handling of her children and in her many moves of house, and she probably preferred her younger son to Edith. At school Edith was compared unfavourably with her physically stronger twin, who was brought up in more steady and stable circumstances by a grandmother and elderly aunts. In the light of this, it does not seem surprising that Edith should have had neurotic symptoms as a child and as a young woman, while her twin, Millicent, had none.

In the case of S m 13, Victor was brought up by an aggressive and socially unstable father. He did less well at school and in later life than Patrick, of whom he was jealous. This case, however, like the last, is further complicated by the presence of physical factors.

There are other pairs in which the circumstances of the separation seem to have made for greater conflict and insecurity in one twin than in the other.

Viola [S f 13] had the better home in that her grandparents were very kind to her, whereas her twin, Olga, was brought up all along by her mother who was a difficult, nagging and sometimes brutally aggressive woman. However, Viola lived in the continual fear that her mother might reclaim her, as she in fact did between the ages of 11 and 16, which were years of very great difficulty for her. Both these twins are neurotic, but perhaps it is by reason of greater early predisposition that Viola is the more severely disturbed of the two.

Conflict with the mother is thought to have been one of the most likely reasons for the complicated character structure of Marjorie [S f 10, IV]. The character of their respective fathers may also have been a factor contributing towards Marjorie's greater ambition.

Parental attitudes seem also, on the face of it, to have been important in causing differences in S f 20 and S f 11. In both these pairs one twin is more anxious and worrying than the other.



In S f 20, the more anxious, Charlotte, was brought up by a somewhat anxious and restrictive grandmother. Molly [S f 11], separated at a later age, resented having to live with her hard-hearted domineering grandmother and is a more worrying, 'martyred' personality than her twin.

Although the relationship between anxiety and family background may seem plausible in these two pairs, there are two other cases with somewhat similar differences in personality, where the family background was not consistent with that of S f 20 and S f 11.

In S f 12, where again the separation occurred late, Sally's aunt, though kind, did not take the place of her own mother, and she did not get on well with her uncle. However, this and later stress seem to have had a toughening effect on Sally; it is her twin sister who, for no very clear reason, is the more anxious personality.

In S m 11, it is not clear why Kevin should be more anxious than his twin. In his own opinion he 'had things better', and his story that his bad nerves were due to his having seen the body of a small girl in her coffin does not seem entirely convincing. (The case has been listed under 'other' causes.)

The degree of personality difference does not necessarily match the extent of the environmental difference.

In S m 1, Kenneth seemed to have slightly more social poise and to be a warmer person than Richard who was inclined to be bored and sulky. This difference is in keeping with Ken's normal home background and Dick's upbringing by a chronically mentally ill mother and a very deaf father. Indeed, it is surprising that the twins were not more different than they were. It is only because their similarities did not relate to any very striking or easily described qualities that they were rated as Grade III.

Early background is not necessarily the principal reason for the difference.

In S f 26, difference in early training may have contributed to the way the twins run their homes—the one being slap-dash, the other house-proud. The differing personalities of their husbands seem to have been more important causes of their differences in outlook.

In S m 10, one might suppose that a difference in the nature of their foster-mothers, or William's more frequent changes of foster-home, may have caused the rather different attitude of the twins to their past history and their future; but, here again, the personality of the spouses seems to have been more important, the one ambitious, 'almost hard on people', and the driving force behind William, the other a placid Irish country girl.

The examples given so far relate mainly to the psychological aspects of early environment. Differences in the home background of a physical kind may have been an influence in S f 18.

Differences in family relationships do not seem to have had much effect in this case; but it is possible that Christine's poorer nutrition during her early years could have contributed to her smaller build and greater susceptibility to illness, which in turn seems to be related to some of the personality differences that were noted.

Differences in early background of a social kind were of importance in some pairs.

In S f 15 the twin who was brought up mostly by her mother, who liked London life, is more lively and sophisticated than her sister; and with her husband she manages a hotel in a south coast resort. Her twin sister is content with a quiet life in the small country town where she was brought up by her aunt.

In S f 3 and S f 16 difference between the foster-parents in occupational class seems to be an initial cause of the divergence of their later school and occupational

history, and it complicated the relationship between the twins when they met. The same is true of S f 29.

Here the twins were brought up in the same village: Gwen was brought up by her aunt, who regarded herself as socially superior to the father and stepmother who brought up Ada. She would not let Gwen play with other village children or with her twin after school. Gwen married the local grocer: Ada married a soldier and moved with him to the industrial north. He was a slaughterer by trade and turned out to be a heavy drinker. Now, at the age of 59, Gwen sets great store on doing the proper thing. She is more reserved and more fussy than her twin, whom her family consider likely to make a fool of herself in public.

On a much smaller scale, social factors may have played a part in S m 2.

Although the twins were brought up next-door to one another and their respective aunts were on excellent terms, Bertram's greater initiative, compared with Christopher's, may perhaps be related to the fact that in their interfamily relationships Bertram's uncle and aunt appear to take the lead. It was, for instance, they who sent in the twins' names, and the families were interviewed in Bertram's home.

### *Physical Health in Later Life*

Physical health in later life entered into the presumed causes of difference in nine cases; but only in S f 23 (IV), where one only of the twins has disseminated sclerosis, did this appear to be a major cause of a large difference in personality. Compared with her twin, Trixie was emotional, indecisive and difficult in her behaviour. In S m 13 (severe emaciation) and in S f 20 (recent hysterectomy) illness seemed associated with loss of energy. In S f 11, the twin who had had a hysterectomy complained of recurrent depression. In S f 13, where one twin had lost weight through anorexia and the other twin was pregnant, there was quite a large difference in present mood, the former being anxious and the latter slightly euphoric. In S m P 9, where there is an exceptionally large difference in weight, there is the possibility that a glandular disturbance in Harry may have contributed to his greater placidity, though it is certainly not its sole cause.

### *Social Influences*

Three of the four pairs which seem to differ most on account of later social circumstances have already been mentioned [S m 10, S f 26, S f 29]. Personality of the husband was also a major influence in S f 27.

In contrast to her twin sister, Brenda married a very quiet man who, like her, does not like to go out on account of 'bad legs'. They live, childlessly, in a small town which she finds dark and dismal after London. Over the years these influences have at least maintained if not accentuated the difference between the twins. Even before marriage Brenda was thought to be less gay than her sister.

In other pairs, too, social influences in adult life which differentiate the twins seem to arise as a result of choice of occupation or of marital partner, which can in turn be traced back, at least in part, to earlier differences between them. However, the effect of the later environment should not be minimized. One of the Grade II (a) cases [S m 12] may serve as an example of this.

On account of the industrial depression, Jimmy left Durham as a young man and came to London, while Robert remained in the mining village where he had been brought up. Jimmy has more difficulty making friends, has more polished manners and more sophisticated tastes, but Robert is part of a closely-knit community. In other respects, however, e.g., in gestures, attitude of responsibility and presence of gastric disorder of a psychosomatic kind, they are much alike.

The histories of some of the twins brought up together also suggest that chance differences in adult circumstances can cause important differences in behaviour.

### *THE MORE ALIKE S PAIRS*

The above analysis of S II (b) to IV pairs according to presumed causes of difference need be followed by only a brief mention of S I and II (a) pairs.

Though personality differences were smaller compared with observed similarities they were usually explicable in the same sort of way in pairs rated as II (a). Thus in S m 14 the twin who came from a less happy home (parents quarrelling) had a slight tremor; and in S f 7 the twin whose early home life was less secure (no father figure) was a little more anxious than her sister. Similar relationships between home background and personality can be traced in S f 17. Early differences of a social kind (respective fathers: headmaster and J.P. in a country town; building contractor in the London area) were matched by differences in interest and in occupation of husband (schoolmaster and poultry salesman, respectively), but differences in personality did not go very deep [S f 25].

So far as could be judged physical causes of difference did not seem to be important in the II (a) pairs. This contrasts with the situation in Grade IV cases, in all of which physical factors were implicated among the causes of difference. As already noted these were: epilepsy [S m 3], disseminated sclerosis [S f 23], congenital syphilis [S f 10], stunted physical growth in one twin and obesity in the other [S m P 9], and the combined influence of lower birth weight, smaller size, more childhood illness and left-handedness [S f 14].

The differences in Grade I cases were of course unimportant so far as personality was concerned, but they were as readily explicable as any of the others.

The twins in S f 5 were both anxious obsessional personalities of a very similar kind. When seen Polly had been going through a period of intrapsychic conflict. She could not decide whether to embark on a further pregnancy, having previously lost through congenital malformation a child born by Caesarean section, and herself suffering from hypertension. She could not expel the thought of children from her mind.

In S m 6 the twin who was brought up in a family where there was a tradition of brass-band playing enjoyed playing the B-flat bass. His twin merely enjoyed listening to music.

One subject had a mild depression when her twin sister had to have a mastectomy [S f 21].

### *S PAIRS: CONCLUSION*

From the discussion of differences in monozygotic twins brought up apart, we may provisionally conclude:

1. That many plausible relations can be traced between home background and personality, but these are not always simple or consistent ones;

2. That multiple factors from all periods of life interact in causing variations in personality; and

3. That physical factors play an important part in those pairs showing the largest differences in personality.

### THE CONTROL PAIRS

Presumptive causes of difference between twins brought up together were analysed in a similar way by examining in the first place the less alike pairs. The findings in the nineteen C pairs in Grades II (b) to IV are shown in TABLE 18.

TABLE 18. NINETEEN C PAIRS IN GRADES II (b), III AND IV

<i>Presumptive Causes of Personality Differences</i>			
<i>Nature of Environmental Difference</i>	<i>Number of Pairs in Which Environmental Factors May Have Caused Twins to Differ in Personality</i>		
	<i>As Main Cause</i>	<i>As Contributory Cause</i>	<i>Total</i>
Early physical	4	4	8
Twin relationship	5	11	16
Later physical	1	5	6
Later social	3	10	13
Other	6	2	8

In no fewer than sixteen of these pairs the relationship between the twins was thought probably to have entered into reasons for the differences in personality. Just as in the analysis of the S pairs it was tempting in the individual case to explain differences in terms of early family background, so in the C pairs there is perhaps a danger of falling back on the effects of the twinship itself in the absence in many pairs of any very tangible reason for the differences. Before pressing the contrast between TABLES 17 and 18 the nature and possible effects of this factor should be discussed.

#### *The Inter-twin Relationship*

Galton (1883) was the first to attempt the scientific study of the personality of twins, and among the differences between physically similar twins he noted the tendency for one to take the lead. Many others have made the same observation. Von Bracken (1936) expands the concept when he speaks of one twin being the *Aussenminister* for the pair, the other *Innenminister*. Leadership may take many forms and other diversions of role or polar developments may occur, as when one is described as the good twin, the other the bad twin, or when one is 'more for mother', the other 'more for father'. However, the commonest differentiating relationship which develops between monozygotic twins is probably that of dominance-submissiveness. This shows itself most clearly in the social field in such ways as

a tendency for the dominant twin to enter a room first, to speak up for the pair in company and to make decisions for the pair.

Gedda and Bérard-Magistretti (1958) were able to identify (mainly from accounts of parents) a *gemello guida* in fifty-seven out of sixty-nine young MZ twins. This was not very different from the findings of Shields (1954a) who in a study of twin schoolchildren thought one twin took the lead in twenty-seven out of thirty-six MZ pairs. Shields also confirmed the observation of Burlingham (1952) that twins sometimes change leadership roles. However, more often a relationship becomes established which remains fairly permanent throughout childhood.

Leadership may be related to other factors. Gedda and Bérard-Magistretti, in the ophthalmological investigation mentioned above, discovered that the leader twin had a significantly higher fusional convergence than his co-twin, which the authors interpret as depending on the higher level of 'will' of the leader twin. Slater (1953), studying mental illness in twins, noted a relationship between submissiveness to twin and severity of illness compared with that of the twin. Dencker (1958) observed that the more submissive twin tended to be the more neurotic.

The occurrence of a division of role in genetically identical twins can perhaps most easily be explained in terms of social psychology. A pair of twins forms a miniature group and, as in other groups, the members come to differ in function. Their different social behaviour may in the first instance be merely a matter of convenience. Later it may be habitual. Some differences between twins may be accounted for by the wish to be independent of the twin or a fear of competing with him. Differences in leadership can be encouraged by parents who protect the weaker member. Initial differences in health, vigour or maturity may determine which twin takes the lead to begin with. Some authorities (Price, 1950) might regard an unequal share of the maternal circulation *in embryo* as the major cause, not only of which is the dominant twin, but of most other differences in health and personality as well. The twin relationship would be an incidental rather than a dynamic factor on this interpretation. Similarly, asymmetry reversal is regarded by Bouterwek (1936) not only as the cause of differences between twins in handedness, but also as the cause of differences in intelligence, masculinity-femininity and many other character traits; according to him monozygotic twins are constitutionally different and this rather than the environment is the cause of any differences between them.

In the group of twins brought up together and studied in the present investigation it seemed probable that one twin used to take the lead during childhood in thirty-five out of forty-four pairs. If we restrict ourselves to the fairly clear-cut instances where both twins stated in their written replies in their booklets that one of them had been the leader we have twenty-six such pairs. (There were no cases where the twins disagreed in the booklets as to which had taken the lead, but in some pairs only one twin answered the question unequivocally.) In the majority of these pairs it was still clear from their behaviour on interview which had been the

dominant partner. Thus, when asked which of them would like to go first for a test, it was generally the childhood leader who volunteered or who was pressed by her partner to go. Moreover it was the childhood leader who more often than not sent in the twins' names for the research.

*Factors Associated with Leadership in Childhood*

It is interesting that differences in behaviour of this kind are not restricted to situations where the twins are together. Childhood leadership was also related to extraversion score on the SRQ as follows:

TABLE 19. CHILDHOOD LEADERSHIP AND EXTRAVERSION

<i>C Pairs</i>	<i>Extraversion Score</i>			
	<i>Leader Higher</i>	<i>Twins Equal</i>	<i>Leader Lower</i>	<i>Total</i>
Males	5	1	2	8
Females	10	4	4	18
Total	15	5	6	26

It will be seen that twenty-one pairs differed in both leadership and extraversion and in fifteen of these the childhood leader is the more extraverted now. Omitting CASE S m 12 for which the extraversion score was uncertain, we can apply a *t* test to the intra-pair differences. The mean intra-pair difference of 1.58 points in favour of the leader twin is significantly different from zero at the 0.05 level ( $t = 2.205$ , 24 D of F).

In the writer's earlier study of twin schoolchildren twenty out of twenty-seven 'leader' twins were reported to have been heavier at birth than their co-twins. In the present C group this was known to be the case in thirteen out of twenty pairs. When the two series are combined the association between birth weight and leadership is highly significant ( $\chi^2 = 7.681$ , 1 D of F,  $p < 0.01$ ). That the difference in extraversion is not a consequence of greater birth weight (as might have been expected on the Price hypothesis) rather than of the interpersonal twin relationship, is suggested in the lack of significant association between birth weight and extraversion in both S or C groups. The distribution of pairs giving information on this point is given in TABLE 20.

TABLE 20. BIRTH WEIGHT AND EXTRAVERSION

	<i>Heavier at Birth More Extraverted</i>	<i>Heavier at Birth Less Extraverted</i>
S group	10	13
C group	16	12
Total	26	25

It may be of interest to record the relationship between 'leader twin in childhood' and some other variables. Taking all the pairs who differed in both variables, the following agreement : disagreement ratios were obtained: Leader—bigger child, 12:2; —taller now, 16:5; —heavier now, 15:11; —more intelligent, 10:10; —less neurotic, 12:9; —better mental health rating, 14:10; —first born, 15:10; —better childhood health, 16:7; —earlier puberty, 10:4; —marries before twin, 10:7; —financially better off now, 12:5; —sent in name to B.B.C., 15:6.

The associations with 'bigger child' ( $\chi^2$  [Yates] = 5.786,  $p < 0.02$ ) and 'taller now' ( $\chi^2$  [Yates] = 4.762,  $p < 0.05$ ) are both significant. In general there is a tendency for the twin who is ahead in one respect to be ahead in other respects too.

These observations from the literature and from the present investigation show that the concept of a leader twin, though not universally applicable, does have some validity, and they support objectively the view that personality differences between twins brought up together can be due to their relationship with one another. There may also be a tendency for the converse to be true, at any rate among female pairs. Three out of six female pairs not showing leadership were in the author's resemblance Grade I, compared with three out of twenty-one such pairs where there was evidence of leadership. The association between leadership and extraversion may explain why MZ twins brought up together differed more in extraversion than those brought up apart [cf. CHAPTER 9].

### *Examples of Differences*

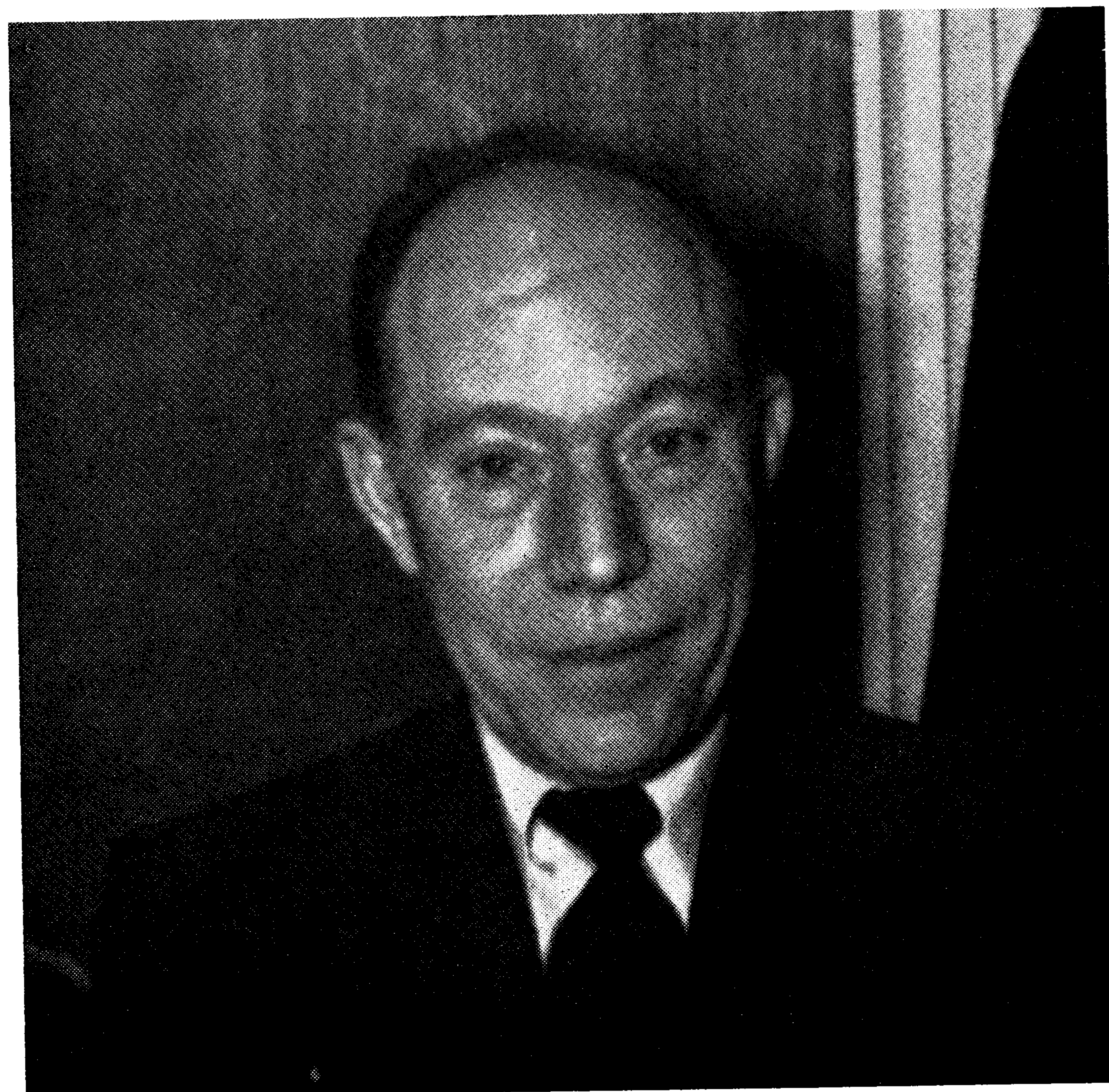
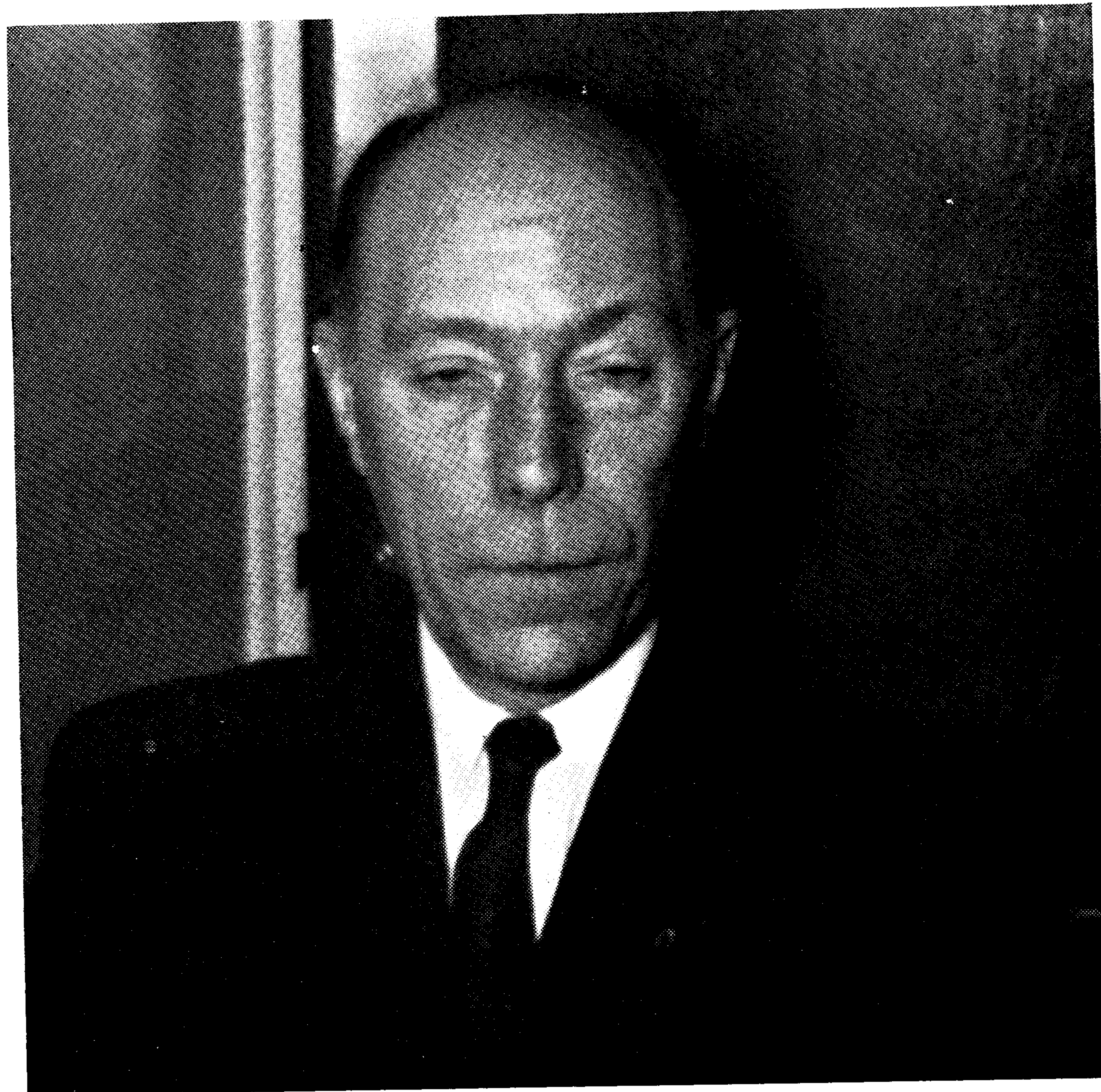
In the light of the above discussion we may now continue with some illustrative case material. This will be given in slightly greater detail than that above, since considerations of space make it impossible to give individual case summaries for the C pairs in the same way as has been done for the S pairs in PART II.

It will be apparent that the twin relationship is often bound up with physical differences and with other family relationships. Differences in energy in one form or another are characteristic of the Control pairs. A systematic review of the male pairs in Grades II (b) to IV shows this clearly.

CASE C m 4, age 23. Their birth was difficult; Claud revived sooner than Denis and he has always been a little bigger and heavier. He took the lead and has more perseverance. He has now shown more initiative than Denis in marrying against the mother's advice, Denis being more dependent on the mother.

CASE C m 6 (IV), age 33. George was smaller at birth and spent nearly a year in hospital with bronchitis when he was 2. Bernard took the lead at school. The twins were made to box one another and George invariably came off worse. He resented being 'the butt of masters' jokes', while Bernard says 'the masters' words of wisdom stood me in good stead'. George was the apple of his mother's eye (in his own opinion, not in Bernard's) and found his father less sympathetic. Bernard speaks more favourably of his father and is considering emigration, as his father did in the past. George was exempt from military service. He is a keen radio engineer and active in the local Labour Party. He is rather tense and hypochondriacal. Bernard kept up an early interest in the theatre, which the twins once shared, and has gone on tour as assistant stage manager of a small company. He still sings in a semi-professional dance band. He has a roving disposition: at present he is a long-distance lorry

PLATE 4



CASE C m 12. John (upper) and Albert, age 50, brought up together and still working for the same firm. The twins are obviously monozygotic, but they are very different in facial expression.



driver, but is not satisfied. He has had some neurological trouble, following a wartime spinal injury.

CASE C m 7, age 35. Philip was always slightly the bigger and took the lead. It is claimed that he takes after father, Elton after mother. Philip was better at games, Elton at lessons. Philip is more energetic physically and he saw more active service in the war. Elton is a good deal more anxious. Philip likes drinking with friends in the pub, Elton rarely does so. Philip is secretary of the works' social club, Elton of his Trade Union branch.

CASE C m 8, age 39. Though leadership is denied, there is a difference of role in this pair similar to that in many of the others. One twin (Cuthbert) is more sociable and sport-loving than the other (Maurice). It was only Cuthbert who volunteered to join the services. In appearance he is a little more tense than Maurice, who is more indecisive and liable to headaches.

CASE C m 9, age 39. Ernest, who is the slightly more energetic and sociably unstable of the two, claims that he was the leader. Basil, however, denied that either twin took the lead. The twin relationship seems to have been more important for Ernest than for Basil. During the war they were both due to return home on leave at the same time from different stations; Ernest wrote an unpleasant letter to Basil's wife, saying he would make sure that he saw more of Basil than she did. When Ernest emigrated he was upset that Basil would not join him.

CASE C m 11, age 45. Birth weights are not known. Arthur was taller as a boy and always took the lead. He was given more responsibility by mother, it is said because he was the first born, though this may be a rationalization. He did better at lessons and became head boy at school. He has considerably more energy of character than Norman. He reached managerial grade at 27—Norman not till 41. He keeps his weight down by playing badminton and tennis. He has a small moustache and a military bearing. He is active in the Scout movement and in church affairs. 'Arthur always had the edge on me', says Norman. It is possible Norman gave up competing with him. Norman is more placid, is 20 lb. heavier, does not share the same sporting or organizing interests and is looked upon by Arthur as a stick-in-the-mud.

CASE C m 12 (IV), age 50. Albert and John went around together till Albert started courting at 20. Albert took the lead then as he does now when the twins are together. Except that Albert was left-handed there was no marked early physical difference between them. The contrast between them now is quite striking. Albert is married with children. John is single; he looks after his elderly mother, and his recreations are solitary ones. Working for the same large firm of printers, Albert has an overseer's job and is popular with the men, while John is very independent, resents being asked to do more than one thing at a time or working with a gang. He has found a niche for himself distributing special advance copies of a magazine which the firm publishes. When the twins were seen, John refused to complete the Dominoes. Their most outstanding difference was in facial expression [see PLATE 4]. Albert has a mobile, humorous expression, John has a longer looking face with a rigid, miserable-looking expression: 'I was born unlucky', he says. John is 2 stone lighter than Albert and he had an operation for duodenal ulcer when he was 25. The story is that when they were 19 they tossed a coin to decide who should take out a certain girl—Albert won. A year later they met the same girl again and Albert started courting her. 5 years later they married. It was then that John had to have the operation which disclosed his ulcer. It is possible to interpret John's resentful, depressive attitude in terms of his reaction to being cast in the role of the submissive and less lucky twin. It was also reported that as a child John but not Albert was taken to a Children's Out-Patient Department along with another sib, but the nature of the complaint is not known. One could speculate as to whether there might be a physical cause for the difference.

In the following case an ulcer also developed in only one of a pair of twins, again in the more resentful of the pair, though this time it was the leader.

CASE C m 14, age 51. Balfour was the heavier at birth and he is an inch taller than Eric now. Balfour took the lead and is still inclined to tell Eric what to do. Eric feels that he relied too much on his twin and that this has held him back. At interview Eric let Balfour

talk, remarking 'I agree with him if I don't say otherwise'. Balfour says, half seriously, that they were silly to have married. Eric married only because Balfour did and he says his wife does not appreciate his closeness to his twin. In keeping with being the leader, Balfour has more drive and has risen to a position of greater responsibility than Eric in the commercial world, but this has been at some expense to his peace of mind. He has high standards, easily becoming tense or anxious, and he drives himself—and those under him—hard. At 33 he first developed gastric symptoms. Last year he had an operation for duodenal ulcer. He attributes the onset of his symptoms to having to work for a bullying boss. This employer had once mistaken Eric for him, and Balfour thinks he took it out of him on this account. Balfour has other sensitive paranoid traits. For instance, he says he knows when people are looking at him from behind, a feeling which he relates to his being stared at when out with his twin. He mentions a number of instances of what he feels to be unfair discrimination. It is not clear that the paranoid traits are linked with the twin relationship, though it is possible that they are secondary to frustration of Balfour's anxious drive. Eric has neither gastric trouble nor paranoid tendencies, though he, too, has had to work for an unpleasant employer, and he is the father of a mongol child—a situation which might have encouraged sensitivity feelings if he had been liable to them. It is possible in this case that there was some early cause, of which we are not aware, for Balfour's anxious drive and that this tendency pushed him into the role of leader.

If there are prenatal or early environmental factors which can stimulate anxious tendencies in this way, they might also explain the similar tendencies of Kevin [S m 11, referred to on p. 80].

CASE C m 15, age 53. In this case there seems to be a difference in the direction of the twins' energies. Frank was a keen cyclist, Wilfred not. Frank felt there was not enough for him to do at the firm where he was apprentice and he joined the Air Force at 19. Evidence on leadership is uncertain. Wilfred, however, seems to have been under Frank's influence. Though satisfied with his apprenticeship, he turned up at Frank's depot 3 weeks later and asked if he could enlist too. The twins were soon parted and, unlike Frank, Wilfred did not take to service life: his father had to buy him out. Later, with his wife, he became converted to the Christadelphians and he has devoted much of his energy to their cause.

Developments similar to many of the above can also be seen in some of the more alike male control pairs. The following case, Grade II (a), may serve as an example.

CASE C m 13, age 51. Possibly because he escaped a severe attack of enteritis in infancy, Allan took the lead and showed more initiative. During the war he joined the army, while Ian stayed at home and helped to manage their mother's property. Allan had more confidence doing the intelligence tests: Ian thought he had done badly, although the twins did equally well on these (good average).

The female control pairs in Grades II (b) to IV show a similar tendency for leadership in the twin situation and energy of character to be associated, and for this to be the most frequently observed within-pair personality difference. It must be stressed that the case descriptions below do not take similarities into account.

CASE C f 2, age 28. Jocelyn took the lead. ('I did things: Carol dithered.') This was despite Carol's slightly heavier birth weight and Jocelyn's more severe asthma. Carol grew up to be dependent on her twin. Jocelyn scores a little higher than Carol on extraversion. She is rather rigid and selfish, while Carol is indecisive, goes out of her way in an almost exaggerated manner to oblige people and has a higher neuroticism score. In her teens she had an obsessional disorder with recurrent sexual thoughts, and she has marked perfectionist trends. When seen, Jocelyn, who was dressed in a plain grey costume, made conditions about co-operating in the tests. Carol, who is plumper and was dressed in bright green and red, was anxious to please. She was handicapped on the Dominoes test by

indecision and lack of confidence. Jocelyn's dominance, and Carol's indecision and apparent efforts to please and impress, could be related to patterns of behaviour which the twins developed in the course of growing up together in the framework of a very close relationship—one on which they still both lay the greatest importance. Carol's difficulty in deciding may have been accentuated by having Jocelyn around to decide things for her. There seemed to be something acquired or affected about some of the characteristics in which the twins differed. As one got to know them better, Jocelyn's aggressiveness and Carol's effusiveness were toned down. Jocelyn still has asthma, while it is Carol who has the more neurotic history.

CASE C f 6, age 34. At birth Doreen weighed  $6\frac{1}{4}$  lb., Eileen  $4\frac{1}{4}$  lb. As a child Eileen says she relied too much on the larger Doreen. Eileen was known as 'the sweet one' of the twins. Both stammered, Eileen more severely, and she feels her stammer has handicapped her. Eileen had no boy friends of her own until after Doreen had married. Only Doreen has learnt to drive a car, taken up horse riding and done voluntary work for the Girl Guides and in a Kindergarten. Temperamentally Doreen is described as a 'bombshell' compared with the somewhat inhibited Eileen.

CASE C f 7, age 34. No differences in leadership or in early health could be elicited. Laura had concussion at 18. Elizabeth's husband turned out to be a hypochondriacal paranoid man who has had psychiatric treatment. Personality differences, however, are said to go back to childhood and there is no simple explanation for them. Laura is more placid, Elizabeth more sensitive (e.g., about the length of her nose), more superstitious (though more intelligent) and more obsessional (house-proud, counting rituals).

CASE C f 11, age 36. Sylvia, who was slightly larger from birth onwards, tried to dominate Susan who retaliated by never agreeing with what she suggested. They regard themselves as 'opposites' (Sylvia) or 'complementary' (Susan). They still disagree. Sylvia is more outgoing, talkative, self-reliant and hard-hearted. Her marriage has been happier and her husband is financially much better off than Susan's. Susan has a stooping posture, a dispirited attitude and an interest in spiritualism.

CASE C f 15, age 41. Cora was the heavier at birth and took the lead. The main difference seems to be that only Beattie had nervous debility when her husband was away during the war (fear of going out, crying spells). Evaluation of the case is hampered by inadequate information.

CASE C f 17, age 41. There was no known difference in birth weight. Greta had a facial paralysis at 8 or 9 from which she has a residual tic. Harriet took the lead, was more of a 'tomboy' and according to school record and tests is the more intelligent. Greta is rather more emotional than her twin and complains of lack of energy. She has had a less fortunate life story all along—physically 'never right since thrombosis at 30', less happy marriage. Cause and effect are difficult to disentangle.

CASE C f 19, age 43. The larger twin, Ada, took the lead. Freda would not go to school if Ada could not go. As adults Ada was the more outgoing and exhibitionist, and they married husbands in conformity with their own personalities. The difference between them has been widened now as the result of a cerebral atheroma in Freda only. This has led to emotional flattening, according to her doctor.

CASE C f 21, age 45. Lucy took the lead and seems to have been the more daring and socially unstable of the two in their earlier years. However she married a long-suffering, stable husband, while (if the account we have is correct) Doris's husband is mean and inconsiderate. Doris is more gloomy and complaining.

CASE C f 26, age 53. The relationship between the twins was not exceptionally close. Their histories diverged without either taking the lead. Alice did better at school; she went in for clerical work and married a solicitor's clerk. Josephine worked in a shop and married first an engineering fitter and, after his death, a commissionaire. In personality, Alice cultivated a deeper voice than Josephine and kept up her interest in singing. She has quieter, more serious tastes, liking to knit at home, watch the ballet or spend a quiet country holiday. She looks after their elderly mother. Josephine likes to visit friends, go out to dances or have a bright seaside holiday; at family parties she takes the lead in 'getting things warmed up'. The twinship means more to Josephine than to Alice.

CASE C f 27, age 54 (IV). Ida was the heavier at birth, Daisy weighing only 2½ lb. Ida remained taller and stronger in childhood and did better at school. Not surprisingly, she took the lead; Daisy still defers to her when they are together. For 6 years after marriage the twins and their husbands shared a home, Daisy doing the cooking for the four of them. Ida's husband is a clerical, Daisy's a manual worker. Daisy has not gone out to work. She and her husband regard themselves as 'home birds'. Her motto in life is 'what will be, will be', but she seems fairly content. Ida has been 40 years with the same firm where she is now personal secretary to the managing director, accompanying him on business trips to America. She stresses her sociability, but she impressed the interviewer as being snobbish, reserved and intolerant. She took for granted the help she had from her twin, who, for example, used to look after Ida's invalid son. The twins' lives had diverged so much that they had little in common. They differed widely in social attitudes.

The above examples appear to show the dominant twin to be at an advantage. This may be so in some pairs, especially in those where social dominance and physical vigour are associated. In other pairs the advantage so far as social adjustment is concerned can be the other way round. If the twins are inclined to be over-aggressive or uncontrolled emotionally, the leader is more likely to get into difficulties and the more restrained partner to make the better adjustment [cf. C f 3, pp. 131-2, where the more impulsive Jennifer had a stormier history, including an hysterical breakdown]. The personality test revealed no association between leadership and neuroticism.

The more alike female control pairs also show a similar consistency. In nearly all pairs where, for whatever reason, one twin took the lead, the less dominant twin turned out to be the more timid or anxious in manner. The following descriptions, extracted from the case histories, relate to the comparison of the less dominant twin with the childhood leader in pairs classified as Grades I or II (a).

C f 1 (girls of 9), needs more encouragement, more feminine; C f 3, less erratic, more persevering, has not had breakdown; C f 5, more idealistic, more demure; C f 9 (inconsistent with the remainder), more outgoing, better off; C f 12, less sophisticated, fonder of reading, does not go out to work; C f 13, took less responsibility at work, less decisive; C f 14, no real difference in personality; C f 18, relatively more indecisive and lacking in confidence; C f 20, made efforts to compete with twin in later childhood, very little personality difference, married younger brother of twin's husband, has not moved out to middle-class suburb; C f 24, cooks for twin and husbands of them both, eight points lower extraversion score; C f 25, more methodical, more dependent on husband, more inhibited; C f 28, did not go out East, remained single, lives with older sister, more conventional.

### *C PAIRS: CONCLUSION*

To generalize about the control pair differences in personality, one can perhaps say that these can most often be described in terms of social inhibition and that they are generally related to the social relationship which is apt to develop between monozygotic twins in childhood. In many pairs this polarity accentuates the significance of early physical differences between the twins, and it leads in some pairs to differences in later social circumstances which in turn add to the different impression the twins make on the observer.

Though often a matter of degree, differences sometimes could be of a more qualitative kind, such as in cases C m 14 (paranoid) or C f 7 (obsessional) described

above. Some cases from both S and C groups are worth mentioning in which one twin seemed more affected or exaggerated in manner, the other twin frequently being more rigid or conventional. For one reason or another, conceivably as a defence against anxiety, the former twins appear to have adopted a changed image of the self.

CASE S f 7. Kathleen, single, uses brown ink, wears long ear-rings, speaks in a refined voice. Jenny, a married housewife, seems more worried.

CASE S f 11. Dorothy talks of the power of love to overcome any difficulty, is interested in the Plymouth Brethren. Molly is more practical, worrying, a martyr to circumstances.

CASE S f 16. Clara from the 'humble' home is a little over-dressed and anxious to impress. June is more tense and reserved.

CASE C f 5. Caroline regards herself as more of an idealist than Pamela, had an ambition to be a florist and married a gardener, looks more demure, a non-smoker. Pamela has more anxious drive.

CASE C f 12. Hester is more sophisticated, uses more make-up; like her husband she enjoys horse racing and a glass of beer.

CASE C f 23. Jane came to feel she relied too much on her twin, though Felicity never thought Jane did rely on her. Jane prides herself now on her independence and broader outlook on life, though objective evidence of this is slight.

CASE C f 25. Ursula wears more jewellery, feels she is more superficial and has less perseverance than Margaret, whom she admires for going out to work.

CASE C f 28. Yvonne, after a more stressful life [see CHAPTER 14], 'gave up worrying long ago', is less restrained, likes to go around in slacks. Jeannette is more worrying and conventional.

### SUMMARY

The pairs differing most in personality have been analysed and systematically described according to what appeared to be the most likely causes for the differences. Despite complications and uncertainties in individual cases, the effects of early family environment showed up in the separated pairs. The control pairs revealed greater uniformity in the nature of their personality differences; and these could often with some plausibility be explained in terms of the social relationship which is apt to develop between monozygotic twins growing up together where one twin takes the lead.

If we are right in thinking that the twin relationship itself is an important differentiating factor between twins brought up together, this may go some way towards explaining why more difference was not found between the S and C groups in total personality resemblance and why the controls actually differed more than the others in extraversion-introversion.

## NATURE OF THE PERSONALITY RESEMBLANCE

Description of personality resemblance can take various forms. CHAPTER 9 describes resemblance between monozygotic twins in the general terms of extraversion and neuroticism. CHAPTER 14 shows, among other things, that it can relate to a specific but comparatively trivial matter such as the number of cigarettes they like to smoke. In CHAPTER 15 the psychiatric aspects of the twins' histories are discussed and various points of similarity noted. In the present chapter selected examples from the case histories will illustrate some other more general ways in which monozygotic twins are frequently alike. In this way it is hoped to give more substance to the claim of likeness implied by the ratings of CHAPTER 10.

The subjects themselves and outside observers often referred to similarity in such things as mannerisms and gestures.

When Harry and Alfred [S m 9] met after 22 years, Alfred's family were much impressed by their similarity in mannerisms. These related to quite ordinary matters of doubtful relevance to personality, such as a mannerism of closing the eyes and turning the head or a way of brushing the hair and tidying oneself up before going out, but which they had thought were distinctive of Alfred. Alfred himself was struck by the similarity in gait and posture ('It looked like myself walking towards me'). At the age of 60 Vera [S f 28] returned to England on a visit, having lived in Canada from the age of 17 and having spent most of her childhood before that apart from Maisie. Maisie's friends and relatives spoke of the twins' 'identical mannerisms' and their tendency to do or say the same things.

Generalizations of a similar kind have been made in probably the majority of pairs, whether brought up apart or together. Often one could not but be impressed by it when talking to the twins themselves.

Jim and Bob [S m 12] both liked to tap the table in an emphatic way when making a point, would flick their fingers when unable to think straight away how to express themselves, and nodded their heads energetically in agreement. In another pair, less emphatic in their gestures [C m 5], one twin sat with legs crossed (left over right) and his left hand placed between them. His brother (interviewed separately) sat with right leg over left and his right hand in between. In C f 9 both twins had a habit of picking the skin above the left eye. The twins of CASE S f 17 were alike in giving an extremely firm handshake, S f 23 an extremely flabby one. Sitting on a bench together Jessie and Winnie [S f 1, age 8] swung their legs in the same rhythm; when the black finger-print ink was rolled out, they let out a similar expression of disgust at the same moment. Arthur and Norman [C m 3], brought up together, sat in the same position, leaning forward with hand on forehead, when talking. When told about the twins brought up apart their faces dropped in the same way at the very idea of parting twins. Olwen and Gwladys [S f 22] seemed both to have a wild, scared look about them, their eyes darting from place to place. Catching each other's eye they would burst out giggling. Their movements were awkward. Amy and Teresa [S f 26] are easily startled and put their hands to their mouths in a similar way; their nails were badly bitten (age 55). In CASE S f 17 both twins made the same half-thoughtful, half-humorous face

when answering questions. A similar quizzical smile is seen on the photographs of the pair C f 11. In S f 5 both twins had a distinctive slow gait; seeing the second twin walking reminded one immediately of the first, seen a few weeks previously.

The above are only a few of the heterogeneous observations that can loosely be classed as similarity in mannerisms and gestures. (There were also pairs in which a distinctive resemblance in handwriting was noted.) Some, no doubt, such as the manner of walking or of smiling or frowning, are in part determined by anatomical structure, yet the similarities generally amount to more than a reflection of physical traits. Twins can differ in these respects more widely than in the underlying physical characteristics. Although the precise significance psychologically of these various features of behaviour may not be clear, they are commonly regarded as expressive movements, bearing some relation to personal tempo, to sense of humour and to the expression of fear, surprise, disgust, unconscious aggression and so on. Sainsbury (1958) has found a relationship between the level of gestural activity during interview and extraversion. The occurrence of similarities of this kind in twins brought up apart as well as in those brought up together suggests that these mannerisms are not determined so much as might have been expected by imitation. The work of Lehtovaara (1938) among others has shown that MZ twins are more alike than DZ twins in facial expression. Luchsinger (1940) and Spindler (1955) have reported various kinds of resemblance in psychomotor behaviour.

Similarity in voice and speech was also frequently mentioned as a likeness and was often observed. Various studies have been made on the voices of twins. Gedda, Bianchi and Bianchi-Neroni (1955), for instance, have shown that MZ twins are frequently unable to distinguish tape recordings of their own and their twin's voices, and an observation of this kind was made spontaneously by one of the present control twins. In a later communication Gedda, Fiori Ratti and Bruno (1959) conclude from an electro-acoustical study of the spoken voice of MZ and DZ twins that the similarity in MZ pairs can largely be ascribed to morphological and functional factors of a genetic nature in the laryngeal generator. Other factors determine traits such as talkativeness in which MZ twins also often show a resemblance.

In CASE S f 9 although the twins come from different parts of the country and pronounced their vowels rather differently, one was struck when speaking to them together of the similarity of their voices. From their tone of voice and their rate of speaking or even, it seemed, the content of what they said on many topics, it would have been difficult to distinguish them immediately from their voices alone. Each tells how as a child she had the reputation of talking too loudly. In the case of one twin this was attributed to her being so used to shouting at grandfather who was deaf, in the other it was said she 'took after' her adoptive father who had a loud voice. Their innate constitution probably had more to do with it. In marked contrast to this pair, who were lively and spontaneous, there is on the one hand the twins of C m 8, who were slow and unforthcoming but described themselves and their interests in very similar terms, and, on the other hand the pair S f 27 with their high-pitched, monotonous, slow speech who were nevertheless extremely voluble. A many-sided similarity in voice was observed in S f 8—their voices too weak for choral singing in a part of the country where singing is popular, their liking for short, telling phrases, and the way they talked about their shyness, their keenness on sport and their tastes.

This leads to a similarity of thought processes which is often claimed by twins. Parents tell how twins will describe things in the same way or will independently ask the same questions. Twins themselves will take a delight in relating stories of their buying identical presents and perhaps [as in C f 4] asking an aunt to hide them in the same place. Or they claim, perhaps, to have changed their hair styles at the same time and to have decided independently to have their watches repaired before coming to London [S f 18]. They are said in many instances to come out with the same remarks at the same time or to know what the other twin is thinking. Nearly all such stories have in common that they cannot be independently confirmed, and one sometimes suspects retrospective falsification of memory [cf. S f 22]. Stories of twins falling ill at exactly the same time are not usually borne out by medical histories, and it is difficult to believe all accounts of one twin knowing intuitively when the other is ill. Nevertheless claims of telepathic-like experiences are so often made, and not only by the hysterically inclined, that one suspects that there is more to it than simply the wish to be alike or a similarity in attitude. Olive and Madge [S f 8], referred to above, were brought up completely separately and had not met since infancy. The way in which they, and others like them, talk about themselves and the importance they give to similar things, suggests a functional similarity to which the similar structure of their nervous systems predisposes them. Other factors besides the genetical no doubt also contribute to the similarity observed between twins brought up apart. In those pairs separated as children who, like S f 21 and S f 22, have had intimate contact as adults, one might suspect that their common life together had contributed to their developing the same attitudes and values. However, it is possible that the similarity of monozygotic twins in brain structure makes it particularly easy for them to communicate with one another and to adopt similar behaviour. Compared with their other sisters, Odette and Fanny [S f 25] find their 'conversation mingles better'. In the absence of other complications similarity may predispose twins to like one another or to react to events in a similar way. It may be true, as we saw in CHAPTER 5, that family disagreements sometimes have repercussions on the S twins' attitudes to one another; and in an earlier study the writer (Shields, 1954b) showed that where the general home atmosphere is disturbed the attachment of monozygotic twins brought up together is likely to be less close than if the home atmosphere is satisfactory. But attraction based on likeness is not just a matter of cultural attitudes to twins. It is seen in the observation, also mentioned in CHAPTER 5, that cattle twins reared apart will, when reunited in the same pasture, very soon be found keeping each other company. Similarities in thought and feeling which one comes across in monozygotic twins are often closely interwoven.

The case histories contain many examples of similarities in temperament.

The twins in CASES S m 8, C m 13 [see p. 131] and C f 11, for instance, all show resemblance in their quick temper, while S m 6, S f 21 and C m 8 are particularly alike in their placidity. Lack of confidence was often expressed in similar terms. Thus Peggy [C f 18] at the end of her booklet writes: 'I sometimes wonder, if we had been parted more, whether I'



(substituted for 'we' which is crossed out) 'would have had more self-confidence and been able to make up my own mind about things more easily . . . I wonder if this is because I'm a twin.' Cecily also makes use of the last page of the booklet (which asks 'Is there anything else you would like to add about yourself?'), writing, in a very similar script to Peggy: 'I . . . have always remained mediocre in everything and never really shone in anything. The main reason for this I know is lack of confidence in myself. I cannot decide whether this is just the way I was born—or because I had a very happy sheltered life as a child . . . —or is it anything to do with being a twin?' On interview, they made a very similar warm, friendly impression, were worrying, conscientious women, devoted to church work (Cecily) or youth work and at one time nursing (Peggy).

As the resemblance in extraversion test score indicates, there was a very considerable likeness in sociability and related traits and interests.

CASES S m 5 and S m 6 form an interesting contrast, the twins in the former being both strongly extraverted, in the latter introverted. S f 9 (reunited for the first time by the investigation) proved to be alike in their extraverted, cyclothymic disposition. Both had taken part in amateur dramatics (they liked comical parts), had shown an ability for salesmanship and were alike in other traits, including talkativeness, excitability and fondness for animals. It is interesting that in three instances among the separated pairs where one twin took a leading part in an organization such as the Women's Rural Institute or the Townswomen's Guild, the other twin was similarly active [see CASE HISTORIES S f 12, 17, 24]. Though it cannot be claimed that both did so quite independently, it is interesting that both twins found these activities congenial and were elected on to committees by their colleagues. By way of contrast, Mary and Nancy in CASE S f 21 attend local Chapel functions, but cannot be persuaded to do anything more active than help with washing the tea dishes.

Temperamental traits of another kind were seen in CASE C f 29 where the twins were alike in their reserve, suspicion and seeming stupidity (they did better on the intelligence tests than one might have suspected). They did not think it necessary to fill in much of the personal and family information requested in the booklet. They believe in 'keeping themselves to themselves'. Asked what sort of thing upsets them most, they both mention (without prompting and interviewed separately) being blamed for things and being taken for granted. As an example of having the same ideas, they give the following: If one says to the other, 'I don't think I like Mrs. So-and-so any more', the other twin will say she has had the same feeling too. They both claim to be house-proud and lay much stress on the value of money. Though their own lives are close, even by standards of identical twins, they accuse their other sisters of being 'cliquish'.

The following further examples may show how alike the twins could be in their tastes and interests.

In S m 13 both twins are musical, they 'love nature and simple things', they like drawing, they play chess. In S m 8 both have collected brass, like making silver paper ornaments, have won prizes in flower shows. In C m 8 both have taken an interest in cooking and rug-making and they enjoy Italian opera. Eric and Balfour [C m 14] have similar realistic tastes in books and independently showed some interest in archaeology; both have won prizes for growing roses, and Balfour is a very keen sweet-pea grower. In C m 10 both twins have recently taken up oil painting and both play wind instruments.

Though the interests of the female twins are on the whole not very varied, various similarities stood out, social interests having already been mentioned. Perhaps more than most, the twins in CASE S f 19 were interested in their clothes and their appearance ('The first thing you think about if you're a woman is your figure'—Herta). Both developed artistic leanings early on and wish there were more scope in their present lives for singing and dancing. At one time Herta entertained in her own restaurant, singing songs and accompanying herself on the guitar. Berta once danced on the stage when younger and has lately taken part in a bathing beauty contest. In C f 2 both twins include reading the Bible and singing among their interests (they sing together in harmony). Olive and Madge [S f 8]

expressed very similar tastes in music and reading; one mentioned the *Messiah* as her favourite work, while it so happened that a copy of the *Messiah* lay on the top of the other twin's pile of music when I visited (the twins at that time not communicating with one another in any way). One mentioned Tchaikovsky's first piano concerto as a special favourite, the other Rachmaninov's second. S f 5 are alike in their fondness for the ballet and classical music. In S f 20 both take particular pride in their love and knowledge of flowers; in S f 21, by way of contrast, neither has taken any interest in gardening or the countryside, though they are both country dwellers and one of the husbands is a fruit grower. In S f 24 both twins have special interests and abilities in teaching, writing and organizing. At 40 both twins in CASE C f 14 keep up their enthusiasm for cycling. On the other hand the twins in CASE C f 4 (more sedentary than C f 14, in keeping with their plump build) are at 30 the youngest members of the Whist Club on their housing estate. In several pairs both twins took an interest in welfare work in some degree, for example one twin collecting for the blind on flag days, the other driving polio patients to a social club (C f 23); in C f 28 among others both twins kept up an interest in the Girl Guides. Mention of interest in dancing (when younger), needlework, watching television and, of course, in the family was so frequent that resemblance between twins in such matters is not worth special mention.

Other resemblances claimed and/or observed in the lives of the twins relate to such things as their taste in dress [e.g., S f 11], the way the women run their homes [e.g., S f 13], the sense of responsibility shown by the men in their work [e.g., S m 12, where both twins emphasize the high expectations they have of those who work under them]. In S f 16 both twins are very conventional in attitude and fond of using clichés. On the other hand, in S m 8 both twins are less concerned than most about social standards.

Occupational and social level are sometimes related to personality traits in which the twins are alike.

In S f 5 both twins are above average in intelligence and have risen in social level; in S f 17 both have reached a similar social level (sending their children to independent schools, for example) in spite of an initial difference between them in background and education. In S m 14 both twins have gravitated to similar jobs in the motor industry, involving the issuing and checking of spare parts. Hardly unusual in the case of Hubert who comes from the industrial Midlands, the choice of occupation is more surprising in Brian with his rural background. There is no reason to suppose he copied Hubert. In S m 13 traits of personality led to a deterioration of social level in both twins, who are rigid and forgetful: Victor as a night porter earns less than he received before the war in tips alone; Patrick has given up his jeweller's shop and restricts his work to repairing watches at home with only his wife to help, instead of four assistants as formerly.

One's personal impression of the twins supported what the intelligence tests showed objectively, namely a close resemblance in intellectual qualities. To take extreme cases, in case S f 24, for instance, both twins are highly intelligent and show some ability as writers. In pair S f 26, the twins make a very dull impression and have poor memories.

Information about special abilities and weaknesses in school subjects was asked for in the booklet. Though the data obtained are not necessarily accurate, nor given in a form that makes a comparison of the twins easy, it did appear that there might be a fairly general resemblance in this. For instance, there were fifty pairs in which both twins mentioned arithmetic (or mathematics) as being either a best or a weakest subject. In twenty-three both members of the pair gave it as one of their

best, and in eighteen one of their weakest, subjects, while in nine cases one member claimed to be relatively good, the other relatively poor at arithmetic. There were forty-one concordant pairs as against an expectation of 20.53 on the whole material.  $\chi^2$  of 26.62 with 1 D.F. is highly significant. Resemblance appeared to be greater in the control pairs than in the pairs brought up apart, where differences in teaching methods and in the personality of the teachers may well have affected the twins' preferences.

Drinking habits were enquired about in the booklet. Though not easily analysed quantitatively (most subjects, especially the women, admitted to only occasional drinking, if any), the impression is that the findings are somewhat like those for smoking habits [CHAPTER 14]. This would be in keeping with the findings of Kaij (1960).

In S m 15 Ron and Ben are both very heavy drinkers of cider. Both twins in pairs S m 8 and C m 9 have been moderately heavy drinkers at one time or another. C m 5 and S m 14 are alike in that both twins are virtual abstainers. In S f 15 they both like an occasional short drink, Joan whisky, Dinah rum.

The sex lives of the twins as a rule could not be investigated with any thoroughness, but when the subject was gone into various similarities in behaviour and attitude were noted.

In S f 19 (brought up without contact) both twins claimed an innocence in sexual matters until a late age. One of them at 17 was kissed by a man she thought she loved, fancied she must be pregnant, developed a pseudocyesis and made an attempt at suicide by cutting her wrist. The other twin at 20 was 'completely innocent and had no idea what sexual relations were', although she had had frequent flirtations and one serious engagement. When she became pregnant at that age she induced an abortion at 5 months. In this pair and in many others there are similar descriptions of premenstrual tension. In C f 2 and 3 both twins complain of frigidity, but their attitudes to this were rather different, the twins in the former pair being alike in that both were much concerned about the fact, while in the latter they were indifferent. In C f 9 both twins complained of sexual frustration. In C f 14 the twins both enjoy their sex lives and like to tell less fortunate neighbours (and their other sister) what they miss. In C f 21 both twins had 'hundreds of boy friends' before marriage. At 36 both members of pair S f 10 are single. In S f 25 both twins married widowers. In C f 29 both remarried when their first husbands died. Among the men both twins in S m 12 complain of decreasing libido; in S m 14 and in C m 14 libido was always low in both. In C m 9 both are highly sexed. For Basil sex is '99.9 per cent. of marriage' and when away from home he has extramarital relations; his twin's many sexual affairs resulted in divorce and he is now living with the wife of a friend.

Easily understandable in light of similarity in voice, expression, temperament and sociability is a similarity of rapport when interviewed by the same investigator. The present writer feels that there is something distinctive about the personality resemblance of certain twins that is almost diagnostic of monozygosity. This is necessarily a subjective judgement. More than anything, the evidence for this opinion comes from a close similarity in many aspects of how they talk and in the rapport they make. As a rough estimate, perhaps about 20 to 25 per cent. of MZ pairs are sufficiently alike in personality for this alone, in the absence of other information, to make dizygosity very unlikely. In so far as this distinctive

resemblance is related to facial expression, it is not entirely independent of physical features, but it is quite as much a matter of the general flow of speech and a similarity of thought processes as suggested by odd similarities in content. In the final determination of zygosity in the present study such considerations were, of course, excluded.

In CASE C m 8, for instance, immediately after the interview and before the serological and dermatoglyphic findings were available, it seemed to the writer that the pair would probably turn out to be monozygotic, partly in view of observations of this kind. Though often mistaken for one another when younger, they were no longer quite so alike that one could unhesitatingly exclude dizygosity. Cuthbert had grown a moustache, which contributed to the difference in appearance. On PTC testing it appeared that Maurice identified weaker solutions as having a more definite taste than Cuthbert, though not more so than a few other pairs that are certainly monozygotic on all other criteria. However rapport was extraordinarily similar. They were both shy, serious, undemonstrative, unforthcoming at first. They were very interested in the results of the tests and wanted to check up exactly where they had gone wrong on the Dominoes. They spoke in very similar terms of the effect on them of being brought up in an institution between the ages of 8 and 15, and they described their tastes in music (especially Italian Opera) in very similar ways. In spite of various differences there was a qualitative similarity in personality greater than I had come across before in dizygotic twins. It transpired that likelihood of dizygosity on the basis of sex and blood groups was 0.0362 and their finger-prints were well outside the range of dizygotic pairs.

Some similarities of voice are frequently observed in dizygotic twins and in pairs of sibs. These may be in part genetically determined too, but in so far as they relate to such things as regional or cultural accent the environment must of course be all important. In the other aspects of personality mentioned in this chapter, dizygotic twins also are sometimes alike, but the impression is that they diverge rather more often than monozygotic twins. They sometimes differ in such a variety of characteristics that members of their families or other lay observers are apt not infrequently to sum up by saying that DZ twins are 'totally unlike in nature' or 'completely different in their ways'.

The observations made in this chapter should not be taken to imply that monozygotic twins are all strikingly alike in all the respects mentioned. The ratings of resemblance, the analysis of causes of differences and, above all, the case histories give some indication of the relative importance of the resemblance: in some pairs it is slight. The present chapter has aimed at no more than communicating what appeared to be the kind of resemblance that seemed typical or particularly notable. The classification is admittedly imprecise and no attempt is made at systematic objective measurement of such things as mannerisms or thought processes, or to test the significance of the degree of resemblance reported. It could be objected that almost any pair of individuals will be alike in some odd way and that it is all too easy for twins to pick on such coincidences and to exaggerate others so that the twin investigator is easily taken in. The very fact that twins often enjoy elaborating on their similarities is itself of interest; but, so far as possible, examples of actual behaviour in the past or observation of behaviour during investigation was sought to substantiate any loose claims of likeness, even if it was sometimes difficult to

reach precision in formulating the significance of the likeness. The results of the personality questionnaire substantiate the fact of resemblance in a more objective way.

### *SUMMARY*

From the clinical evidence, an attempt has been made to illustrate the more important respects in which MZ twins reveal a similarity in personality. These include various aspects of mannerisms, voice, temperament, sociability, interests, abilities (including mathematics) and, occasionally, of occupational level. There seemed to be a similarity in their sexual behaviour. There may be some resemblance in drinking habits. Thought processes and feelings were sometimes reported as being much alike. Rapport on interview was often similar, and in some pairs similarities, for example in the way of talking, revealed a likeness which seemed almost peculiar to monozygotic twins. However, it is difficult always to be precise, and the similarities described must be seen in the context of both similarities and differences.

## ENVIRONMENTAL ANALYSIS

### EARLY DIFFERENCES BETWEEN SEPARATED TWINS

#### *EXTENT OF CHILDHOOD SEPARATION AND ASSOCIATED RESEMBLANCE IN PERSONALITY AND INTELLIGENCE*

In CHAPTER 11 we took the pairs that differed most and tried to see what were the most likely environmental causes of the differences. In this chapter we examine specific environmental or developmental differences and see how they are related to the other findings.

CHAPTER 5 described the varying degrees of environmental separation experienced by the twins brought up apart. Let us first see whether those pairs that were parted earliest or whose families differed most tended to be less alike than the others, and similarly whether those twins who had most contact or whose social backgrounds were most alike tended to show the closest resemblance. We can compare the subgroups in which we are interested with one another, and with the separated twins as a whole, in respect of resemblance in total personality (Author's Ratings) and in mean intra-pair difference on the intelligence tests and the extraversion and neuroticism questionnaires.

This has been done in TABLE 21. The total S group has been divided into three in respect of age at separation. Various subgroups mentioned in CHAPTER 5 are then shown: the eight pairs where the twins were reunited in the same home some time during childhood; the twelve pairs where the twins had the least amount of contact, which can be compared with the fourteen pairs where the twins mostly attended the same school; and two classes of pair in which the family or social environments might be presumed to have been less alike than in the remainder. Detailed statistical analysis is not warranted. Inspection of the table should show whether any of the variables have a clear or consistent effect on intellectual or personality resemblance.

So far as Author's Ratings are concerned, the resemblance grades are not distributed in any very meaningful way between the various subgroups. There is no hint of an association between age at separation and extent of resemblance. If pairs separated at birth or early infancy may be a trifle less alike than those separated a little later on, pairs first parted between the ages of two and nine years contradict the early environmental hypothesis, for this small group shows a scarcity of pairs closely alike in personality. Twins having least contact as children are on the whole *more* alike than those who went to school together. When one or both twins were adopted, the pairs tended to be just as alike as when both were brought up within the same extended family. Even the ten pairs that experienced the largest social

TABLE 21. DEGREE OF SEPARATION AND INTRA-PAIR RESEMBLANCE: SOME INTERNAL COMPARISONS

<i>Degree of Separation (MZ Pairs*)</i>	<i>Distribution of Personality Resemblance Grades</i>								<i>Psychological Tests Mean Intra-pair Difference in Score</i>			
		<i>I</i>	<i>II (a)</i>	<i>II (b)</i>	<i>III</i>	<i>IV</i>	<i>Total Rated</i>	<i>Not Rated</i>		<i>Extra- version</i>	<i>Neuro- ticism</i>	<i>Intelli- gence (Com- bined Tests)</i>
<i>All Separated Pairs (44)</i>	Number Per cent.	9 22	6 15	10 24	11 27	5 12	41 100	3	Number tested Mean difference	43 2.5	43 3.1	38 9.5
Separated at 3 months or earlier	Number Per cent.	4 17	5 22	5 22	6 26	3 13	23 100	1	Number tested Mean difference	23 2.4	23 2.6	21 9.6
Separated between 6 and 22 months inclusive	Number Per cent.	4 36	1 9	3 27	1 9	2 18	11 99	1	Number tested Mean difference	12 2.8	12 4.5	10 9.2
Separated at 2 years or later	Number Per cent.	1 14	0	2 29	4 57	0	7 100	1	Number tested Mean difference	8 2.4	8 2.2	7 9.0
Reunited during childhood	Number Per cent.	1 13	1 13	4 50	2 25	0	8 101		Number tested Mean difference	8 3.8	8 3.9	7 7.3
Twins with least childhood contact	Number Per cent.	4 33	3 25	2 17	1 8	2 17	12 100		Number tested Mean difference	11 2.4	11 2.5	12 13.6
Twins mostly at same school	Number Per cent.	2 14	0	4 29	5 36	3 21	14 100		Number tested Mean difference	14 3.2	14 3.2	13 8.1
Twins not brought up within same family network	Number Per cent.	6 43	1 7	1 7	4 29	2 14	14 100		Number tested Mean difference	13 2.5	13 2.5	13 12.0
Twins with largest social or cultural differences in background	Number Per cent.	1 10	3 30	1 10	4 40	1 10	10 100		Number tested Mean difference	9 2.7	9 3.1	9 13.8

\* Including S m P 4 and S m P 9.

or cultural differences (i.e., those mentioned in CHAPTER 5 where the families differed notably in culture, occupation or religion) were not much less alike than the average S pair.

The more important case histories from this point of view bear this out. On the one hand, S m P 4, separated at birth and living, the one in an Anglo-Chinese environment, the other in a middle-class suburb, were extraordinarily alike in their history of dull intelligence, behaviour disorder and eventual psychosis; and S f 9, adopted by different families and remaining in ignorance of their twinship until they came to be investigated, were nevertheless amazingly alike in their talkativeness, emotionality, interests in acting and looking after pets and their part-time occupations as door-to-door canvassers. On the other hand, in spite of being separated only until the age of 5, CASES S f 15 and S f 24 differed in important ways, and the three pairs not separated until 7, 8 or 9 years [S f 12, 11 and 29] were graded as II (b), III and III respectively.

Looking next at the Self-Rating Questionnaires we again find that twins separated earliest and those with the least mutual contact are quite as alike in extraversion as any other group. Those differing most are the twins that were reunited and those that went to school together. This finding is consistent with the suggestion, based on observations of the control-twin differences, that contact between the twins can encourage differentiation in certain traits of an extraverted kind [see CHAPTER 11]. The neuroticism differences are not very informative, but tend on the whole to run in the same direction as those in extraversion.

Unlike the various measures of personality resemblance, the mean intra-pair differences in combined intelligence test score do vary consistently in the direction expected on the early environmental hypothesis. The greatest difference in intelligence was seen in the pairs with the greatest difference in social background and those having the least contact in childhood, while the smallest difference was observed in the pairs that were reunited during childhood. Even the small differences between the three age-at-separation groups run in the expected direction.

### *Conclusion*

There was some sign of association between degree of environmental similarity in childhood and within-pair difference in intelligence; but early age at separation and lack of contact between the twins did not make for greater differences in personality. Indeed the internal comparisons offer some support to the view that the proximity of monozygotic twins can encourage differences in extraversion.

### *EFFECTS OF SPECIFIC SOCIAL ENVIRONMENTAL DIFFERENCES IN CHILDHOOD*

In relating such factors as age at separation to difference in personality and intelligence we have been making between-pair comparisons. Many of the environmental factors in which we are interested can be more readily analysed by means of within-pair comparisons. For instance, we can take pairs in which one



only of the twins was brought up as an only child, and examine the findings to discover whether the only child tended to be more or less intelligent, better or less well adjusted, than his twin brought up along with other sibs.

### *Mental Health Ratings*

From the life histories of the twins brought up apart, it was difficult in every case to say with confidence which twin had enjoyed the better psychiatric health. Nevertheless in the interests of the analysis of the material an attempt was made to do so in all except two of the pairs where personality resemblance ratings were made. (S m 5 and S m 15 were too alike for a decision to be reached.) In sixteen pairs there was not much difficulty in deciding, and it is hoped that errors in assessing the remainder have not been too frequent to render the attempt useless. Social adjustment and freedom from neurotic traits were taken into account in making the mental health ratings. Intelligence test scores were not considered specifically, but relatively large differences in intelligence probably entered into the rating to some extent [TABLE 22; see also TABLE 33 for control group Mental Health Ratings].

TABLE 22. RELATIONSHIP OF MENTAL HEALTH RATINGS TO DIFFERENCES ON THE OTHER TESTS

<i>S Group: Twin with Poorer Mental Health Rating (n = 39*)</i> <i>(definitely poorer MHR in brackets, n = 16)</i>				
	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	12 (3)	1	25 (13)	1
Extraversion score	13 (5)	6 (2)	19 (9)	1
Neuroticism score	20 (12)	3	15 (4)	1

\* 2 pairs had equal MHR; 3 pairs not rated (booklets only).

We can now examine those specific environmental differences which occurred relatively frequently in the material with a view to discovering whether a twin, subjected to a particular influence when his co-twin was not, tended to be (1) more intelligent, (2) more extraverted, (3) more neurotic according to the SRQ or (4) to have a poorer mental health rating than his co-twin.

### *Separation from Mother*

In twenty-six pairs one twin remained with his own mother, the other being taken at some time during infancy or early childhood by a foster or adoptive parent, whether within the same family network or not. Whatever similarities or differences there may have been between the homes in which these twins were brought up, those remaining with their mother might be expected, on balance, to

have had a better opportunity in their earliest years of forming a secure mother-child relationship in a normal family setting. The hypothesis that the twins remaining with mother would enjoy better mental health or have a lower neuroticism score than their partners is not borne out, however, by the findings. Various reasons why this should be so emerge from what follows.

TABLE 23. TWIN BROUGHT UP BY OWN MOTHER, COMPARED WITH CO-TWIN BROUGHT UP ELSEWHERE

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	13	—	11	2
Extraversion score	14	4	8	—
Neuroticism score	17	2	7	—
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>	<i>Not Rated</i>
Mental Health Rating	13	1	10	2

The eight pairs where one twin was breast-fed while the other was bottle-fed did not suggest any association between breast-feeding and test results or ratings.

#### *Age of Mother-figure*

In twenty pairs there was a difference of 10 years or more in the ages of the 'mothers' who looked after the twins. These are eleven pairs where a grandmother took one twin and nine in which one twin was taken by an elderly aunt or foster-parent. There was no tendency for the twin with the older parents to be more intelligent or to be more neurotic; but the twin who had the younger parents was inclined to be more extraverted, which seems plausible. Taking the seventeen pairs that differ in both extraversion and age of mother, the ratio observed, 3:14, is statistically significant at the 0.05 level;  $\chi^2$  (Yates) = 5.882. The twin with the younger mother had a mean extraversion score of 11.800, the twin with the older mother-figure a score of 10.075. The intra-pair difference of 1.725 points was significantly different from zero according to the *t* test ( $t = 2.35$ , D. of F. 19,  $p < 0.05$ ).

TABLE 24. TWIN BROUGHT UP BY MOTHER-FIGURE AT LEAST 10 YEARS OLDER THAN THAT OF HIS CO-TWIN

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	10	—	10	—
Extraversion score	3	3	14	—
Neuroticism score	8	—	12	—
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>	<i>Not Rated</i>
Mental Health Rating	11	1	8	—

*Only Child*

For present purposes we have counted as an only child any subject who, after separation from his twin, was brought up in a home with no other sibling within 10 years of his age. There were twenty-seven pairs where one twin was brought up in such circumstances, while the other member of the pair was brought up along with at least one sib or foster-sib. There was no significant tendency for the only child to be more intelligent, as might have been expected if the generally found negative association between family size and intelligence were largely due to the greater amount of stimulation which only children receive from adults. More marked, however, is the tendency in this material for the only child to be the less extraverted and less neurotic.

TABLE 25. TWIN BROUGHT UP AS ONLY CHILD, CO-TWIN WITH OTHER SIBLINGS

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	14	—	11	2
Extraversion score	8	3	15	1
Neuroticism score	7	2	17	1
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>	<i>Not Rated</i>
Mental Health Rating	9	1	15	2

*Size of Sibship*

In eight of the pairs analysed in the above paragraph there was a difference of between four and nine in size of sibship. In two further pairs there was a difference of the same magnitude, though neither child was the only one in the family. Though the environmental difference must have been very marked in these ten pairs, the tendencies observed above show up much less clearly.

TABLE 26. SIBSHIP MUCH SMALLER THAN THAT IN WHICH CO-TWIN WAS BROUGHT UP (DIFFERENCE BETWEEN FOUR AND NINE IN SIBSHIP SIZE)

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	5	—	5	—
Extraversion score	3	2	5	—
Neuroticism score	3	1	6	—
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>	<i>Not Rated</i>
Mental Health Rating	4	—	6	—

*Step-parent in the Home*

In six pairs [S m 3, 9, 14; S f 5, 18, 29] one only of the twins was brought up with a stepmother or stepfather. In four of these cases difficulties in the

twin-step-parent relationship were reported, but the effects do not show up on statistical analysis.

### *No Father-figure in the Home*

No differences emerge from the analysis of this factor.

TABLE 27. TWIN BROUGHT UP WITH NO FATHER-FIGURE, CO-TWIN HAVING A 'FATHER' IN THE HOME

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>
Intelligence score	4	—	4
Extraversion score	4	—	4
Neuroticism score	5	—	3
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>
Mental Health Rating	2	1	5

### *Urban-rural Difference*

In eleven pairs one twin was brought up in a town, while the other was brought up for part of his childhood in the country or in a much smaller town. Once again the differences are very small. The town-bred twin may have done better on the intelligence tests, but he tended to fare less well according to neuroticism score and Mental Health Rating.

TABLE 28. TWIN BROUGHT UP IN COUNTRY, CO-TWIN IN TOWN

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>
Intelligence score	4	—	7
Extraversion score	4	3	4
Neuroticism score	3	—	8
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>
Mental Health Rating	4	—	7

### *Social Class*

When the occupations of the fathers were classified according to the Registrar General's classification of Social Class, twenty pairs showed differences. The twin brought up in the lower class was significantly more often the more neurotic member of the pair on the SRQ.

The probability of getting the ratio 15:2 by chance is less than 0.01;  $\chi^2$  (Yates) = 8.471, 1 D. of F. The mean neuroticism score of the nineteen twins from the lower social class was 12.342, that of their twins from a higher social class being 10.237. The mean intra-pair difference of 2.1 points differs significantly from zero ( $t = 2.97$ , D. of F. 18,  $p < 0.01$ ).

TABLE 29. TWIN BROUGHT UP IN LOWER SOCIAL CLASS

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	7	1	10	2
Extraversion score	10	2	7	1
Neuroticism score	15	2	2	1
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>	<i>Not Rated</i>
Mental Health Rating	11	—	7	2

It will be shown in another section [p. 120] that there is also a general association, present in both S and C groups, between social class and neuroticism. Since the association is so marked in the above intra-pair comparison of MZ twins brought up apart, it is likely to be environmental in origin.

The findings as regards Mental Health Rating go in the same direction. If only those pairs are counted who showed a distinct difference in mental health, we find that, in seven out of eight pairs differing in social class of parents, the twin from the lower class was the less well adjusted. There was little or no tendency for the twin from the lower class to do less well on the intelligence tests or to differ in extraversion.

#### *Psychiatric Abnormality in Parent*

Next let us examine some of the factors that might have a harmful psychogenic effect on a child. First, let us take the presence in the home of one twin only of a parent with psychiatric abnormality. There are twelve cases where something of the kind may have happened. The four clearest cases are: S m 1, mother of Richard chronically anxious, unable to go out; S f 13, mother of Olga, brutally aggressive—also psychopathy among the sibs; S f 19, father of Herta, manic-depressive with unstable personality; S f 21, mother of Nancy, psychosis (? presenile) first manifesting itself in personality disorder. Only in S f 19, and to a lesser extent in S m 1, does the case history suggest a connection between abnormality in the parent and greater abnormality in the twin. In S f 13 Olga adjusted relatively well to the home situation, while Viola had an understandable fear of being returned to her mother.

In other pairs the mental illness of the parent did not occur during the childhood of the twins. Theoretically, the previous personalities of these parents might in some way have been unsatisfactory. Nevertheless in S m 5 the uncle made an apparently good recovery from a psychosis before Fred was born. In S f 5 the father's breakdown occurred only after Megan had left home; however, he seems to have passed on his obsessional personality to both twins. The father in CASE S f 12 also did not break down until later life, and it would be far-fetched to attribute Pauline's greater anxiety to the influence of his pre-psychotic personality. The same applies to S f 25.

Norah's adoptive father [S f 10] had psychopathic traits, but the mother apparently protected her from any influence they might have had on her; and it seems that the adoptive mother of the other twin was a difficult woman. The mother of Edith [S f 14] was moody and changeable; she moved house twenty-seven times in Edith's early years. This doubtless contributed towards Edith's difficulties. The same is true of the nagging stepmother of Alfred in CASE S m P 9, though we may not be entirely justified in calling her psychiatrically abnormal. In S m 13 the twin brought up in the home of the ill-tempered and occupationally unstable father did less well socially.

TABLE 30. TWIN WITH GREATER PSYCHIATRIC ABNORMALITY  
IN PARENTS

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>
Intelligence score	5	—	7
Extraversion score	8	1	3
Neuroticism score	8	1	3
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>
Mental Health Rating	7	1	4

Over the group as a whole there was only a slight tendency for the twin with the psychiatrically unstable parent to be handicapped compared with his co-twin.

#### *Psychologically Poorer Environment*

The presence of minor personality abnormality in the parents, quarrels between the parents, bad relationships between parent and child and similar factors which might be harmful for healthy development of the personality are difficult to assess objectively and are often related to one another. Rather than analyse each separately, it seemed more appropriate to select all pairs where factors such as these were present in only one member of a pair, or present to a greater degree. There were twenty-two such pairs (including many of those analysed in the previous section), of which the following may serve as further examples:

CASE S m 14. Hubert's stepfather drank, and there were frequent quarrels, witnessed by Hubert, between him and the mother.

CASE S m 15. In Ron's home there was less quarrelling and discipline was better than in Ben's.

CASE S f 5. Megan was looked after by a housekeeper, then by foster-parents before father remarried when she was 20 months and took her home. The stepmother is sensitive and reserved, and she suppresses information about her being a stepmother. Megan had a more restricted adolescence than Polly. Also she had to leave elementary school at 14, while Polly went on to central school till 16.

CASE S f 12. Not separated till 7, Sally was unhappy in her new home, and her uncle did not like her.

CASE S f 16. Clara's mother used to nag and 'would not let her grow up'.

CASE S f 17. Jacqueline's uncle was a rigid worrier, her aunt liable to attacks of migraine. Jacqueline felt restricted in her home, while Beryl felt more at ease with her adoptive mother.

It is worth noting that the home into which the twins were born and in which one of them remained was generally poorer than the home in which the other twin was brought up. In seventeen of the twenty-two pairs analysed here one of the twins was brought up in his original home (fourteen by mother, three by father and stepmother) and in all but four cases this was the home that was considered to be the poorer psychologically.

Once again we see, as one would expect, that the twin in the poorer home tended to do less well. This shows up on intelligence score as well as in Mental Health Rating and neuroticism. There is also a slight tendency for the twin from the poorer home to be the more extraverted.

TABLE 31. TWIN FROM PSYCHOLOGICALLY POORER HOME

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>
Intelligence score	7	—	15
Extraversion score	12	4	6
Neuroticism score	13	2	7
	<i>Poorer</i>	<i>Equal</i>	<i>Better</i>
Mental Health Rating	15	1	6

The difference in Mental Health Rating is the greatest so far noted but does not quite reach statistical significance. (On exact test,  $p = 0.0669$ .) The association between kind of home and Mental Health Rating still holds if only pairs with a more marked difference in rating are counted. There are ten such pairs in the group and in eight of them the twin with the poorer rating came from the poorer home.

The chapters on the presumed causes of the differences and on psychiatric illnesses illustrate some of the relationships existing between home background and personality. Two further typical if unspectacular examples may be mentioned here.

CASE S f 9. Lilian's adoptive parents were older, stricter and less sympathetic than Madeline's. Almost the only personality difference between the twins that could be elicited relates to Lilian's schooldays when she remembers being frightened of everyone and at times would sit and cry for hours in class.

CASE S f 17. Jacqueline, who had the more anxiety-provoking childhood [see above], bit her nails as a child while Beryl did not. As an adult she is the more anxious of the two and (like her adoptive father) a little obsessional.

Though a number of associations, like the above, between environment and behaviour can be pointed out, the reader may well be more impressed by the similarities between the twins in personality development despite the differences in family environment.

#### *Independent Assessment of the Environments*

It could be objected that an estimate by the writer of the likely effect of a given difference in environmental history might easily be influenced by his knowledge

of the outcome of the separation in terms of personality and neurotic traits. In order to obtain an independent assessment of what consequences for personality one would expect from a given separation history, summaries of the forty-one personally investigated S cases were prepared, giving details of the separation of the twins, the age, occupation and personality of parents or foster-parents, and the amount of contact between the twins. Important physical illnesses were noted (except that possibly psychosomatic diseases were excluded), and later environmental differences in occupation, marital status, size of family, etc., were also mentioned. No direct indication was given of neurotic traits or personality resemblance. On the basis of these histories, three colleagues were asked to say how they would expect each pair to differ, other things being equal. In particular, they were asked to say which twin was likely to enjoy the better mental health. A consultant in child psychiatry assessed the histories of twenty-three pairs. The remainder were divided between another psychiatrist and a psychiatric social worker who assessed nine pairs each. In a few pairs no decision could be reached.

As explained in CHAPTER 9, personality could not easily be rated by outsiders. The independent assessments of the environmental histories have therefore been compared with the author's Mental Health Ratings and with the test results.

TABLE 32. TWIN WITH POORER EXPECTED ADJUSTMENT  
(INDEPENDENT ASSESSMENT OF HISTORIES)

	<i>Higher</i>	<i>Lower</i>	<i>Equal Score or Uncertain Assessment</i>
Intelligence score	20	17	4
Extraversion score	13	19	9
Neuroticism score	19	16	6
	<i>Poorer</i>	<i>Better</i>	<i>Uncertain</i>
Mental Health Rating	24	14	3

The comparison with the Mental Health Rating is the one of most interest. Though the findings could easily be accounted for by chance, they are in the expected direction and show a closer relation than that between the environmental assessment and any of the other variables. The ratings by outsiders accord more closely with introversion than with neuroticism as measured by the SRQ.

It can also be noted that in sixteen out of twenty-two cases where the writer thought there was a difference between the homes of the twins in poorness of psychological environment, the ratings of the total histories by outsiders and the opinion of the writer agree as to expected outcome.

No conclusions could be drawn from these findings considered in isolation. They are, however, consistent with some of the observations above which relate environmental factors and mental health.



*Interrelation of Environmental Factors*

In interpreting the differences observed so far it should be stressed that most of the factors we have analysed are closely related to one another. This is because the circumstances of the separation of the twins were alike in many of the pairs. Thus, the twin who remained with mother tended to have the younger mother figure, since the other twin was usually taken by a grandmother or elderly aunt. The twin remaining with mother also tended to be brought up with other sibs, his partner as an only child. Similarly, the twins differing from their partners in presence of father, town environment and lower social class were more likely than not twins that had been kept by the mother. The mother's home tended to be the poorer psychologically [p. 109]. There was also a tendency for the mother to keep the lighter-born and more delicate twin [p. 113].

As a case example we may mention S f 14.

Edith was brought up in the home of her own parents. The father was a tailor's cutter (class III). There were six other sibs in the home and the mother favoured the younger brother. Edith resented comparison with her physically stronger twin, Millicent, who was brought up nearby as an only child by her grandparents (grandfather, master tailor, class II) and aunts who were clerical Civil Servants. Unlike Millicent, Edith had neurotic symptoms as a child and young adult, but in personality she was a little livelier than Millicent who is single, works as a Civil Servant and still lives with her aunt. On the Self-Rating Questionnaire, what little difference there is shows Edith to be the more extraverted and more neurotic of the pair.

*Conclusion*

From an analysis of family structure, social background and a number of other factors of possible importance psychologically, intelligence seems to be singularly little affected by the various differences in environment. Neuroticism and Mental Health Ratings usually agree in the direction of any observed difference. The pattern that most commonly emerges is for the twin remaining with the mother and other sibs to be the more extraverted of the pair, but to be more neurotic than the twin brought up as an only child, by older parents and in rather better social circumstances. While it is difficult to disentangle all the variables, we may note that the largest differences occurred in the pairs that differed in age of parent (the twin with younger parents being more extraverted,  $p < 0.05$ ), in socio-economic class (the twin from the lower class being more neurotic,  $p < 0.01$ ) and, less significant statistically, in poorness of psychological environment (the twin from the poorer home having the worse Mental Health Rating). This last finding was given only slight support when the environments were rated by colleagues in ignorance of the personality or psychiatric history of the twins.

## DEVELOPMENTAL AND OTHER FACTORS

In this section we examine the effect of differences in which we can consider the control as well as the separated twins. Mental Health Ratings were therefore made for the control group. Their relation to differences in the other tests was as follows:

TABLE 33. RELATIONSHIP OF MENTAL HEALTH RATINGS TO DIFFERENCES ON THE OTHER TESTS

*C Group: Twin with Poorer Mental Health Rating (n = 37\*)*

	<i>Higher</i>	<i>Equal</i>	<i>Lower</i>	<i>Not Tested</i>
Intelligence score	16	—	15	6
Extraversion score	14	6	17	—
Neuroticism score	23	4	9	1

\* 5 pairs with equal MHR, 2 pairs not rated (booklets only).

Comparing this with the corresponding table for the S group [TABLE 22] there is no association with intelligence and agreement with neuroticism is closer. In the combined material the twin with the poorer MHR had the higher neuroticism score in forty-three pairs, the lower neuroticism score in twenty-four ( $\chi^2$  [Yates] = 4.821,  $p < 0.05$ ).

Differences between twins were noted in the following: birth order, birth weight, birth difficulty, rate of early development, size in childhood, childhood health, school achievement, leadership in childhood (control twins), present height, present weight, age at menarche, age at marriage, adult economic status, adult health and which twin volunteered first to take part in the investigation. Differences occurring in each of these variables were related to differences occurring in others and, particularly, to differences in intelligence, extraversion, neuroticism and Mental Health Rating.

A rigorous statistical analysis of the data could not be carried out since the amount of information available differed greatly both as between pairs and between variables. What was done was to take most variables two by two, omitting cases which did not give information as to differences in both factors. S and C groups were examined separately and, if they behaved consistently, then combined to give agreement-disagreement ratios for the hypotheses under investigation.  $\chi^2$  was applied to test whether the ratio differed significantly from 50:50.

For example, information as to a difference between the twins in birth weight was available in twenty-seven S pairs (one pair stated to have weighed the same, no information in sixteen pairs) and in thirty-four C pairs (three weighed the same, seven not known). Information as to difference in present height was available in thirty-seven S pairs (six the same, one uncertain) and in thirty-six C pairs (eight the same). Examining the hypothesis that the heavier twin at birth will tend to be the taller now, there was information as to difference in both variables in twenty-two S pairs. In seventeen of these the heavier born was the taller now, in five the heavier born was the shorter. There was a similar tendency in the twenty-nine C pairs giving information on this point, in twenty-one pairs the heavier born being the taller, in eight the shorter. The combined ratio was 38:13. With Yates' correction,  $\chi^2$  of 11.296 with one degree of freedom was significant beyond the 0.01 level.

Associations between birth weight, size in childhood and present height were all highly significant, the ratios for 'heavier birth weight, bigger child' being 36:5,

and for 'bigger child, taller now' 34:5. Association between these variables and present weight was not significant.

### *Birth Weight*

Birth weight was not associated with test score differences, except that in the S group the heavier born tended to be the less neurotic (17:7,  $p$  almost = 0.05). There was no such tendency in the C group. In the S group the heavier born tended to be the twin who was taken by a relative, while the mother kept the lighter (14:5, bordering on significance at the 0.05 level). However, birth weight was not associated with differences in social class or psychological environment in the S group. Birth weight and physical size were associated with childhood leadership in the C group, and this in turn was associated with extraversion. This has been discussed in CHAPTER 11 [p. 85].

### *Height*

Differences in present height were not associated with psychological test differences in any general way. But it is odd that the taller twin should have been the more intelligent in the S group (22:11) but not in the C group (11:18)—difference between S and C group significant at 0.05 level. This was not accounted for by social class differences within the S group. There was no marked tendency in the present material for the twin brought up in a higher social class to be the taller or heavier at the time of the investigation.

### *The Heavier Twin*

The heavier twin at time of investigation tended to be the more extraverted (45:25,  $p < 0.05$ ); this could be regarded as in keeping with views associating body build and extraversion. More difficult to explain are associations bordering on significance, and present equally in S and C groups, between heavier weight and lower intelligence score (38:22) and between heavier weight and better Mental Health Rating (45:28).

### *Birth Difficulty*

Twin births are liable to be difficult. Some authorities (e.g. Rosanoff *et al.*, 1941) consider that differences between monozygotic twins are often due to the birth injury of one of them. Information indicating that one twin was more endangered at birth than his partner was available in only sixteen pairs, five S and eleven C. For example, in S m 7 the mother was taken to hospital after the birth of the first twin and the second twin, when born, was 'black and blue' and almost given up for dead. No general tendency could be shown for the twin who had the more difficult birth to be less intelligent, more neurotic or less well adjusted than his partner. He was more introverted in nine out of thirteen pairs that differed in extraversion-introversion. He was the heavier at birth in only two out of twelve cases, but this difference may be due to difficulty in distinguishing between low birth weight and

birth difficulty. An association between the two is well established, for instance in premature babies. There was no association detected between birth difficulty and birth order, though other studies show that when one of twins is still-born it is more likely to be the second than the first born.

The evidence of the present investigation, such as it is, does not support the view that the birth itself is often of critical importance as a cause of intra-pair differences. A prospective study, based on carefully recorded data from maternal hospitals, would be of interest.

#### *Rate of Early Development*

Though differences were inquired about systematically, little information could be obtained on this point from the separated twins and not much more from the controls, so that a detailed analysis is not warranted. According to what information we have, the twin who was reported as being the more advanced in passing the milestones of development was likely to be the heavier at birth, the bigger child and the leader of the pair later on.

#### *School Achievement*

Such differences, generally small, were reported in twenty-one S and thirty-two C pairs. The two groups are not quite comparable since the former includes pairs where one twin had greater educational opportunity. Eight of the S pairs differing in school record also differed in social class of parent, the twin from the poorer home having the poorer educational achievement in seven of them. The control pair differences relate to such points as these: 'one twin in higher class than the other for one year', 'one twin usually a little higher up the class', or 'one twin did a little better in the eleven-plus examination'. When we compare 'better at school' with 'higher intelligence score now' the association is much closer in the S group (19:2) than in the C group (18:13) where random elements probably entered into the scholastic and test differences to a greater extent. This is in line with our other findings which relate intelligence to interfamily differences.

There was no detectable association within pairs between school achievement and extraversion or neuroticism or birth weight, but there was a slight tendency in both groups for the twin who did less well at school to have the lower Mental Health Rating (30:19 in total material). It seems reasonable to regard the twin who makes less use of his innate intelligence as being less well adjusted.

#### *Childhood Health*

Twenty-five S and twenty-nine C pairs were known to differ. The differences, particularly in the C group, were sometimes marginal. Plotting the twin who was thought to have enjoyed the better childhood health against differences in birth weight, size in childhood, present height, school achievement and the intra-pair differences on the psychological tests, nothing of interest emerged. The twin with the better health tended to be the leader in the C group (16:7) and to come from a socio-economically better home in the S group (8:3), but neither of these

ratios is significantly different from 1:1. Some of the more outstanding health differences are mentioned in CHAPTER 14.

### *Age at Menarche*

Information as to which twin was the first to menstruate was more reliable in the C than S group, since in the former the twins were living together at the relevant time.

In seven out of twenty-six C pairs for which we had information on this point, the periods are said to have started within a month or two in the two twins. In three other pairs there was stated to have been little difference, and in eight pairs the interval was probably between 2 and 6 months. The remaining eight pairs differed by intervals ranging from 6 to about 15 months. In twenty-two pairs there was a statement as to which twin was the first.

In the S group there is information from both twins in nineteen pairs, but the interval was difficult to determine. It was probably 6 months or less in about nine pairs. In the other ten pairs the twins stated different years for onset of menstruation. These include two differences of about 18 months, two of 2 years, one of about  $3\frac{1}{2}$  years [S f 22, menstruation commencing at 12 in one twin and not till 15 or 16 in the other], and one of about 4 years [S f 13 at aged 13 and 17]. In fifteen S pairs there was information as to which twin was the earlier.

On account of the uncertainty of the information, considerable caution is needed before one can conclude that the different childhood environments of the S twins caused them to resemble one another less closely in age at menarche than the C twins, though this may well be true.

When known differences in age of menstruation are compared with differences in other variables, association is quite random in the case of SRQ score and size. A significant association with intelligence emerges, however. In the S group, the twin who had been the first to menstruate was, when tested in the present investigation, the more intelligent in thirteen cases, the less intelligent in two. In the C group the ratio was 14:5. For the combined material the ratio (27:7) yielded a  $\chi^2$  of 10.618, significant at the 0.01 level. The relationship holds equally strongly when only those pairs with relatively large differences are counted (12:2,  $p < 0.02$ ). There is a suggestion that the degree of difference in intelligence and age at menarche are associated, but this did not reach statistical significance. Grouping menarcheal age differences into 0-1 month, 1-6, 6-12 and over 12 months groups, and omitting pairs where it was not known which twin was first or where intelligence testing was incomplete, an analysis of variance was carried out on thirty-two pairs, giving an F ratio of 1.78,  $p < 0.2$ . However, the measurement of neither variable can be regarded as completely accurate and the more general overall association between intelligence and age at menarche remains.

This is consistent with the finding of Shields (1954a) where, in twenty-one out of thirty-one twins aged between 12 and 15, the sexually more developed was the more intelligent. It is perhaps surprising that such a relationship should hold in

mature adult twins. Tanner (1955) did not know of any reports associating later intelligence and age at puberty in this way, though postmenarcheal girls tend to be more intelligent than premenarcheal girls of the same age. If there are non-genetical factors which retard both sexual maturation and growth of the brain, there is no evidence that they also retard physical growth too, since there was no sign of a general association within twin pairs between differences in menarcheal age and present height and weight.

There is also an association with birth order. For the hypothesis, 'menstruated earlier, first born', agreement:disagreement ratios were S, 9:4, and C, 16:5. The combined ratio 25:9 was almost significant at the 0.01 level ( $\chi^2$  [Yates] = 6.618).

The degree of association between first born and higher intelligence is much less than this, namely 26:17. There is no obvious explanation for the relationship between birth order and menstruation. There may of course be some factor operating here which we do not yet understand, such as, for example, an endocrinological difference influencing perhaps birth order, sexual maturation and (? less directly) intelligence, or the finding might be due to chance despite the large  $\chi^2$ .

There was no association between age at menstruation and birth weight. There is no observable tendency in the S group for the twin from the higher socio-economical background to reach puberty earlier. In the C group there is a slight tendency for the leader to be the more developed physiologically (10:4).

#### *Socio-economic Status*

Present differences in socio-economic status could most easily be assessed by taking into account the information we had on occupation and income. Thirty-three S and twenty-nine C pairs were thought to differ in this respect if only to a modest extent. In these sixty-two pairs the better off twin did not differ from his or her co-twin to a marked degree so far as intelligence, SRQ score or Mental Health Rating were concerned. The largest associations occurred in the S group, where the better off was more intelligent (21:10) and less neurotic (also 21:10; but the C pairs did not show the same tendency or show it to the same degree). Perhaps early environmental differences between the S twins account for this. The S twin from the socio-economically poorer home was usually less well-off as an adult (9:4); and the same was so for the twin from the 'psychologically' poorer home (11:6). In the C group the 'leader' was usually the better off (12:5).

#### *Married First*

Among pairs where both twins were married, there was no tendency for the twin who married first to differ from his or her co-twin in the tests. The childhood leader was the first to marry in ten out of seventeen pairs. Social class, marriage and fertility are also discussed in CHAPTER 14.

#### *Contact Since Childhood*

The fourteen S and eight C pairs in which the twins had least contact since childhood were examined to see whether they tended to be any less alike than the

others. This was not so in the case of extraversion or neuroticism, but in the S group there was an excess of Grade IV cases (S m 3, S m P 9, S f 10, S f 14). The histories suggest adequate reasons for the differences which date from early on, and in three pairs the twins did not see eye to eye.

### *The Volunteer*

There was a tendency, present in S and C groups alike, for the volunteer twin to be more intelligent (36:26), less neurotic (41:26) and more extraverted (39:23) than his partner. This last tendency almost reaches statistical significance. No association was found between the volunteer and the twin who was considered to have enjoyed the better mental health. More often than not it was the childhood leader who sent in the twins' names (15:6). It is possible to regard the control twins as more typical volunteers than the separated twins who, on account of the special appeal made for twins brought up apart, had more incentive to send in their names. As noted previously, the controls as a group were also more intelligent, less neurotic and more extraverted than the separated twins. These observations may be of interest in suggesting how volunteers in other investigations might be expected to differ from those who do not volunteer.

### SUMMARY

The findings in the first part of this chapter were summarized on pages 102 and 111. The principal findings of the second section were these:

Differences in weight at birth, size in childhood and present height (but not weight) were all significantly interrelated. As reported in CHAPTER 11, leadership in childhood was related to these and also extraversion. The twin who was heavier tended to be the more extraverted and possibly the less intelligent and better adjusted of the pair according to the Mental Health Ratings. Within-pair differences in birth difficulty, rate of early development, childhood health and school achievement have been discussed. Differences in schooling between twins brought up apart appeared to be related to their performance in intelligence tests later on.

Within-pair differences in birth difficulty, rate of early development, childhood health and school achievement have been discussed. Differences in schooling between twins brought up apart appeared to be related to their performance in intelligence tests later on.

It is possible that the S twins differed more in age at first menstruation than the C twins. The first-born tended to be the first to menstruate, and there was a highly significant tendency for the twin who menstruated earlier to do better on the intelligence tests. The reason for this is obscure.

Possible relationships between differences in test score, differences in adult socio-economic status, age at marriage, amount of intertwin contact since childhood and in which twin it was who volunteered first to take part in the investigation have also been examined. None of the findings was statistically significant, though a tendency was noted for the volunteers to be more intelligent, more extraverted and less neurotic than their partners.

## SOME ASPECTS OF THE LATER HISTORIES OF THE TWINS

### *MARRIAGE AND FERTILITY*

There was no detectable difference in the marriage rate for S or C twins. Out of forty adult pairs in each group, there were four S and three C pairs where one twin was married and the other twin single. In three S pairs but in no C pairs both twins were single. In the remaining pairs both twins were married.

Among pairs where both twins were married, intra-pair differences in age at marriage varied only slightly from group to group, but in the expected directions. Thus mean difference in age at marriage was 4·0 years for the S twins (or 3·0 if the two pairs, S m 14 and S f 25, showing extreme differences of 24 and 14 years respectively, are omitted), but only 2·6 years for the C twins. In the DZ group the mean difference was 3·4 years.

Similarly there was a slight but non-significant tendency for the C twins to resemble one another more closely in size of family than the S twins; but the S twins were more alike in this respect than the DZ twins. Intra-class correlation coefficients for number of live-born children (adult pairs) were: forty C pairs,  $r = +0.55$ ; forty S pairs,  $r = +0.36$ ; twenty-five DZ pairs,  $r = +0.21$ . Families were, of course, not all complete, but degree of incompleteness was similar in each group.

So far as they go, these findings could be regarded as showing an influence on age at marriage and fertility of both genetic constitution and early upbringing.

Analysing the intra-pair differences of the monozygotic pairs, it seemed largely a matter of chance which twin had married first and, as reported on p. 116, the first to marry did not differ systematically from his or her co-twin on the tests. Nor could difference in number of children be linked up with any of the other variables. In the individual case, the inability of one twin or her spouse to have children could be a source of unhappiness. There was, however, no tendency for one of a pair of twins to be sterile (freemartin effect), as some of the subjects had feared.

It is sometimes supposed that the decision to marry is a particularly hard one for twins on account of the intimacy of their relationship with one another and the feelings of loss experienced by the twin who does not marry first. While this may sometimes happen\*, it is not the usual experience for twins to react in this way—

\* CASE C m 12 [see p. 87] could possibly be interpreted in this way, and in C m 14 [p. 88] one twin claimed he married because the other twin did. There is also an instance [C m 7] where one girl was courted for a while by one twin, but rejected him because he could not make up his mind, and later on married his twin brother. A pair in which the close relationship between female twins made marital adjustment difficult is referred to in the chapter on psychiatric illness [p. 132].



or at least any temporary difficulties of this nature are not frequently recalled in retrospect. Kallmann and Bondy (1952) found no excess of single persons among twins.

The pairs differing in marital status deserve some comment.

CASE S f 7. One twin is happily married but a somewhat anxious mother. The single twin, once engaged to a foreign serviceman, does not expect to marry now. She is more affected in manner than her twin [see p. 91].

CASE S f 8. The single twin, brought up as an only child, was over-dependent on her adoptive mother. The other twin married against her mother's wishes and, though not a maternal woman, had two children. On follow-up she was discovered to be divorced, so that the twins are now both unmarried.

CASE S f 14. The twin who was brought up by the grandmother and maiden aunts did not marry. The other twin suffered from a neurotic depression in the early (war-time) years of her marriage. She sends her only son to boarding school. (Grade IV.)

CASE S f 16. As in S f 7, the single twin was a little more affected in manner than her married sister. Possessive adoptive parents may have prevented her marrying.

CASE C m 4. The one twin has only recently been married. The single twin is more dependent on his mother. (Age 23.)

CASE C m 12. The bachelor twin [see p. 87] is much more reserved and solitary in his habits. He said he did not marry because he had to look after his mother; also he had a duodenal ulcer. (Grade IV.)

CASE C f 28. The twin who remained single and has a responsible secretarial job is the more conventional and worrying. Her sister lived many years in India; she sustained severe facial burns; she became the mother of triplets of which two died at 11 months, while the third had encephalitic malaria with residual hemiplegia and a behaviour disorder for which he was referred for Child Guidance treatment. This twin, now retired, is less conventional and more impulsive than her single sister and claims that she has now 'given up worrying'.

It is worth noting that the above group contains two Grade IV pairs and none in Grade I. CASE C f 28 illustrates how a difference in marital status can predispose a pair to differ in other ways besides. Though one may not generalize from such small numbers, it is also interesting that in two of the female pairs the married partner of a twin who had remained single was thought in some ways to be less than usually maternal.

### *Summary*

Small differences between S, C and DZ groups were found in intra-pair resemblance in age at marriage and number of children. These have been discussed. Brief descriptions have been given of pairs in which one twin was single, the other married.

### *OCCUPATIONAL CLASS*

The impression was obtained that the S group belonged as a whole to a rather lower socio-economic class than the C group. This showed up when the present occupations of the twins or their husbands were compared, but an analysis of the occupations of the fathers according to the Registrar General's classification of Social Class did not reveal any significant difference. However, the S parents had often done less well in their particular occupations, and economic hardship or poor

social conditions were among the reasons why some of the twins came to be parted. A further reason why the control twins tended to be better off than the separated twins might be the fact that the former were generally living in the Outer London area, while the latter came from all parts of the country.

Almost half the twins were brought up in a Social Class III background. The others were fairly evenly divided between Classes I and II on the one hand and Classes IV and V on the other.

Test scores of the MZ twins have been grouped according to social class of the home in which the twins were brought up. Individuals from Social Class I had a mean score of 76.00 on the combined intelligence tests compared with the remainder whose mean score was 58.55; but there was no consistent or marked decline from Class II to Class V.

Neuroticism score showed a steady increase from Class I to Class V. The fourteen individuals in Social Class I had a mean neuroticism score of 7.68 points, the thirty-three in Class II a mean of 9.12, the seventy-six in Class III a mean of 10.92, the twenty-six in Class IV a mean of 11.13, and the twenty-two in Class V a mean of 11.39. As noted on p. 68, the twins brought up apart were as a group more neurotic than those brought up together, and this showed up in all social classes. Eysenck (1957), investigating a large stratified sample of the general population by means of a short questionnaire, found a small but significant association of the same kind as this between neuroticism score and class. Though the wording of the questions could possibly have a different significance for people of different social backgrounds, it is worth noting that psychiatric disorders, including those of a non-psychotic kind, are reported by the Registrar General to occur relatively more frequently in persons of Social Class V. Interpretation of social class differences is always hazardous. It can, however, be said that the association in the present material between test score and class is environmental in nature; for, as reported on p. 107, where one twin was brought up in a lower social class than his partner, he generally had a higher neuroticism score.

No clear association between extraversion score and social class could be demonstrated.

The size of the intra-pair differences in the various tests was also analysed according to social class, but without positive result. In other words, MZ twins both brought up in Social Class I or II were not significantly more or less alike than those both brought up in Social Class III or in Class IV or V, so far as intelligence, extraversion or neuroticism were concerned.

Intra-pair differences in social class are another matter and have been analysed in a general way in CHAPTER 13. As might be expected there was a slight tendency within S pairs for the twin who was brought up in the socio-economically poorer home to be the less well off now, and for the S pairs to differ a little more widely in present socio-economic status than the C pairs, but neither tendency approaches the level of statistical significance. In the C group female twins could marry husbands who differed quite widely in occupation.

There were some S pairs where differences in home background had an understandable effect on, among other traits, the relationship of the twins to each other. They are balanced, so far as numbers are concerned, by other pairs where, despite fairly large early social differences, the twins were much alike in outlook and became very fond of each other.

In the former class the following can be mentioned:

CASE S m 11. The twin whose home was of better standard regards himself as more a man of the world than his (actually more intelligent and less neurotic) brother.

CASE S f 3. The twin from the more prosperous home feels guilty at having had a better chance in life, and some of her attempts to advise her sister are resented.

CASES S f 14, 23, 18. In these pairs the twin brought up in the lower social class feels inferior to or jealous of her sister or has thwarted social ambitions.

CASE S f 16. The twin from the better-off home feels relatively cool towards her 'humbler' sister.

CASE S f 29. Childhood differences were increased by a large social difference between the twins' husbands. The poorer twin senses the disapproval of her sister's relatives when she visits.

On the other hand, in CASES S m 6 and 14 and S f 12, 17, 19 and 25 the twins developed a close feeling for one another, although brought up in homes differing in occupational class. Differences in social background could show up in ways other than the mutual relationship of the twins. It was sometimes the case that the twin from the higher social class seemed to be the more reserved of the pair.

Similar comments could be made regarding the control pairs so far as adult differences in social class are concerned.

### *Summary*

As a group the C twins belonged to a slightly higher social class than the S twins. SRQ neuroticism score increased inversely with social class of parent, i.e., the higher the social class of the subject the less neurotic, according to the test. Some effects of intra-pair differences in social class on the personal relationship between the twins have been described.

### *SMOKING HABITS*

In a communication to *Nature* in 1958 concerned with the controversy over smoking and lung cancer, Sir Ronald Fisher used provisional data from the present investigation and from twins collected in Germany by Professor von Verschuer.

A detailed analysis of the German data from Tübingen, Berlin and Frankfurt-am-Main has recently been made by Todd and Mason (1959). There were fifty-two MZ and thirty-two DZ pairs. Using several different definitions of a smoker, concordance was found more frequently in monozygotic than in dizygotic twins. Proximity of residence did not appear to exercise any marked influence in leading both twins to be smokers or both to be non-smokers.

Earlier in 1959 Friberg, Kaij, Dencker and Jonsson published the results of an investigation into the smoking habits of Swedish twins. Their subjects formed the

greater part of an unselected series of twins previously ascertained from the birth records of Lund University Hospital by Essen-Möller. Fifty-nine MZ and fifty-nine DZ pairs were studied, each group consisting of twenty-one males and thirty-eight females. Classifying the pairs into regular smokers, sporadic smokers, former smokers, and other non-smokers, there was a significantly greater proportion of concordant cases within the MZ than within the DZ group.

In the present study the twins were asked in the booklet, 'How many cigarettes do you usually smoke in a day?' This information was then confirmed or further elucidated in personal interviews with the majority of the MZ pairs. After converting the occasional pipe-smokers' consumption of tobacco into the equivalent in cigarettes, the subjects were grouped as follows: non-smoker, 1-5, 6-10, 11-15, and 16 or more cigarettes per day. Excluding children, there was information on both members of eighty-four MZ (forty-two C and forty-two S) and twenty DZ pairs. Pairs in which both twins fell into the same group were regarded as being closely similar in smoking habits, those in which the twins fell into neighbouring groups as fairly similar and those in which they were less alike as dissimilar, with the following result:

TABLE 34. SMOKING HABITS

	<i>Percentage of Pairs</i>			
	<i>MZ</i>			<i>DZ</i>
	<i>S</i>	<i>C</i>	<i>Total</i>	
Closely similar	67	50	58	35
Fairly similar	19	31	25	35
Dissimilar	14	19	17	30

There were not many heavy smokers. In CASE S m P 4 both twins were assessed as 'very heavy'. In CASE C f 17, both twins smoked twenty-five a day. In S m 11, S f 15 and S f 22, both smoked twenty. In S f 10, one twin said she smoked over twenty, her partner about three a day. One of the DZ twins smoked twenty-five to thirty, her partner ten. Both twins in S m 6 used to smoke forty to fifty a day when in the army but smoke only twelve or fourteen a day now.

Pipe-smokers were few. One pair stands out in the writer's memory: as Hubert and Brian [S m 14] left the interview together they took out of their pockets pipes of similar shape and lit up. The twins in S m 5 both like rolling their own cigarettes. In C f 28 both express a preference for small cigarettes. Ninety-five subjects, mostly women, were non-smokers. There was no important difference in resemblance between male or female pairs.

However it is subdivided, the material gives no suggestion that their different early environment and relatively less mutual contact have led the S twins to differ more in their smoking habits than the C twins. Indeed the S twins were the more

alike. As in the German and Swedish series, monozygotic pairs were more alike than dizygotic pairs. Classifying the twins simply as either smokers or non-smokers, as did Fisher (1958), the resemblance within the combined MZ group reported in TABLE 35, was very highly significant ( $\chi^2 = 20.698$ ,  $p < 0.001$ ), while the distribution within the DZ group could not be closer to random expectation. In the general environmental circumstances of these investigations there is, therefore, a very strong presumption that the genetically determined constitution enters into the reasons why people differ in their taste for tobacco.

TABLE 35. SMOKING HABITS

	Number of Pairs		
	MZ		DZ
	S	C	
Both non-smokers	18	10	4
One smoker, the other non-smoker	9	12	10
Both smokers	15	20	6
Total	42	42	20

We can only speculate as to how this comes about. Smoking may not be very different from other social and personal habits or preferences, in which, on the whole, MZ twins are more alike than DZ twins. The genetical element may be nothing more than a reflection of other features of personality, partly under genetical control. Given a similar level in sociability, anxiety, suggestibility, idealism, or whatever personality traits may influence our smoking or non-smoking habits (see Eysenck *et al.*, 1960), twins might well be expected to be alike also in this respect. On the other hand, it is possible that, in some cases at least, there are biochemical factors which play a more direct part in determining our like or dislike for tobacco and the effect, soothing or otherwise, that it has on us.

As in the other studies of smoking habits in twins, there is a sizable proportion of monozygotic twins who do not conform. They deserve a brief mention.

CASE S m 8. Ted, who says he smokes ten a day but from observation may well smoke more, is a town dweller, and is more unreliable, restless and in poorer physical condition than his countryman twin brother who is a non-smoker.

CASE S m P 9 (10, 0). The psychiatric subject is the smoker (Grade IV).

CASE S m 14 (15-20, 10). Both smoke cigarettes and pipes. Though 'discordant' on our classification, there is in fact little difference in habits. Hubert says he can't afford more than ten a day.

CASE S f 10 (20+, 3). The heavier smoker is a more complex character and less placid than her twin (Grade IV).

CASE S f 13 (20, 10). The heavier smoker is thinner, more worrying, says she cannot eat solid food.

CASE S f 20 (8-10, 0). The smoker is the more anxious.

CASE C m 2 (8, 0). The smoker was the leader, is more physically developed, earns more (age 17).

CASE C m 5 (almost 10, 0). The non-smoker 'never developed the taste for it'.

CASE C m 6 (20, 10). The twins differ in many respects besides smoking habits (Grade IV).

CASE C m 8 (15-20, 0). The smoker is the more neurotic.

CASE C m 13 (12, 0). The non-smoker gave up at his wife's request.

CASE C m 15 (7 + pipe, 0). The non-smoker joined the Christadelphians and does not approve of smoking.

CASE C f 5 (20, 0). The smoker started the habit when suffering from an anxiety neurosis. She is the more tense and restless of the pair.

CASE C f 7 (7, 0). The more obsessional is the non-smoker.

The reasons for the differences are various, but they are often associated with greater anxiety in the smoker. The group contains more than its share of Grade IV cases and none in Grade I.

### *Summary*

The S pairs were no less alike in smoking habits than the C twins. As in other studies on the subject, MZ pairs were significantly more alike than DZ pairs. The possible nature of the genetical basis of smoking has been discussed briefly and the MZ pairs differing most in smoking habits have been described.

## *PHYSICAL HEALTH*

The life histories of the monozygotic pairs could diverge considerably in respect of physical illness, but the Separated did not differ markedly from the Control group in this respect.

Among childhood illnesses, scarlet fever was notable in that in as many as ten control pairs one twin contracted it while the other did not. Discordance in infectious illnesses later on, though very common, was of importance only in a few pairs, for instance in cases where only one of the twins suffered from chronic bronchitis.

Fractures, head injuries, burns and other injuries, occasionally severe, were generally discordant, though in a few pairs both twins seemed to be accident prone (e.g., S f 27 and a control male pair which was concordant for motor-cycle accidents).

Minor menstrual disturbances, including premenstrual tension, were often alike, but gynaecological operations, including hysterectomy, generally differed. So, too, did the occurrence of more than one miscarriage, the birth of a child with congenital malformation or the necessity for delivery by Caesarean section. In S f 5, however, toxæmic pregnancy occurred in both twins, while one had five miscarriages followed by the birth of monozygotic twins, the other a child by Caesarean section that died with spina bifida.

TABLE 36 lists most of the complaints mentioned by the twins and the frequency with which they were alike or unlike. Among serious conditions that differed were congenital syphilis with partial blindness, cerebral atheroma with partial deafness, disseminated sclerosis with personality change, and cancer of the breast.

TABLE 36. SOME PHYSICAL ILLNESSES REPORTED BY MZ TWINS

*(with concordance:discordance ratios)\***Conditions Never Concordant*

Various alleged heart conditions—mitral stenosis, ? myocarditis, systolic murmur, ? V.D.H., weak heart after tonsils or mastoid, 'strained heart' at 16—(0:7); rheumatic fever (0:6); paralysees—three facial palsy, one each disseminated sclerosis and partial paralysis ? origin—(0:5); 'glands of neck', removed or ? T.B. (0:4), also mastoiditis 2 cases both discordant; multiple miscarriages (0:4); parent of malformed child (0:4); delivery by Caesarean (0:3); slipped disc (0:3); peritonitis (0:2); ? thyroid disorders (0:2); thrombosis—legs—(0:2); black-outs (0:2); constipation—specially mentioned—(0:2); Bright's disease (0:1); cancer of the breast (0:1); cerebral atheroma (0:1); congenital syphilis (0:1); diabetes (0:1); diverticulitis (0:1); heat stroke (0:1); lipoma (0:1); meningocele (0:1); undescended testicle (0:1); vascular spasm (0:1).

*Conditions Sometimes Concordant, but at Least Twice as Often Discordant*

Fractures, head injuries, burns and other accidents (3:21); chest infections—bronchitis, pneumonia, etc.—(2:13); various other infections—e.g., cystitis, glandular fever, malaria—(2:12); gynaecological operations (4:14); appendicitis† (4:10); nose and throat troubles other than tonsils—e.g., nasal polypus—(3:6).

*Conditions as Often or Nearly as Often Concordant as Discordant*

Hernia (3:5); piles, varicose veins, varicocele (3:5); gastric complaints (6:9); eye complaints (9:13); ear complaints (4:5); tonsillectomy (9:9); ? allergic disorders (10:10)‡.

*Conditions More Often Concordant than Discordant*

Rheumatism, excluding rheumatic fever (16:13); minor menstrual disturbances, etc. (7:1); anaemia (?11:2); headaches (?); dental troubles (5:1); jaundice (2:1); high blood pressure (3:2); cystinuria (1:0).

\* These relate to pairs. Thus a ratio of 3:5 means that there were three pairs in which both twins had the condition (six individuals) and five pairs in which only one had it (five individuals).

† In three S pairs [S m 4, S f 10, S f 19] both twins are said to have had the appendix removed within 1 or 2 years of one another, knowing nothing of the other twin's medical history.

‡ The ? allergic complaints that were concordant comprise two cases of asthma (both controls), three of migraine and one each of urticaria, hives, recurrent heat spots and allergies to brazil nuts or cat's fur. Discordant were two cases of asthma (both separated), four of hay fever (though in some of these diagnosis was doubtful and others may have been partially concordant), one of psoriasis (in a subject who also had asthma and a thyroid disorder, S f 18) and two other skin disorders (doubtfully allergic).

Concordant illnesses include one apparently clear-cut genetical condition: in C m 7 both twins developed stone formations between the bladder and kidneys requiring surgical intervention at the ages of 23 and 34 respectively. Among other kinds of complaint in which the twins were often alike were disorders of vision, minor physical deformities, tonsillectomy (probably about as often concordant in di- as in monozygotic twins), and a variety of complaints that are thought sometimes to be psychosomatic or to mask a neurotic disorder. These include various allergies, rheumatism (but not rheumatic fever) and gastric complaints. Three concordant instances of what was probably peptic ulcer are reported among the separated males [S m 11, 12 and possibly 6] while two male controls [see pp. 87–8] were discordant. Anaemia and headaches were also often alike, but not alleged heart complaints. The importance the subjects laid on complaints such as these or, alternatively, their pride in never having to consult their doctor, was frequently thought to be associated with personality.

The general picture of a rather greater difference than resemblance in respect of most specific illnesses in twins is what one would expect from work done on unselected series of twins (von Verschuer, 1958). Though monozygotic concordance rates are higher than dizygotic concordance rates in a large number of internal medical conditions, the actual percentage of pairs that are concordant rarely exceeds 50 per cent. It is, for instance, 56·8 per cent. for diabetes, 33·3 per cent. for bronchial asthma, 28·4 per cent. for rheumatoid arthritis, 25 per cent. for peptic ulcer and 17·4 per cent. for cancer, according to von Verschuer.

No consistent differences emerged when those twins who were thought to have enjoyed the better adult health were compared with their partners as regards differences in the tests and other variables.

### *Summary*

Some of the ways have been examined in which the life histories of monozygotic twins can diverge as regards physical health. The popular view that identical twins suffer from the same illnesses at the same time was not found to be true.



## PSYCHIATRIC DISORDERS

### *SEPARATED TWINS*

#### *The Psychiatrically Ascertained Pairs*

Two pairs came to our notice on account of one of the twins being under treatment in a psychiatric hospital and have already been mentioned by Slater (1961) in his Maudsley Lecture. One of these [S m P 4] turned out to be concordant for schizophrenia and also for a number of other disorders—low intelligence, enuresis, fire-setting and repeated conviction for stealing. Onset of schizophrenia occurred at the same age in both—22. Though Nicholas' illness was a little more florid to begin with, symptomatology was quite as similar as that of most concordant monozygotic twins brought up together (cf. case histories in Slater, 1953). This is all the more remarkable in view of the different external environments experienced by the twins who were separated at birth. It is true neither had a normal home at first—Herbert was in an orphanage for the first 5 years, Nicholas in three different foster-homes—but their experiences cannot have been very similar. At 5 they first met and were evacuated together, but they never got on well; they were in the same foster-home for not more than a year and have only met occasionally since the age of 7. Since then they were brought up in very different environments, Herbert in a semi-Chinese home in Limehouse and South London, Nicholas in the home of a building contractor in the outskirts of Greater London. The possible precipitating factor in the breakdown of each twin was an event which turned his attention to his family background—in Herbert's case the return of their mother from America, in Nicholas' his meeting with his twin, already mentally ill. Although it was at first thought by some of those who treated Herbert that his might be a case of hysterical pseudodementia in a young man of low intelligence, subsequent developments leave little doubt that in each case the illness is a genuine schizophrenia. Factors in the early environment may have contributed to the twins' predisposition to enuresis and behaviour disorder, and one may speculate as to whether their propensity for setting light to paper may not have developed during the short period when they were together. Nevertheless their striking resemblance in personality and symptomatology is strong evidence of the importance of genetical factors. Concordance for schizophrenia in monozygotic twins has been reported to be 76 per cent. (Slater, 1953) or 86 per cent. (Kallmann, 1950). It is interesting that concordance seems to be no lower in monozygotic twins brought up apart in childhood [see CHAPTER 2].

The other psychiatrically ascertained case [S m P 9] was a patient diagnosed

as suffering from 'hysteria in psychopath (early environment)' while his monozygotic twin has not shown any obvious psychiatric disorder. Even with twins brought up together discordance for hysterical illness is the general rule (Stumpfl, 1937; Slater, 1961). In this particular case it seems reasonable to attribute the difference to the early home background of the twins. Of the pair, only the patient experienced child neglect in the earliest years and an unhappy home life from the age of 2 onwards. The neurotic disorder for which he was treated took the form of a prolonged disability in walking, arising out of a minor injury to his heel which he says he sustained at work and for which he hoped to get compensation. In personality he was decidedly more anxious and paranoid than his twin brother, but the psychopathic features in his make-up were not very marked. However, it was of interest that on follow-up the unaffected twin, a bus driver, had developed a functional inability to talk, lasting only a week or two, following an accident in which someone had been killed. Although the proband came to our notice through a psychiatric hospital, there are others among the volunteer twins who in one way or another would be regarded as equally abnormal; some of them also received psychiatric advice.

#### *Other Pairs*

One of the twins in S m 3 is disabled by epilepsy, his pathological slowness rather than his fits, which have been controlled for some time, making it impossible for him to keep a job; at the age of 19 he is regarded as unsuitable for rehabilitation. His first known fit was at the age of  $2\frac{1}{2}$ . At 14 he entered an epileptic colony for 2 years. His twin has been free from fits and disorders of behaviour, but his E.E.G. shows epileptic spike and wave on photic stimulation [see p. 168]. Discordance for epilepsy is not uncommon in monozygotic twins. Speculation as to the causes of the difference usually centres on the birth process in the first instance. Concordance, however, is more common (Conrad, 1935; Lennox and Jolly, 1954), and in CASE S f 22 we have an example of this: both twins are reported to have had epileptic fits in childhood, though it does not seem that their very close personality resemblance is a consequence of this.

CASE S f 23 is discordant for disseminated sclerosis and for emotional and socially difficult behaviour which is evidently the result of this. Mackay and Myrianthopoulos (1958) in a preliminary communication found at least twenty-two out of twenty-nine MZ twins to be discordant for this disease. We have no grounds for implicating any particular environmental circumstance with the difference between the twins in our case.

Turning to more functional disorders occurring among the separated volunteer twins it is not very helpful to discuss these in terms of concordance and discordance since it is such an arbitrary matter where one makes the dividing line. Among the pairs that are most alike is S f 26 where both twins have had breakdowns in their 40's or 50's with depression and tenseness for which mental hospital treatment was advised. They are both of low intelligence, are extremely anxious, restless and

easily startled and have both at one time or another shown choreiform movements. Perhaps even more alike, though less notable psychiatrically, are the S m 15 twins, also of dull intelligence but both unruly when children and later on heavy drinkers of cider; the burden they have been to their families makes their classification as borderline psychopaths not unreasonable. Alike in their psychopathic traits are the twins in CASE S m 13; they are both liable to violent rages which, combined with their very rigid personalities, forgetfulness and lack of sociability, seem to have led in each to some deterioration in occupational level. The twins in S f 7 are very much alike in their anxious, emotionally labile personalities. More interesting psychiatrically is CASE S f 15 which shows a striking resemblance in neurotic symptomatology, both twins being frequent attenders at their respective doctors' surgeries with anxiety and hypochondriasis. The twins in S f 13 are alike in neurotic traits of an obsessional and hysterical kind and they have both complained (apparently quite independently of each other) of a globus hystericus and have both had hospital investigation for various symptoms with essentially negative results; however there is quite a big difference in the degree of neurotic disturbance in that Viola's fear of eating solids has become chronic.

CASE S f 8 could also be regarded as showing a basic similarity of an hysterical kind. In S f 11 the twins have both had minor psychiatric troubles but not of a particularly similar kind. Molly, at the age of 12, living in unhappy circumstances apart from her twin of whom she was fond, had spells of depression. During the war she was treated for fears of being left on her own, which cleared up when her husband was taken off night-duty. Dorothy on the other hand has been liable to sudden bouts of depression since a total hysterectomy at the age of 32.

CASE S f 28 could not be fully investigated, but the suggestion from the history of depression and loss of energy in one twin and of a spell of overactivity in the other might perhaps indicate a common cyclothymic basis; it was not clear whether the later behaviour of the second twin ('she does and says such unaccountable things that I sometimes think her mind is warped') is to be explained as a psychotic episode or simply as a consequence of the disturbed family relationships that could have been stirred up by Vera's visit to England.

A distinct difference in psychiatric history is seen in S f 14. Edith had various neurotic symptoms in childhood, including sleepwalking; and at 23 and at 27 she complained of burning feelings in the abdomen and weeping spells which, on the latter occasion were diagnosed by a psychiatrist as a neurotic depression. Millicent has not had similar troubles.

More striking are the differences in S f 10, where only Marjorie was a rebellious child, developed homosexual attachments and has had three attacks of amnesia (seen by psychiatrist, diagnosed as hysteria). The twins were not much alike in personality. Also different in psychiatric history, but much more alike in personality [see p. 223], are the twins of CASE S f 19. Only one developed a pseudocyesis and made a dramatic suicidal gesture when she was 18, was 3 months in hospital at 25 with a diagnosis 'commotio cerebri seq., neurosis' and has had subsequent attacks

of depression. Important differences are also seen in S m 8. One twin had a severe stammer. The other absconded from the Home where he was brought up, got in with bad company, has led a very irregular domestic life, has complained of headaches, black-outs and other neurotic symptoms and gives an exaggerated account of himself, amounting to pathological lying. (He said he had been in prison which was untrue.) The twins, however, were alike in their quick tempers and their poor social contacts.

CASE S f 24 is worth mentioning here on account of the almost pathological tendency of Joanna to regard her twin's experiences as her own. She wrote an article for the press in which she described under her own name events which had recently happened to her sister.

The illustrations that have been given include the cases of greatest psychiatric interest in the separated group.

CASES S m 10, 11 and 14 are among those that differ in neurotic traits, but in which it would be misleading to imply that either of the twins had had a definite psychiatric illness or was a psychopathic personality. S f 3, 5 and 21 are among those where one could perhaps be regarded as having had a minor illness, such as a mild reactive depression, well within the normal range.

### CONTROL PAIRS

Since case histories of the control twins cannot be given, it will be of interest to report here some of the psychiatric disorders that these twins showed. On the whole they showed fewer abnormalities than the separated twins.

#### *Neurosis*

Overt illness of a probably neurotic kind occurred in one or both of pairs C f 2, 3, 5, 10, 15, 24. Two of them showed close concordance.

In C f 5 both twins had illnesses in which they complained of anxiety, loss of confidence, depression, fear of crowds and of closed spaces. Pamela at the age of 18 had these symptoms when working under an unpleasant supervisor and was off work for 6 weeks. Caroline, after the birth of her first child while living with in-laws, was under her doctor for a while and continued to have symptoms for 18 months until she was able to move into a house of her own. They are both somewhat tense and anxious in personality. Pamela's son is under treatment for phobias.

The second concordant case is C f 10. One twin is reported as having had a nervous breakdown at the age of 24 which she attributed to feeding her baby born the previous year. She complained of strange bodily sensations and was afraid to lie down or go to bed. Her sister at 36 is suffering from anxiety, unreality feelings and a phobia of travelling. Both twins' illnesses were associated with a loss of weight.

In C f 15 the twin who was interviewed had an illness during the war when her husband was away in which she was afraid to go out and had the idea she might

throw herself and her children under a train; later she had crying spells. Her twin also has a number of fears, but she is not known to have had an illness of this kind.

Carol [C f 2] consulted a psychiatrist at the age of 18 on account of recurrent sexual thoughts that worried her. She is more perfectionist and indecisive than her more aggressive twin who has asthma more severely than Carol.

CASE C f 3 is concordant for hysterical personality, but only Jennifer, the slightly more irresponsible of the two, has had an actual illness. At 21, when living unhappily away from home and unable to face returning to her mother, she claimed she was the victim of an attempted rape. She had sleeping difficulties and may have had cystitis. She fainted and was taken to hospital, but she ran away. Taken back again, she was rude to the matron and generally unco-operative. She felt she had no one to talk to and that everyone was against her. She was sedated and sent home recovered in 2 weeks.

The twins in C f 24 are now a young 51 and very much alike and living together. As children they were both anxious, excitable and closely attached. At the age of 16 Wendy was due to leave school. Imelda was reluctantly going to stay on 3 months longer to finish the dressmaking course when she dislocated her elbow. When this was being attended to at hospital she had an attack of panic. Similar attacks, in which she felt unaccountably frightened and could not bear to be left on her own, recurred. She would run home from school in a panic and did not complete her course. The illness cleared up after about 6 months without active treatment. Though both had tics or chorea as children, Wendy has not had anxiety attacks.

#### *Other Psychiatric Illness*

One of the twins in C f 19 could also be regarded as psychiatrically ill, though probably on the basis of organic changes. Three years ago at the age of 40 Freda had black-outs and dizzy turns and in the next year difficulty in hearing and tinnitus. Hospital investigation revealed some cerebral atheroma. She complains of forgetfulness, and fear of mental illness, always present, has become more marked. Her doctor reports that she has become bland and flat emotionally with some reduction of intellectual capacity. Her twin has also noticed a change in her, saying she has become more depressed.

In C m 6, a pair that diverged in many respects, including hospital investigation of a black-out in one of the twins, a war-time spinal nerve injury suffered by this twin complicates the picture.

#### *Abnormal Personalities*

Some of the pairs showing traits verging on the psychopathic or with otherwise conspicuous personalities can be mentioned. Among twins that are much alike in this respect is C m 13 where as young men both were in trouble on account of aggressiveness. At 22 Ian felt he had been insulted at work, and started a fight

with the young man concerned. The other man spent two days in hospital with a black eye, while Ian spent a night in the cells and was fined 5 guineas with 5 guineas costs. About a year later Alan started a fight with a Welshman and blacked his eye. The magistrate fined him 7s. 6d. At 51 the twins are branch managers of shops and have both been warned by headquarters for their tendency to get excited if a customer makes a complaint.

As children these twins were both enuretic at least till 10. It is not proposed to refer to childhood neurotic traits in detail [see p. 134], though mention should perhaps be made of twins who both attended a speech clinic for their stammer [C f 6].

Some pairs were alike in manifesting a hysterical personality. C f 3, referred to above, is an example. As children they showed much jealousy and did not get on with their mother. They were sensitive, imaginative and difficult girls. They left home early and in adolescence first one and then the other had trouble with anaemia, fainting turns and loss of weight. Tuberculosis was suspected in Karen's case but not found. In their late teens, after a good many changes, they became very close to one another. They played their young men off against one another and eventually insisted not only on a double wedding but a double honeymoon. They still live next door to one another and prefer each other's company to that of their husbands: 'our husbands get on our nerves'. Sexually they are frigid. They say they enjoy anything creative, but never settle at any one thing for long. 'I have a shallow brain', as one of them says. Their flamboyant hair-styles, their superficiality, their bland indifference and the over-valuation of their twinship all seem part of a hysterical personality make-up. Differences (apart from Jennifer's illness) are mainly small ones of degree.

In C f 11 hysterical traits are also present in both twins, but the difference is more marked. Both showed a lack of perseverance in their school work and in a very unstable early work record—Sylvia had fourteen jobs in 3 years, Susan nearly as many. A tendency to exaggerate was strongly suspected, as when Sylvia described their father's restrictive behaviour with them and when Susan writes 'None' against 'Interests' in the booklet. Their account of physical ailments suggests an ability to play off one doctor's opinion against another's and their account of telepathic experiences, of which they make much, suggests an ability to deceive themselves. They have always been mutually antagonistic and have regarded each other as opposites. Sylvia tried to dominate, but Susan, on principle, would never fall in with her suggestions. Sylvia takes part in many local organizations, activities which Susan finds childish. Sylvia has made quite a good marriage and seems reasonably well adjusted. Susan is the more 'psychic' one—she can 'call' Sylvia from a distance. Sylvia receives the message and comes if she feels so inclined but cannot 'call' Susan. Susan 'heard' her first ghost when aged about 12—she was alone in the house and, having bolted doors and windows, was enjoying a surreptitious cigarette when there were 'footsteps' on the stairs. Many years later she had some press publicity over her reports that her house was haunted, but thought it

too dangerous for the Society for Psychical Research to be called in. Her interests in spiritualism, her dispirited attitude and her stooping posture—as well as her higher neuroticism score—suggest a less well-adjusted person.

Examples also occurred of twins who were alike in their obsessional personality make-up [e.g., C m 5 and 7], their subjective feelings of inferiority [C f 18 and 25], traits of a sensitive, paranoid kind [C f 20 and 29] or their marked talkativeness and emotional lability [C f 21]. In this last pair both twins were expelled from a trade school for misbehaviour. CASE C f 17 seemed to be concordant for hypochondriasis.

Sometimes a basic resemblance in personality could be seen, while in only one twin did behaviour approach a psychopathic level. C m 9 is an example of this. Both twins are of an intelligent, extraverted, independent and rather restless nature, physically active, fairly heavy consumers of alcohol and tobacco and highly sexed ('Sex is 99·9 per cent. of marriage', says Basil). When in the Navy (different stations) both were offenders against discipline, but whereas Basil's heaviest sentence was 21 days' leave stopped, Ernest's was 90 days' leave stopped—he was constantly falling out with his superiors and being sentenced for striking a superior officer, refusing to obey an order or being absent without leave. He has written unpleasant letters to Basil's wife. He is divorced. He has tried working in three different countries overseas and is considering emigrating to a fourth. As Basil puts it, Ernest has no roots. A less extreme example is C m 7 where in only one twin are obsessional traits so marked as to be described as almost eccentric.

In other pairs personality traits, reasonably describable in psychiatric terms, occur in one twin only, the other twin having shown nothing similar, so far as could be discovered. Some of these have been mentioned in the chapter on personality differences [pp. 86–90]. John's depressive and unsociable attitude [C m 12], and Balfour's paranoid traits [C m 14] are cases in point, as is Elizabeth's obsessional superstition and counting rituals [C f 7].

### COMMENT

The above review shows that monozygotic twins can be alike or can differ in most psychiatric syndromes. That neurotic illness fairly often occurs in only one member of a pair is in keeping with the work of Slater (1953 and 1961) and Slater and Shields (preliminary report, 1955). It is perhaps suggestive that illnesses of a probably hysterical kind are conspicuous in the discordant pairs [S m P 9, S f 10, C f 3, hysterical psychopathy in S m 8], while anxiety states account for several concordant pairs [e.g., S f 15, C f 5, C f 10 and possibly S f 26]. Like other personality traits, obsessional tendencies were often present in both members of a pair. But in the following three separated twins there was the suggestion that early upbringing might have been responsible for some degree of difference in this trait:

In S f 5 the twin who is said to be the more thorough, systematic and fonder of routine was brought up by a stepfather described as very conscientious and particular with set ideas. (However it was her sister who had the minor obsessional illness later on.)

In S f 17 the twin who is the more cautious and routine-bound was brought up by an uncle who was a believer in 'everything to schedule', a worrier. She and her uncle both have a step-counting ritual.

In S f 29 the twin brought up by the stern aunt who believed in 'a place for everything and everything in its place' is more bustling and methodical than her sister and is kept awake some nights by recurrent thoughts of her next day's duties.

### *Childhood Neurotic Traits*

An attempt has been made to estimate the resemblance within pairs of various neurotic traits and behaviour disorders in childhood. The analysis can only be a very approximate one, on account of unreliabilities in assessment.

The following traits were usually reported as being concordant: enuresis\* (7 pairs concordant, only 1 discordant); aggressive behaviour disorders (5 concordant: 1 discordant); sleep disturbances other than sleepwalking (5:2); emotional difficulties during adolescence (5:0); backward development (2:0); feeding problem (1:0).

The following traits were about equally often reported as being concordant as discordant: specific fears, anxiety attacks (7:7); nail-biting (6:7); acidosis and other physiological symptoms (3:4); fainting attacks (3:2); fits (1:1); truancy, delinquency (1:1); stammer (1:2); excessive thumb-sucking (1:2).

Discordance was the usual finding in the following: sleepwalking (1:6); tics, St. Vitus' dance, etc. (2:5); overdependency (0:4); crying spells (no other symptoms) (0:3).

Examples of concordance for most of these traits are to be found among the separated pairs as well as those brought up together. However, concordance was in general a little less frequent in the separated pairs, as one would expect. Totalling the pairs positively concordant or discordant for any of the traits listed, we find that twenty-two out of forty-nine S pairs (45 per cent.) are concordant, compared with thirty-one out of fifty-four C pairs (57 per cent.).

The occurrence of more than one trait in an individual adds to the difficulty of further analysis. The general picture is of a fair degree of resemblance between twins in childhood behaviour. It is in keeping with the previous views of the present writer, based on a study of twin schoolchildren, that when monozygotic twins were alike in showing neurotic traits in childhood, these often take a similar form in the two twins. It will, of course, be equally clear that nothing approaching complete concordance is to be expected.

### *SUMMARY*

Two cases of male twins brought up apart came to the notice of the Genetics Unit at the Institute of Psychiatry on account of psychiatric illness. In the first of

\* S m 4, 8 and 12, C m 1, 7 and 13 and C f 15 were concordant for enuresis; C f 19 was discordant, the difference being attributed by the family to an operation for hernia in infancy.



these both twins developed schizophrenia in spite of having been brought up in different cultural environments. In the second, one twin, an anxious personality brought up in unfavourable circumstances, developed a compensation neurosis, while his brother, brought up in happier conditions, was essentially normal. A variety of (on the whole) minor psychiatric illnesses and personality abnormalities was encountered among the twins who responded to the television appeal, occurring both among those brought up apart and those brought up together. The descriptions that have been given show that both groups include some remarkable similarities as well as striking differences. Some of these are mentioned again in the next chapter.

## SUMMARY AND CONCLUSIONS

In CHAPTER 1 the rationale of twin investigations as a means of throwing light on problems of heredity and environment was discussed. The study of differences arising in monozygotic twins brought up apart offers an opportunity for assessing the effects of differing environmental influences, especially those of an inter-familial kind operating during childhood. To this end it seems reasonable to compare such twins with monozygotic twins brought up together. The latter might be expected to show how much one should allow for prenatal, intrafamilial, later environmental and various chance factors, leaving any greater difference among twins brought up apart to be accounted for mainly by differences in upbringing.

General considerations of the complexity of genetical-environmental interaction and difficulty in assessing environmental and personality variables, together with the rarity of twins brought up apart, makes it unreasonable to expect results of any great scientific precision from such an undertaking. Consideration of the literature on the subject [CHAPTER 2] bears this out. Nevertheless the literature includes a number of interesting observations. On the one hand there are instances of close similarity in twins in spite of quite different environments. On the other hand some of the differences observed could plausibly be related to differences in the experiences of the individuals concerned, while others were difficult to interpret. Even in respect of characters such as intelligence, for which there are fairly reliable tests, this was so. The need to do justice to both similarities and differences has been stressed.

It was unlikely that further study of the life histories and personalities of twins brought up apart would in any sense solve the problem of the role of genetics in personality development. It was nevertheless hoped that investigation along the present lines of the relatively sizable group of separated twins which the author was fortunate enough to secure would be of some value. If not succeeding (as Galton put it) in 'weighing in just scales nature and nurture', it should certainly be of interest to view the problem from the perspective which only the study of twins can give.

### *OUTLINE OF THE INVESTIGATION*

As described in CHAPTER 3 the investigation took the form of interviewing and testing, as best one could in the circumstances, forty-four pairs of monozygotic twins brought up apart (the S group) and comparing them with the same number of monozygotic twins brought up together, obtained from the same source—mostly volunteers responding to an appeal made on television—and matched for sex and age (the C group). The ages of the subjects ranged from 8 to 59, but most of them

were women in their 30's or 40's. Two of the S males were ascertained in the course of a systematic investigation of twins treated in a psychiatric clinic. Possible selective factors have been discussed.

Quantitative data were obtained on the following: height and weight; intelligence, tested by means of the Dominoes (a non-verbal test) and the Synonyms section of the Mill Hill Vocabulary Scale; and extraversion and neuroticism. The scores for the latter personality dimensions were derived from a self-rating questionnaire (SRQ), devised by Professor H. J. Eysenck, which was included in a larger questionnaire (the booklet), covering much of the personal history. Information from the booklets could be elaborated on interview with the twins. Of 176 individuals 151 were seen personally by the writer. Seven members of S pairs, some of them living abroad, were seen by colleagues only. In a few pairs only one member was seen. Three S and two C pairs were included where information was from the booklets only. Degree of investigation was similar in both groups. On the basis of all information available, including reports from outside sources, ratings were also made by the author of total resemblance in personality. Various aspects of the histories were analysed.

The investigation, as originally planned, consisted only of the comparison of the S and C monozygotic groups. When it came to obtaining the control group of twins brought up together the available lists of female twins gave little information as to whether a pair was likely to be monozygotic or not. A number of like-sexed but, from their replies, obviously dizygotic twins were written to and were found ready to co-operate. These pairs were sent booklets to complete and in some instances were interviewed. Together with eleven separated dizygotic pairs that had already been investigated there was then available data on twenty-eight DZ pairs (or thirty-two if four further pairs are included where a booklet was completed by only one member of a pair). Selection of these dizygotic pairs was somewhat haphazard and investigation was less thorough than that of the monozygotic pairs, amounting often to little more than the SRQ scores for extraversion and neuroticism. But they do not appear to have been selected for degree of personality resemblance, and it seemed worth while to make use of the information and to compare the findings in this smaller mixed group with those of monozygotic twins, brought up apart or together. In general, findings were consistent with other work on twins from this Unit and elsewhere, a *post facto* argument in favour of this procedure. Subject to certain qualifications the expectation is that the greater the importance of heredity for a trait the greater will be the difference in resemblance between MZ and DZ twin pairs.

Zygoty was determined by the similarity method and in most pairs included full blood-grouping, finger-printing and a physical comparison of the twins side by side. The findings are given and their reliability discussed in CHAPTER 4.

CHAPTER 5 describes the reasons for the parting of the twins in the S group, their ages at separation, the outcome, and various aspects of the different homes in which they were brought up. Some pairs were illegitimate and adopted by different

families. (One of these twins did not know of her twinship until reunited by the present research.) In other cases the death of the mother in childbirth was the cause. More typical were cases in which the health of the mother or other family circumstances resulted in one twin (generally the more robust) being taken by an older relative and brought up in effect as an only child, while the mother kept the other twin, who was brought up along with other sibs, perhaps in poorer social circumstances. More than half the group had been separated by the age of 3 months, but a few cases of late separation were included. A few pairs were reunited during childhood, having spent at least the first 5 years in different homes. The parents of the twins differed quite widely in age and personality. Though the twins in one pair were brought up as far apart as Scandinavia and South America, wide cultural differences between the homes were exceptional. The S group could be subdivided in various ways in order to study the possible effect of different degrees of separation and specific environmental factors.

After discussion of some of the statistical methods which can be used to compare the various classes of twins and derive estimates of the importance of heredity and environment [CHAPTER 6], the presentation of the material continues with the quantitative comparison of the S, C and DZ groups in respect of height and weight, intelligence and personality as measured by the tests [CHAPTERS 7-9]. CHAPTER 10 describes the author's ratings of personality resemblance (in effect, on a five-point scale) and discusses the findings.

CHAPTERS 11 and 12 are more descriptive and clinical in nature and relate to the differences and similarities in personality as they were observed by the writer or recounted by the twins themselves. In CHAPTER 13 the principal environmental differences noted in the histories are related to differences between the twins in intelligence, personality test score and the writer's assessment of which twin had the better mental health record (M.H.R.) These include differences between the early homes of the separated twins, and also various physical and social factors in which the control twins could differ. Marital status, fertility and social class are analysed in CHAPTER 14, as also are the smoking habits of the twins, and a brief account is given of their physical illnesses. In CHAPTER 15 there is a somewhat fuller account and discussion of psychiatric illnesses and personality disorders as they were observed in the material. Conclusions are summarized at the end of each chapter or section. In PART TWO individual case histories of all the S pairs are given, enabling the reader to form a picture of the objective environmental differences and of the similarities and differences between the twins in life history and personality.

### *QUANTITATIVE COMPARISONS*

At this point it may be helpful to draw together the general comparison of the three main groups, C, S, and DZ, in respect of the quantitative traits and resemblance ratings. The following tables show correlation coefficients [37], mean intra-pair differences [38], and the distribution of the differences [39] for physical measurements, intelligence and personality. In each case, findings in the C group

are presented in the first column, this being the group in which one might expect to find the closest resemblance between the twins, i.e., the highest correlation and the smallest difference. The DZ group appears in the last column.

TABLE 37. INTRA-CLASS CORRELATION COEFFICIENTS

	<i>C</i>	<i>S</i>	<i>DZ</i>
Height*	+0.94	+0.82	+0.44
Weight*	+0.81	+0.37	+0.56
Dominoes	+0.71	+0.76	-0.05
Mill Hill	+0.74	+0.74	+0.38
Combined intelligence	+0.76	+0.77	+0.51
Extraversion	+0.42	+0.61	-0.17
Neuroticism	+0.38	+0.53	+0.11

\* The correlations shown here for height and weight relate to the female pairs only and, in the case of the dizygotic pairs, to those brought up together only.

The intra-class correlation coefficient is generally regarded as the best single measure of resemblance between twins in a quantitative trait. On all characteristics assessed in this way the monozygotic twins, whether brought up apart or together, showed sizable correlations:  $r$  was significantly different from zero in all cases. There is little difference between the *S* and *C* groups, and what there is does not always support the hypothesis that the early family environment has a lasting effect on the traits in question. On the other hand correlation between *DZ* pairs was generally much lower. In the case of weight the findings do indeed show that female monozygotic pairs brought up apart were less alike than dizygotic twins brought up together, but the male pairs did not show the same tendency.

Turning to TABLES 38 and 39, the distribution of the differences probably conveys more information than do the means. Both give perhaps some slight suggestion, not generally revealed by the correlations, of a closer resemblance

TABLE 38. MEAN INTRA-PAIR DIFFERENCES

	<i>C</i>	<i>S</i>	<i>DZ</i>
Height	0.509 in.	0.813 in.	1.770 in.
Weight	10.41 lb.	10.50 lb.	17.30 lb.
Dominoes	4.68	5.24	10.88
Mill Hill	2.14	3.39	4.14
Combined intelligence	7.38	9.46	13.43
Extraversion	2.71	2.52	4.72
Neuroticism	2.97	3.10	4.04

The number of cases on which these means are based vary. In the monozygotic groups they range from 34 (Control Dominoes) to 43 (Control SRQ), in the dizygotic group from 7 (Mill Hill) to 25 (SRQ). See CHAPTER 3, p. 32, and CHAPTERS 7-9.

TABLE 39. DISTRIBUTION OF DIFFERENCES  
In percentages (to nearest 1 per cent.)

<i>Trait and Intra-pair Difference</i>		<i>C</i>	<i>S</i>	<i>DZ</i>
<i>Height</i>				
	Under $\frac{1}{2}$ inch	42	21	4
	$\frac{1}{2}$ -1 inch	40	37	20
	1-1 $\frac{1}{2}$ inch	16	30	24
	1 $\frac{1}{2}$ inch and over	2	12	52
<i>Weight</i>				
	Under $\frac{1}{2}$ stone	43	43	28
	$\frac{1}{2}$ -1 stone	25	21	12
	1-1 $\frac{1}{2}$ stone	23	24	16
	1 $\frac{1}{2}$ stone and over	9	12	44
<i>Dominoes</i>				
	0-2 points	35	30	13
	3-5 points	27	27	13
	6-8 points	24	19	25
	9- points	15	24	50
<i>Mill Hill</i>				
	0-1 point	50	24	14
	2-3 points	28	34	57
	4-5 points	17	18	0
	6- points	6	24	29
<i>Combined Intelligence</i>				
	0-4 points	44	32	14
	5-9 points	21	30	14
	10-14 points	23	14	14
	15- points	12	24	57
<i>Extraversion</i>				
	0-1 $\frac{1}{2}$ points	49	45	28
	2-3 $\frac{1}{2}$ points	19	33	20
	4-5 $\frac{1}{2}$ points	18	12	24
	6- points	14	10	28
<i>Neuroticism</i>				
	0-1 $\frac{1}{2}$ points	35	33	36
	2-3 $\frac{1}{2}$ points	40	36	20
	4-5 $\frac{1}{2}$ points	14	12	16
	6- points	11	19	28
<i>Author's Resemblance Grade*</i>				
	I	19	21	0
Similarities outstanding	II (a)	36	15	9
	II (b)	21	26	19
Differences outstanding	III	17	28	25
	IV	7	10	47

\*Note: The ratings on the dizygotic pairs are less reliable than the others.

between twins brought up together than between twins brought up apart, at least in respect of height and intelligence, particularly vocabulary. (Weight and neuroticism, in which there is less evidence of this kind, are both traits which are likely to be environmentally labile during adult years.) But even in the case of the author's personality ratings the difference between S and C groups did not reach statistical significance over the material as a whole. Once again, there is quite a marked contrast between monozygotic twins on the one side and the dizygotic twins on the other. Of the psychological tests this was most true of the Dominoes and of extraversion. In the latter a significant difference could be demonstrated. FIGURE 1 illustrates in diagrammatic form the frequency of relatively small and relatively large differences in the Control, Separated and Dizygotic groups.

The conclusion from these broad intergroup comparisons must be that there is only very slight support in the present material for the early environmental hypothesis. There is much stronger support for the relative importance, for intelligence and personality as well as for physical traits such as height, of other factors, particularly genetical ones.

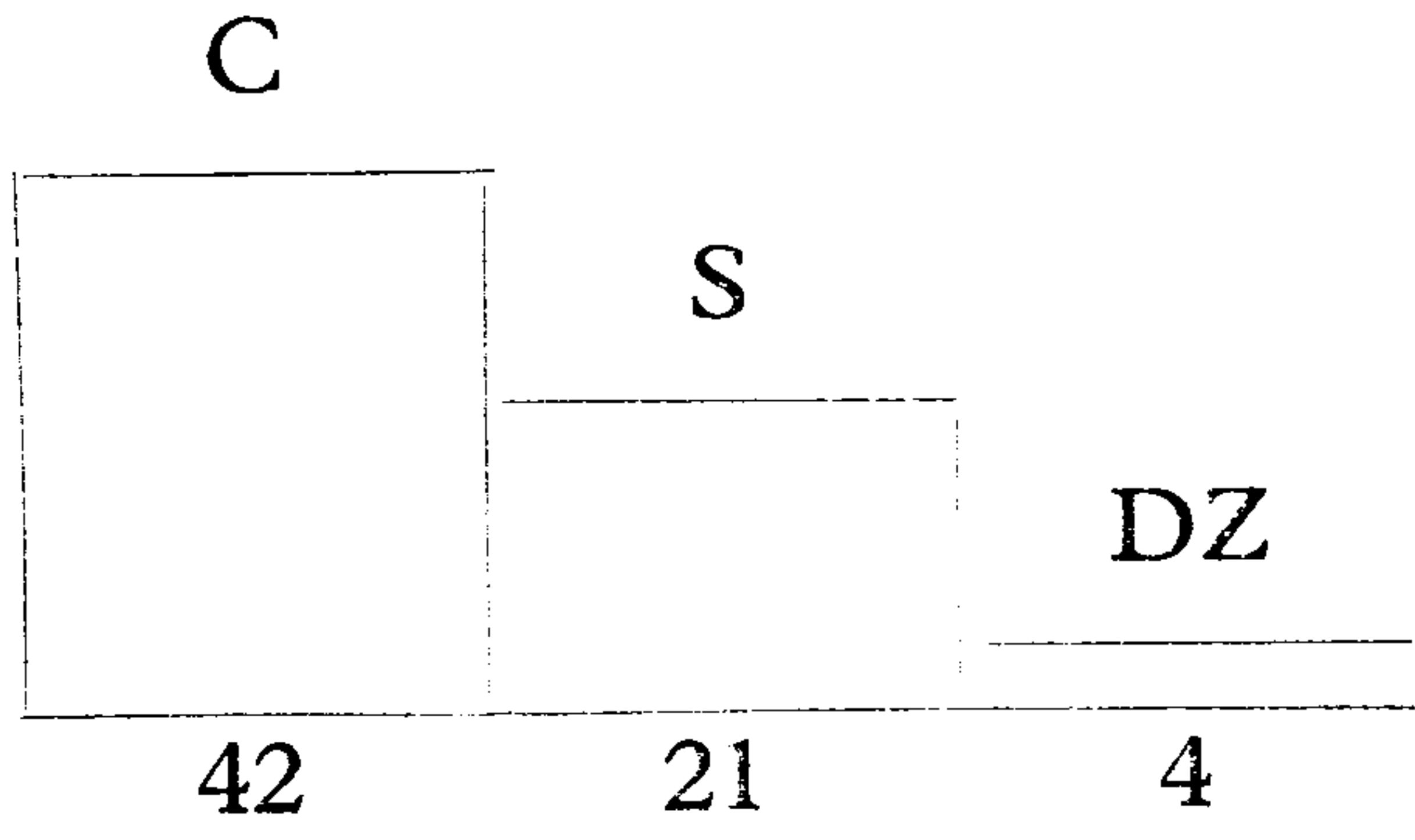
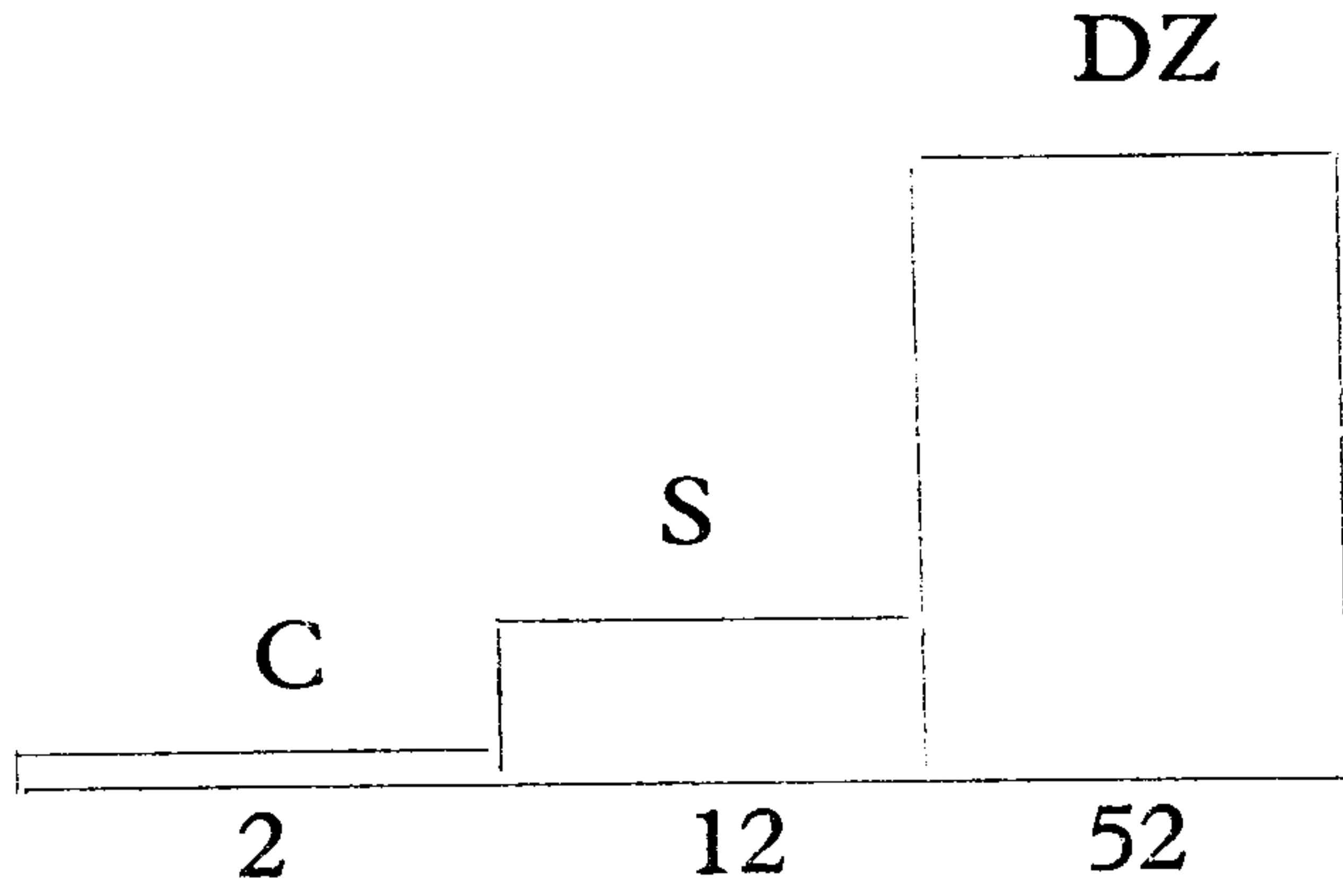
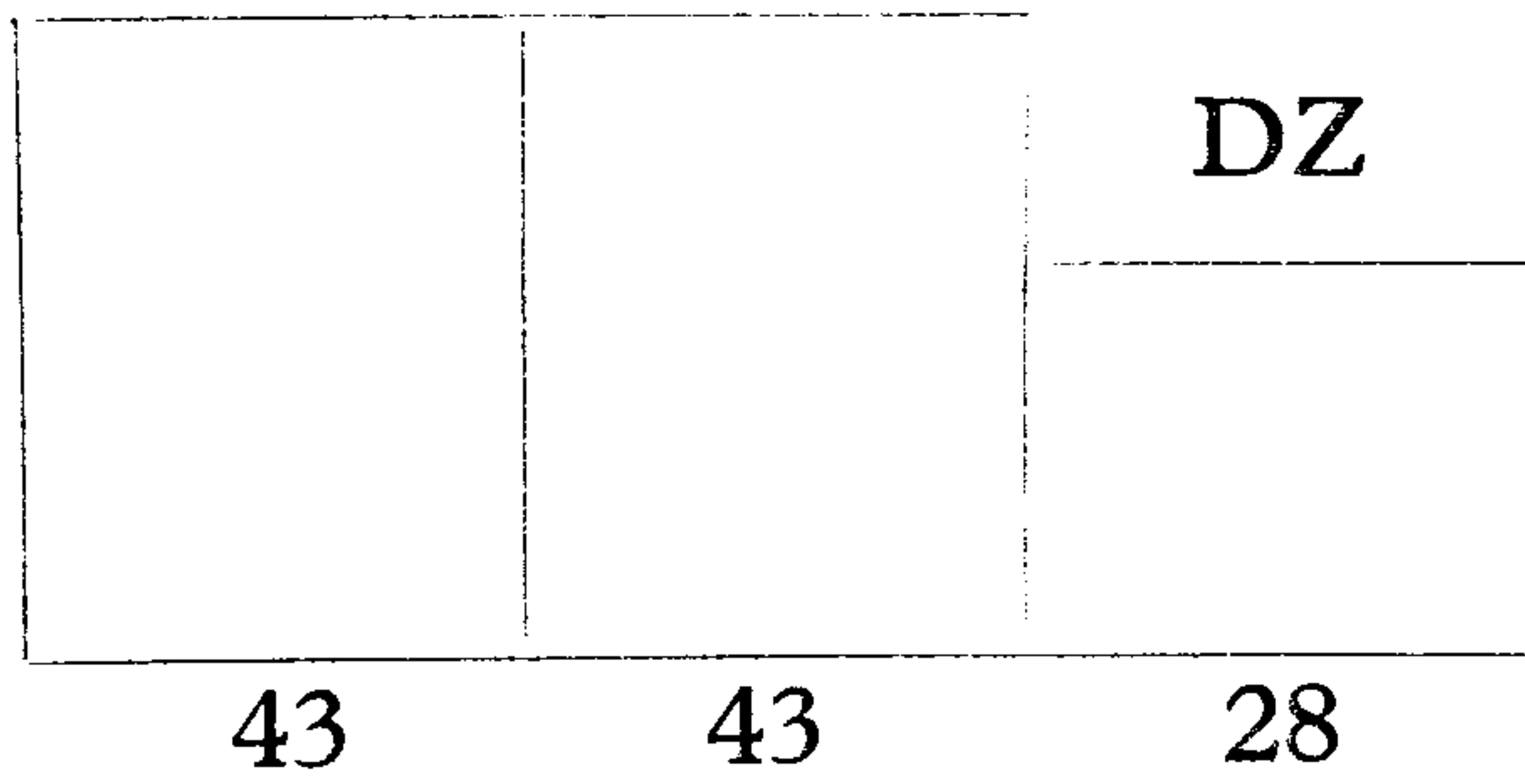
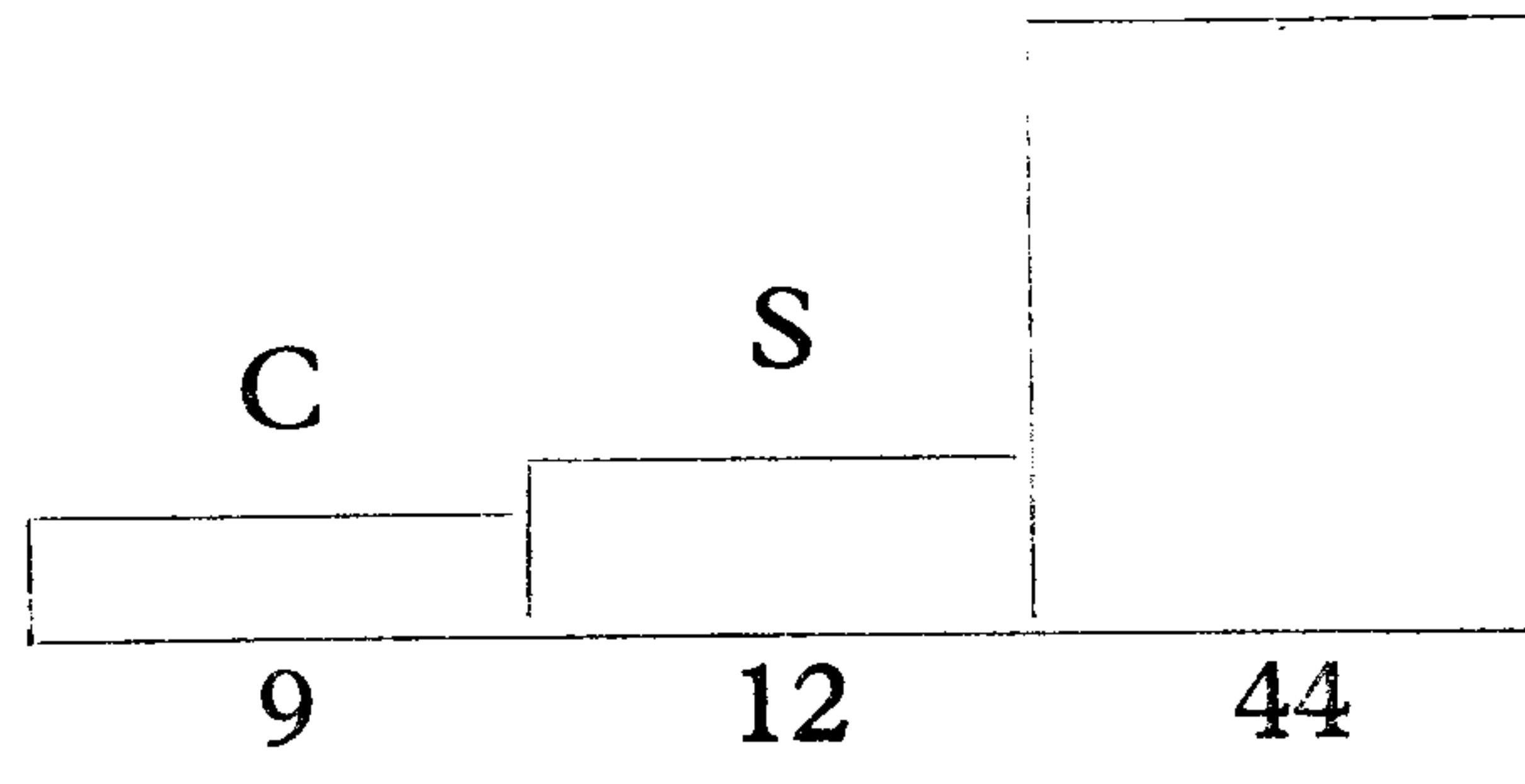
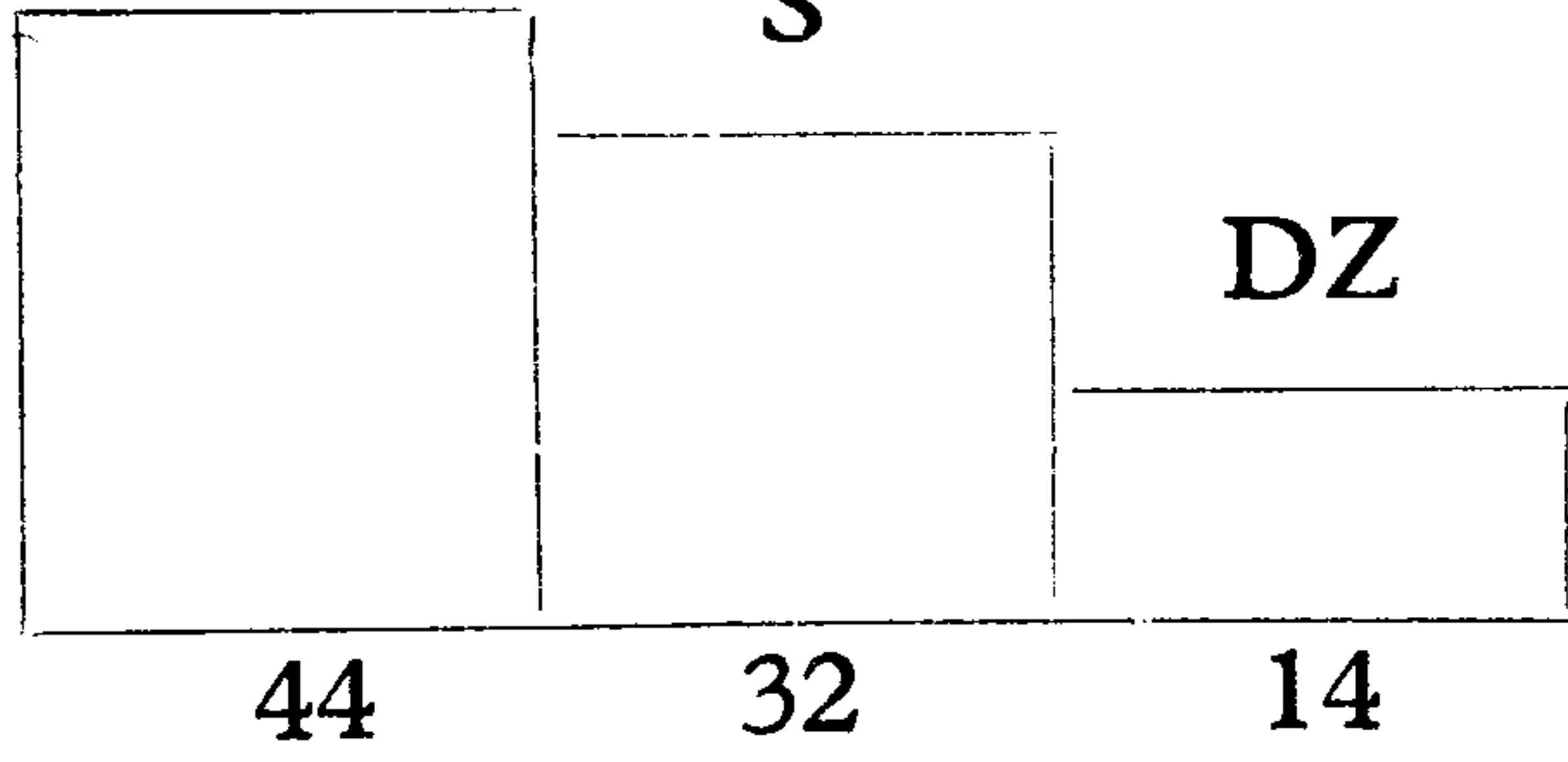
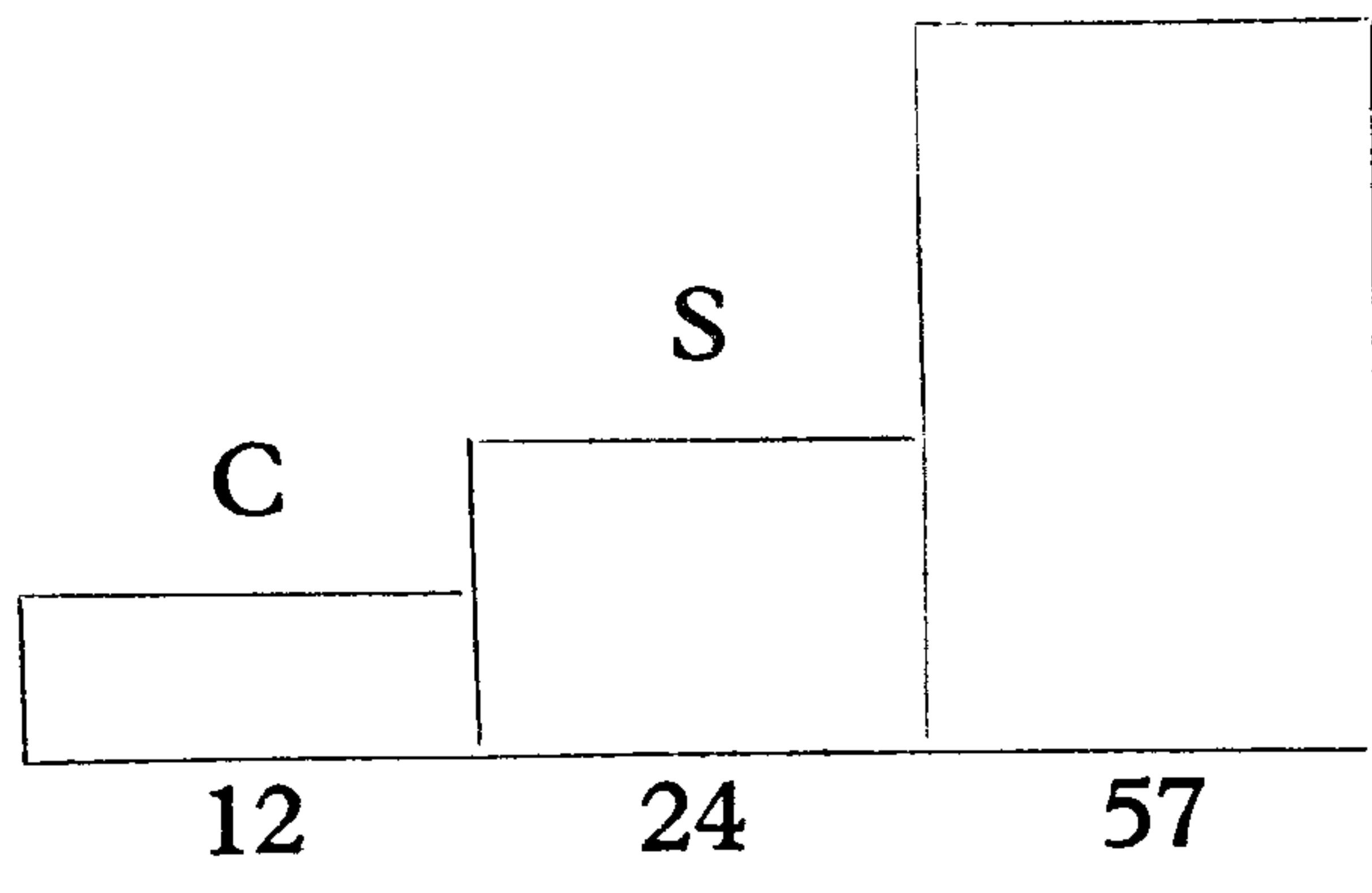
As one might expect, resemblance (as judged by  $r$ ) was generally closer in the physical characteristics than in intelligence or personality. This is likely to reflect ease of measurement. Nevertheless in the S group  $r$  was as high as 0.61 for extraversion and only 0.37 for weight (females). The intelligence correlations (0.7 or a little over) are about what one might expect from the two short tests of adult intelligence which were given. The correlations for extraversion and neuroticism, though lower than this, are remarkably high, considering that only a single short questionnaire was used.

Though it is the differences between pairs in which we are principally interested, the S and C groups did differ from one another in some general ways. Those C twins that were interviewed came from London and the Home Counties, while the S twins came from all parts of the country. On the whole the controls belonged to a higher social class than the S twins and were a little taller and decidedly more intelligent. The C twins were more extraverted and less neurotic (SRQ) than the S twins. These intergroup differences could be partly regional and partly due to an association between poor environmental conditions and the likelihood of twins being brought up apart. Though the two groups of twins are thus in some respects samples from different populations, there is no particular reason to suppose that within-pair differences will be greater in groups of twins that are relatively tall, intelligent, extraverted and non-neurotic than among twins who are on the whole less well endowed in these respects. The differences between the S and C groups in these respects do not therefore, so far as one can see, account for the lack of support which the correlation coefficients give to the early environmental hypothesis.

### *SPECIFIC FINDINGS*

We shall next review the objective traits and ratings separately, with special reference to the results of the environmental analysis.

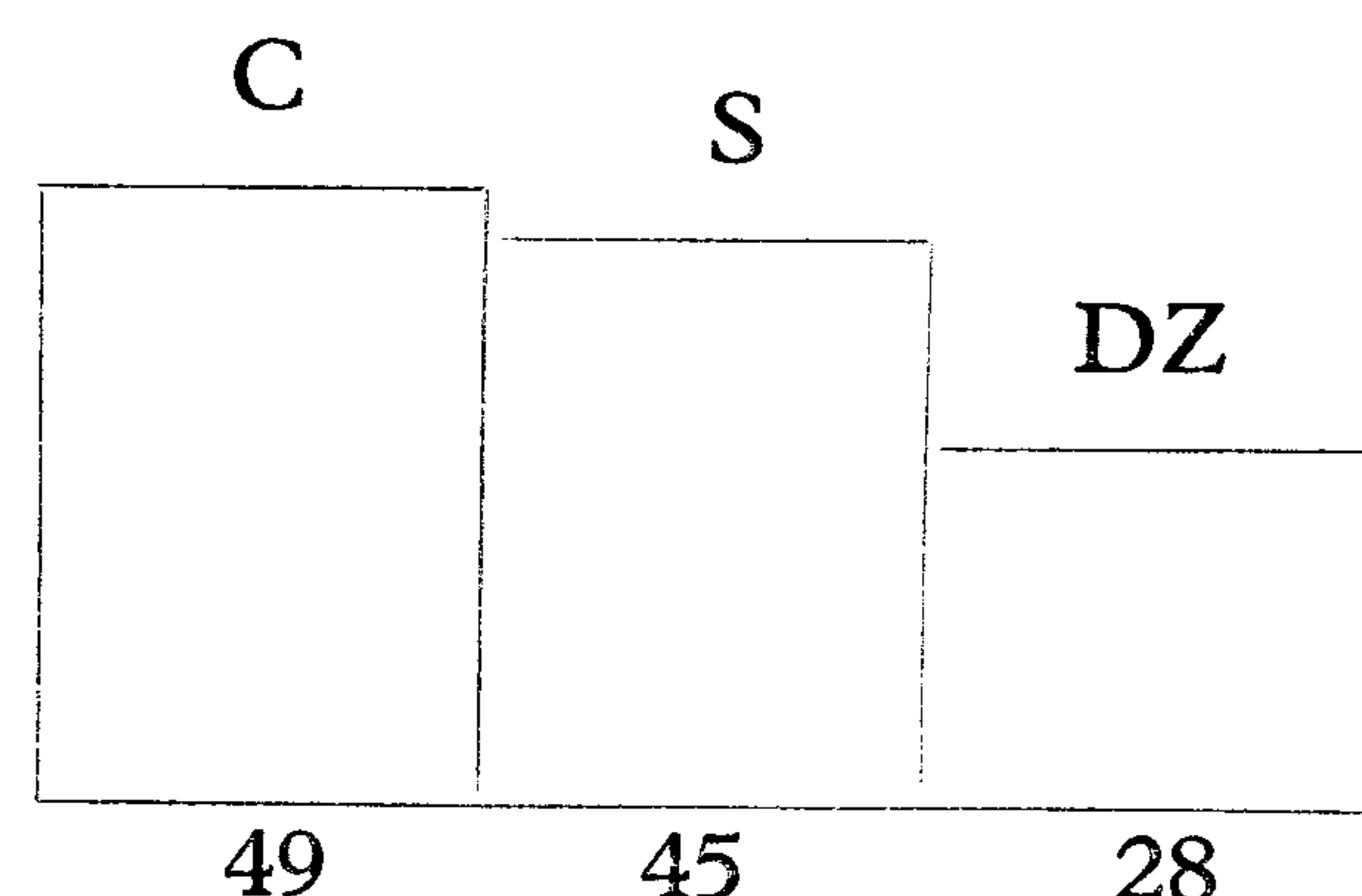
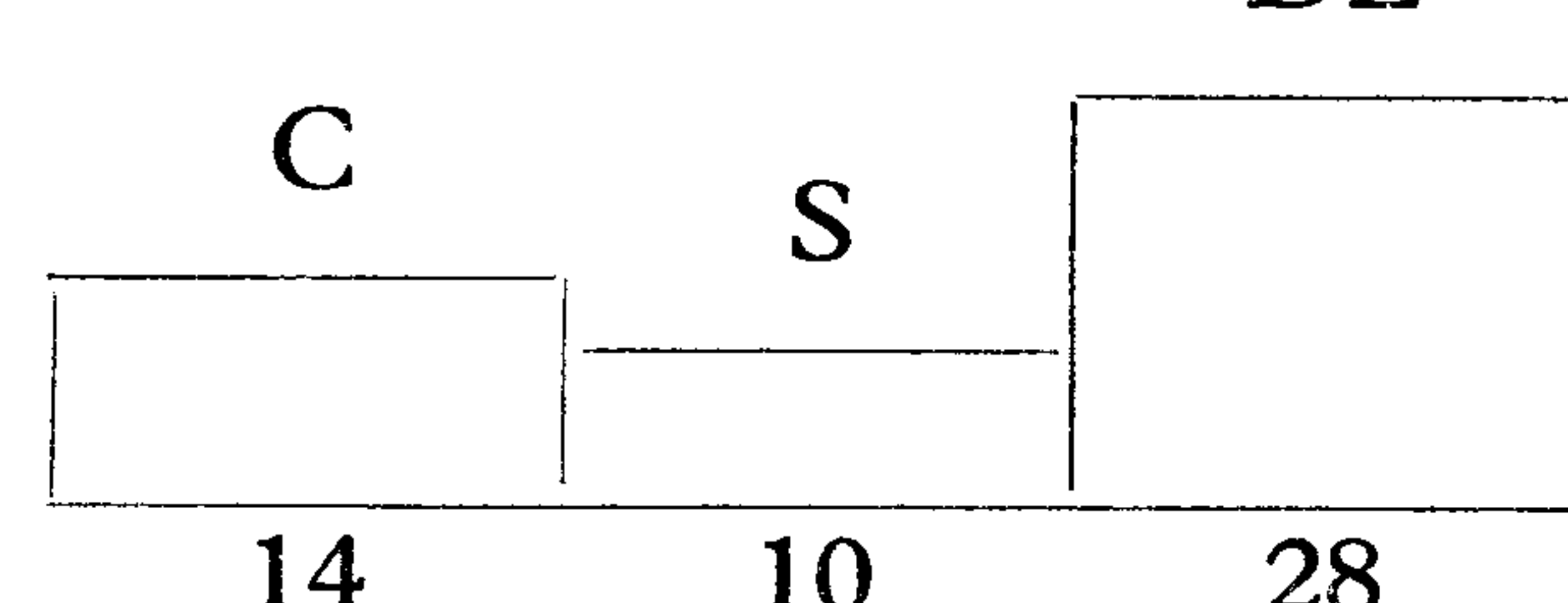
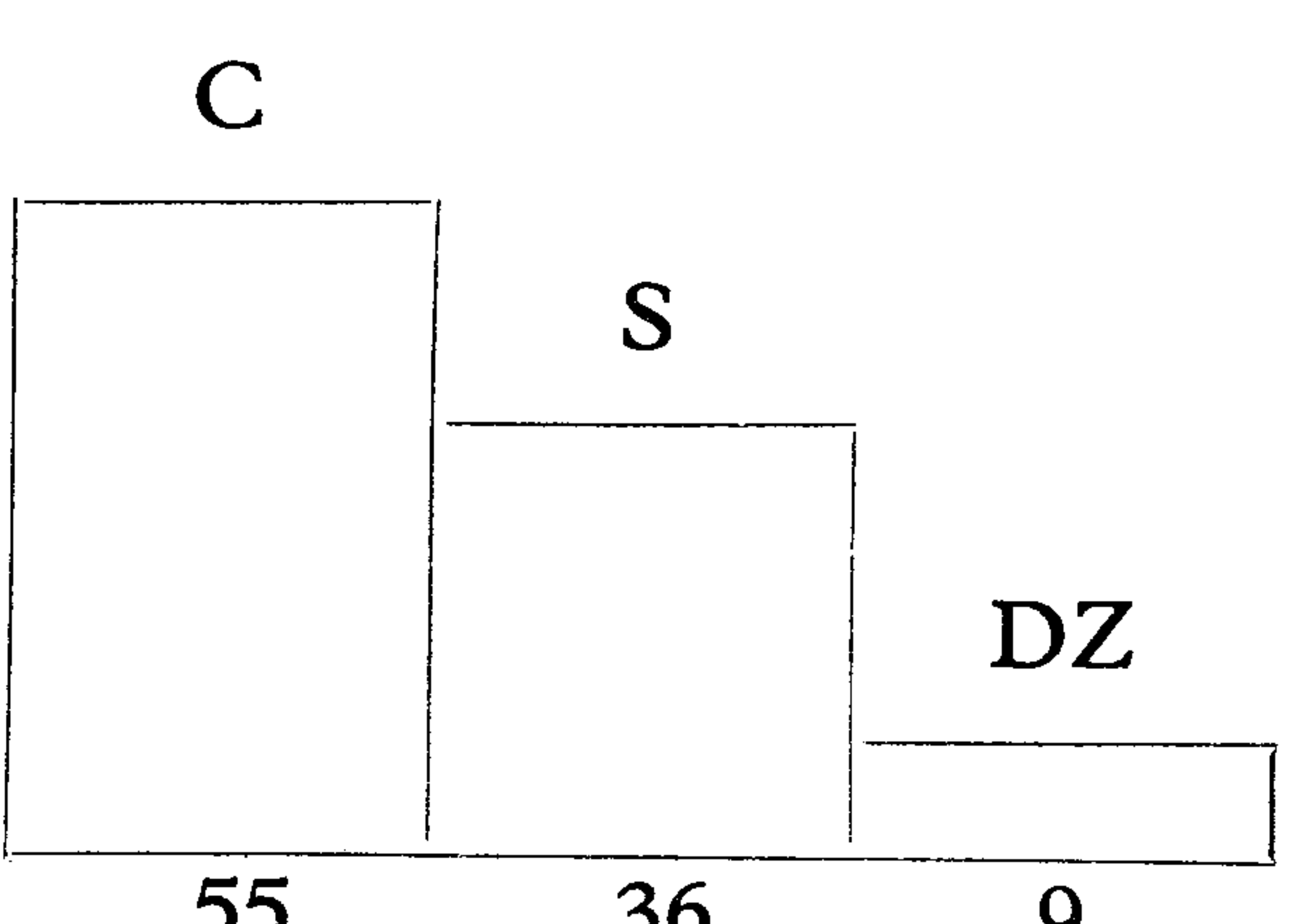
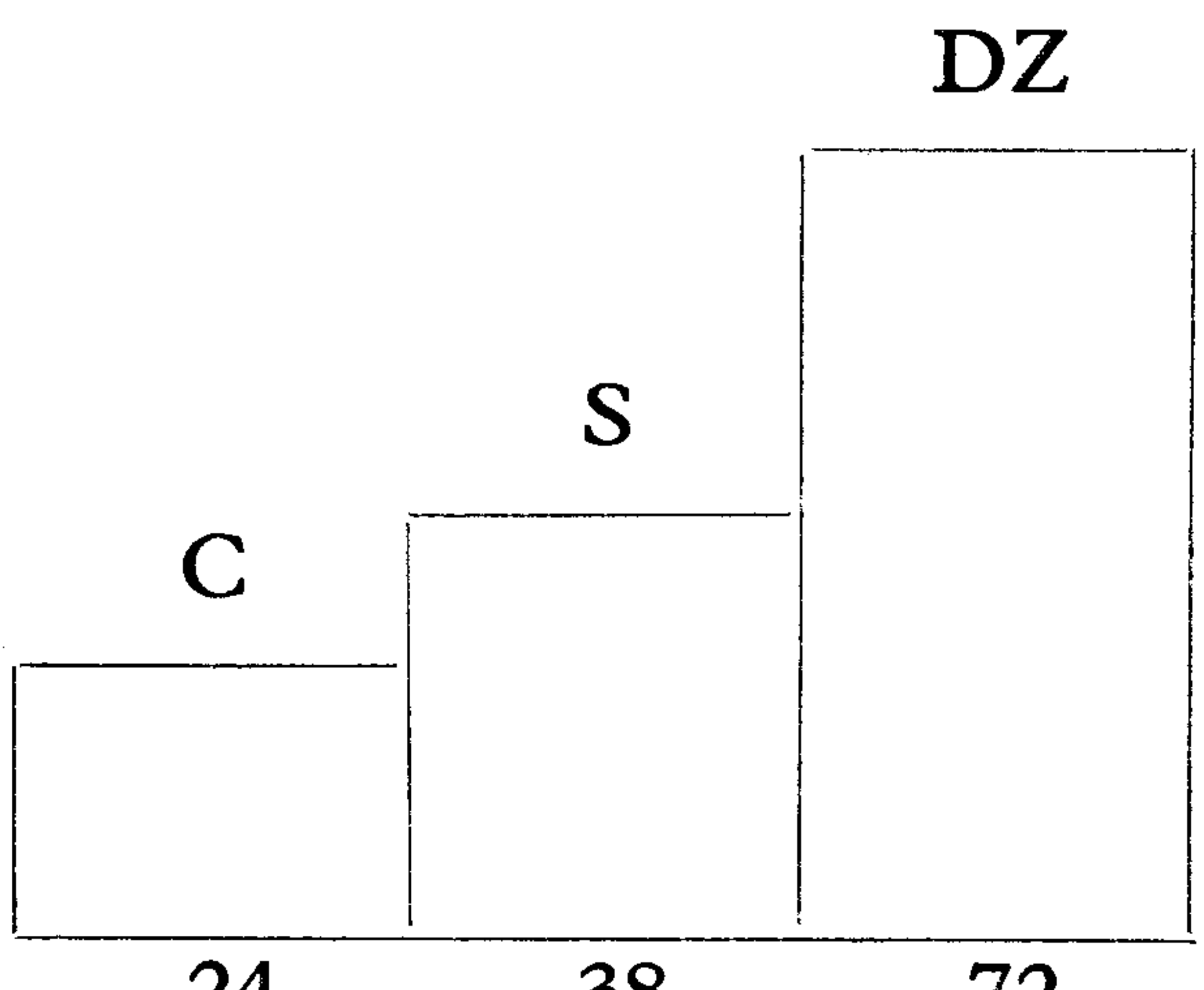
FIG. 1. PROPORTIONS OF 'CONTROL', 'SEPARATED' AND 'DIZYGOTIC' AMOUNTS IN PHYSICAL TRAITS,

<i>Trait</i>	<i>Percentage of Pairs Much Alike</i>	<i>Percentage of Pairs Showing a Large Difference</i>
Height	<p style="text-align: center;">Differ by under <math>\frac{1}{2}</math> inch</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">42                      21                      4</p>	<p style="text-align: center;">Differ by <math>1\frac{1}{2}</math> inches or over</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">2                      12                      52</p>
Weight	<p style="text-align: center;">Differ by under <math>\frac{1}{2}</math> stone</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">43                      43                      28</p>	<p style="text-align: center;">Differ by <math>1\frac{1}{2}</math> stone or over</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">9                      12                      44</p>
Intelligence (combined tests)	<p style="text-align: center;">Differ by under 5 points</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">44                      32                      14</p>	<p style="text-align: center;">Differ by 15 points or over</p>  <p style="text-align: center;">C                      S                      DZ</p> <p style="text-align: center;">12                      24                      57</p>

On the assumption that both early environment and heredity have an effect on the trait, one would expect the C group (MZ twins brought up together) to be more alike than the S group (MZ twins brought up apart), which should in turn be more alike than the group of DZ (genetically non-identical) twins.



PAIRS DIFFERING BY RELATIVELY SMALL AND RELATIVELY LARGE INTELLIGENCE AND PERSONALITY

<i>Trait</i>	<i>Percentage of Pairs Much Alike</i>	<i>Percentage of Pairs Showing a Large Difference</i>
<p><i>Self-rating Questionnaire:</i> Extraversion</p> <p>Neuroticism</p>	<p>Differ by under 2 points</p>  <p>C                      S                      DZ</p> <p>49                      45                      28</p>	<p>Differ by 6 points or over</p>  <p>C                      S                      DZ</p> <p>14                      10                      28</p>
<p><i>Author's Rating:</i> Personality Resemblance</p>	<p>Grades I and II (a)</p>  <p>C                      S                      DZ</p> <p>55                      36                      9</p>	<p>Grades III and IV</p>  <p>C                      S                      DZ</p> <p>24                      38                      72</p>

The proportion of pairs 'Much Alike' should therefore decrease from C to S to DZ group, and the proportion of pairs showing a relatively large difference should increase from C to S to DZ group. The diagrams show how far this was the case for the various traits.

*Intelligence*

HEREDITARY INFLUENCE. This seems clearly established from the significant resemblance between monozygotic twins, found both in those brought up apart and those brought up together. We tested only very few dizygotic pairs. Other investigators have agreed in finding them to be less alike than monozygotic twins. The degree of resemblance found in our MZ pairs is consistent with that of other workers. Blewett (1954), who gave a battery of intelligence tests to twin children, found a correlation in factor score ( $r = 0.76$  for MZ pairs) no higher than the present results.

ENVIRONMENTAL INFLUENCES. Unlike Newman, Freeman and Holzinger, we obtained little support, in the comparison of our S and C groups, for the importance of the early family environment as a cause of differences in intelligence. This could be because educational differences were less marked in the present study. Only the distribution of the differences, particularly in the vocabulary test, offered any suggestive evidence that the twins brought up apart differed more widely than the controls. However, when the pairs that differed most widely were examined in detail, their histories revealed a variety of reasons, physical and social, why one twin did better on the tests than the other [TABLE 10]. When the S twins were classified according to degree of separation, there was also some slender evidence for an environmental effect, those separated longer or more widely being on average less alike than the others [TABLE 21]. There was an association between school performance and later intelligence testing [p. 114].

The statistically most significant finding as regards intelligence was the association with menarcheal age: the twin who was the first to menstruate was the more intelligent when tested [pp. 115–6]. The reason for the relationship remains in doubt for the present, though its direction is consistent with some previous work. There were some other findings verging on statistical significance between intelligence and height or weight [p. 113] but these were difficult to account for. No significant association was found between better intelligence and smaller family [TABLE 26] or between intelligence and any of the other interfamily differences examined.

OTHER ASSOCIATIONS. Over the material as a whole Social Class I subjects had the highest intelligence, but there was no decline with social class otherwise [p. 120]. The C twins scored higher than the S twins on both intelligence tests [TABLE 7].

*Extraversion-Introversion*

HEREDITARY INFLUENCE. This seems to be well demonstrated. MZ twins in S as well as C groups showed a significant resemblance on the test and, in keeping with this, resemblance in degree of sociability and related traits and interests was quite notable on the clinical side [CHAPTER 12]. DZ twins were less alike, the distribution of the differences in MZ and DZ pairs giving a significant  $\chi^2$  [p. 68]. This is in accord with the conclusions of previous work on twins by Eysenck and his associates (McLeod, 1954; Eysenck, 1956).

ENVIRONMENTAL INFLUENCES. The S and C test results offer no general support for the view that differences in childhood family environment are important for this trait. However, two statistically significant observations were made which may be meaningful psychologically:

1. There was a tendency for the childhood leader in the C twins to have a higher extraversion score [p. 85]. This is in line with the clinical discussion of the differences observed in this group [p. 86 ff.]. These rather often related to traits such as sociability and energy and seemed to be associated with the twin relationship. When the S twins were classified according to degree of separation, those that had had relatively most contact with one another during childhood tended to differ more than the others in extraversion [TABLE 21]. From these observations it seems possible, therefore, that differences between the twins brought up apart due to interfamily environment have to some extent been counterbalanced by differences between twins brought up together due to the twin relationship.

2. The twin brought up by a mother-figure who was ten years or more younger than the woman who brought up his twin had a significantly higher extraversion score than his partner [TABLE 24]. There were also less marked tendencies for the twin brought up by his own mother, with other sibs or in the psychologically poorer home to be the more extraverted of the pair [TABLES 23, 25 and 31]. In the present material all these factors are difficult to disentangle. A cluster of factors, among which age of parent is likely to be important, may have an influence on extraversion. This seems plausible on general considerations.

Another statistically significant tendency was for the heavier twin to be the more extraverted [p. 113]. This was more marked in the S than in the C twins. There may be some connection between this observation and theories relating body build and extraversion, but there is no very obvious explanation.

OTHER ASSOCIATIONS. The C twins were more extraverted as a group than the S twins. The males in this material were a little less extraverted than the females. There may be a slight tendency for extraversion score to decrease with age. Though extraversion and neuroticism are theoretically independent dimensions, there was a small negative correlation between the two on the self-rating questionnaire used [p. 68].

### *Neuroticism*

HEREDITARY INFLUENCE. As in the case of extraversion MZ twins showed significant resemblance in both S and C groups, while DZ twins were less alike. However, MZ correlations were a little lower and the contrast between MZ and DZ differences not so marked. The descriptive chapters [CHAPTERS 11 and 15], too, could be taken to imply that genetical factors, while important, do not play quite such a large part in the determination of neurotic manifestations as they do in extraversion-introversion. It is also probably the case that neurotic tendencies are more difficult to measure because they vary more from time to time. The work of Eysenck and Prell (1951) showing the neuroticism factor to be highly hereditary

could not be confirmed by Blewett (1953). The work of Cattell and his colleagues (1955, 1957) suggests that personality factors such as those he calls General Neuroticism, Somatic Anxiety and Neural Reserves are less determined by heredity than Cyclothymia, Cortical Practicality and Exuberance.

ENVIRONMENTAL INFLUENCES. Once again early family environment fails to show up in the separated-control comparisons as an important factor.

In the environmental analysis of the S pairs social class showed a significant relationship to neuroticism. The twin brought up in a home of a higher social class than his partner had a lower neuroticism self-rating and (to a lesser degree) a better MHR [TABLE 29]. A similar tendency was seen over the material as a whole: neuroticism score increased as social class decreased [TABLE 34]. Related to this is the finding [p. 117] that the S twin who was better off financially than his partner tended to have the lower neuroticism score. While this may be a genuine association, it could be that the validity of the neuroticism test differs according to social class. It is also possible that the observed relationship has been exaggerated for the following reasons: (1) the knowledge that the twins and their families usually had of their respective backgrounds and the invidious comparisons to which this could give rise may have been more stressful for the twin from the lower social class; (2) the tendency, already noted, for the economically poorer home to be at the same time the less satisfactory so far as personalities and home atmosphere are concerned might not hold to the same extent in the general population as in the present material.

Though neuroticism did not show up significantly in the analysis of other environmental factors, the following points were perhaps suggestive. The twin brought up with his own mother tended to have a higher neurotic score, as did the twin brought up along with other sibs and also the twin who was thought to have had a poorer home psychologically [TABLES 24, 25 and 31]. The lighter twin at birth tended to be the more neurotic in the S group [p. 113]. As already noted, these occurrences—being lighter weight at birth, remaining with mother, having other sibs and living in poorer economic and psychological circumstances—tended to go together in this group of twins brought up apart. There was a slight tendency for the twin who volunteered to be the less neurotic; he was also the more extraverted and the more intelligent [p. 117].

OTHER ASSOCIATIONS. Besides the association with social class referred to above and the correlation with introversion, there was some degree of agreement between SRQ neuroticism and the author's ratings of personality resemblance [TABLE 15] and poorer mental health [p. 112]. The S group was more neurotic than the C group [p. 68] and probably included severer cases of psychiatric troubles [CHAPTER 15]. The male subjects were on the whole less neurotic than the females [p. 68].

### *Personality Assessments*

HEREDITARY INFLUENCE. The author's ratings of personality resemblance do not have quantitative values like the SRQ scores. Further, the assessment of

dizygotic pairs should be treated with caution. However, the large difference between MZ and DZ pairs in these ratings does, it is believed, illustrate a real difference between the two kinds of twin. It will also be noted that Grade I (most alike) cases occur with about the same frequency in S and C groups. In the majority of monozygotic pairs similarities were thought to be more outstanding than differences. Some pairs were thought to show a degree of likeness which was almost diagnostic of monozygosity. Support for these opinions is to be found in CHAPTERS 12 and 15 and in the case histories themselves.

**ENVIRONMENTAL INFLUENCES.** The resemblance ratings gave more support than did any of the tests for the relevance to personality of the early family environment, but the difference between S and C twins did not reach statistical significance over the whole material. However, the female S twins were less alike than the female C twins, and the S twins under the age of 45 less alike than the C twins of the same ages, both these differences reaching the 0.05 level of significance. Possible reasons for this have been discussed [pp. 74–5]. While age at separation, duration of separation and geographical proximity of the twins did not affect the ratings [pp. 100–2], there was some suggestion that the kind of home made some difference: the twin brought up in what was considered by the writer to have been the poorer home psychologically tended to have the poorer mental health rating (difference nearly significant statistically) [TABLE 31]. When the environments were rated by colleagues in ignorance of the personalities and psychiatric histories of the twins slight (but only very slight) support was obtained for this commonsense view [TABLE 32]. Examples are given in pp. 79–81 of some of the ways in which upbringing was thought to have influenced personality, and this is brought out too in the comments on several of the case histories.

Differences in family structure did not relate systematically to MHRs [TABLES 24 to 27]. As noted, there was some support for a relationship with social class.

**OTHER ASSOCIATIONS.** There was a slight tendency for the physically larger twin and (in the S group) the more intelligent twin to have the better rating [p. 103; TABLE 22]. Though author's ratings and the SRQ results disagreed in some cases, a moderate degree of association was found [TABLES 15, 22 and 33].

### *Some Physical Characteristics*

While heredity is generally accepted as an important determinant of height and, to a slightly lesser extent, weight, the present findings could be interpreted as showing early environment to have an influence on bodily development too [CHAPTER 7].

The histories of the twins suggest that differences between them in weight at birth are related to differences in size in childhood and to present differences in height [p. 112]. A cluster of factors such as these, and also childhood health [p. 114], help to determine which twin takes the lead in childhood and in this way may have an indirect influence on personality in twins brought up together. Other associations between physical differences and differences in the psychological

tests and ratings have been mentioned above, the most significant statistically being that between age at first menstruation and intelligence. Menarcheal age was also significantly related to birth order, the first twin born being the first to menstruate. This also is difficult to account for, and it was the only marked association between birth order and any of the other variables [p. 116]. 17 per cent. of the monozygotic twins differed in handedness, and there was a significant tendency for the left-handed member of these pairs to have been the lighter at birth and to be the smaller now [p. 41].

Some of the larger psychological differences were due to organic factors such as epilepsy or disseminated sclerosis, while in individual cases [pp. 78 and 81] physical causes of other kinds seemed to be likely causes of difference. Though not suitable for a detailed study of physical illnesses, the investigation showed that the medical histories of monozygotic twins could diverge quite widely [CHAPTER 14], irrespective of whether they were brought up separately or together.

### *Some Social and Personal Characteristics*

**SOCIAL CLASS.** The slightly higher social level of the C twins and the association between Registrar General's Social Class and neuroticism score have been mentioned above. CHAPTER 14 gives examples of the effect of class differences on the attitude of the twins to one another, and other instances of social factors are to be found on pp. 82, 90 and 116. There was a slight tendency for a twin brought up in a lower social class than his partner to be less well off economically later on.

The degrees of social and cultural difference between the families in the S pairs were as a rule not remarkable, though they reflect differences commonly to be found between families in our present social structure [p. 48]. Had the material consisted mostly of pairs where one twin was brought up in the criminal underworld, the other in a 'respectable' upper-middle-class home, no doubt many interesting differences would have emerged. But if our South American/Scandinavian pair [S f 19] and the pair where one twin was brought up by a Chinese cook, the other by a building contractor [S m P 4] are anything to go by, interesting similarities would have occurred too.

**MARITAL HISTORY AND FERTILITY.** There was some degree of resemblance in all groups in age at marriage and number of children, the C group being slightly more alike than the S and the S slightly more alike than the DZ [CHAPTER 14]. The general level of resemblance here was not particularly striking, however, and the case histories show that both S and C twins, whether by chance or not, often married persons of differing personal characteristics.

**SMOKING HABITS.** In this respect monozygotic twins resembled one another significantly, those brought up apart quite as much as those brought up together. Dizygotic twins showed no more than chance resemblance. As other workers have done, we must conclude that genetical factors, directly or indirectly, have some bearing on one's liking for cigarettes [CHAPTER 14]. It is possible that the same may hold for drinking habits [p. 97].

RESEMBLANCE IN PERSONALITY AND IN PSYCHIATRIC DISORDER. In CHAPTER 12 examples are given of similarities in mannerisms, voice, temperament, tastes and other aspects of personality, including sexual behaviour, in which it appeared that monozygotic twins were often alike. There is a similarity between these observations and some of those on twins brought up apart described in the literature [p. 19]. The close feeling which such twins frequently have for one another was bound up with their similarity. The similarity of some pairs, particularly in their manner of talking and their personal rapport, was, as already noted, such as to be almost diagnostic of monozygosity. Since twins with little or no mutual contact can show an unusual similarity in personality traits, one should be cautious in the extent to which one attributes resemblance between twins brought up together or living together to the influence of one twin on the other.

One of the S pairs [S m P 4] was concordant for schizophrenia in spite of a large cultural difference between their homes. Other instances of schizophrenia occurring in both members of a pair of monozygotic twins brought up apart have been reported in the literature. From the other cases of psychiatric interest [CHAPTER 15] the impression emerged that personalities verging on the extreme as regards quick temper, anxiety, emotional lability, rigidity and cyclothymic tendencies might often be concordant in monozygotic twins, whether brought up together or apart. They were also alike sometimes in hysterical personality, but here, more particularly, they could diverge quite widely. In one S pair, for instance, only one twin had attacks of hysterical amnesia [S f 10]; in another, hysterical conversion symptoms [S m P 9]. In yet another pair [S f 13] both twins had a globus hystericus, but this was very much more disabling in one twin than in the other. That several instances of minor breakdown or abnormal traits in only one of a pair were found is in keeping with other work on twins brought up together. As regards neurotic traits in childhood there was a moderate degree of resemblance, possibly more so in the C group; enuresis was a symptom which tended to be concordant, sleep-walking discordant.

Clinically the points of difference in personality were as various as the similarities. Though often a matter of degree, one twin could sometimes develop traits, including those of a paranoid or obsessional nature [see pp. 87-8, and 89 for instances in C pairs], of which there was no sign in the other twin. In a few pairs one twin seemed slightly more affected in manner or more idealistic [p. 91]. However, it is difficult to pick out some traits and say that they are predominantly hereditary while others are predominantly environmental in nature. Traits such as energy and sociability, for instance, which we have seen to differ between twins according to the relationship which develops between them, are at the same time important components of the extraversion-introversion dimension which is strongly determined genetically. The findings are not inconsistent. They merely show extraversion to be a valid concept. One might well find a trait or factor in which both hereditary and environmental factors are more clearly demonstrable than in many other traits. This would mean that in such a trait (perhaps this is the

case with extraversion more than neuroticism) random or error factors were playing less part. Such a trait would then be a good one for clinical and research purposes, while traits in which neither hereditary nor environmental factors showed up much, or were therefore much more largely accidental, would be less reliable for study.

CHAPTER 11 suggests that the causes of difference are multiple. Physical and social causes arising at different times in life interacted with one another so that home background was sometimes obscured as a differentiating factor or else related only to rather unimportant aspects of personality. In some pairs the twins remained obstinately alike in spite of quite large differences in environment.

## DISCUSSION

### *The Genetic Side*

Different though monozygotic twins are, it is claimed here that they are significantly alike in various aspects of their behaviour, and that there is comparatively little difference between those brought up apart and those brought up together. From this the conclusion is drawn that genetical factors must be considered as playing an important part in the development of personality. Let us consider some objections that could be raised against this view.

1. Are the twins as alike as is claimed? Certainly neither personality tests nor assessments from life history and interviews are completely reliable, but there is no particular reason to suppose that the former have exaggerated the resemblance. The life histories are retrospective and obtained from the twins themselves [see PARAGRAPH 3 for the possibility that this may have exaggerated the resemblance]. Prospective studies in the present context are ruled out for practical reasons and have their own disadvantages, among them the dropping out of cases with the lapse of time and the possibility that continuous follow-up involves an interference in the lives of the subjects which might influence the turn of events. Opinions may differ as to whether more weight should be given to the tests or the more subjective estimates based on more extensive data. An important point is the fact that both approaches agree in finding a degree of resemblance. It is conceivable that similarity is greater in the present material, consisting mostly of volunteers, than it would be in completely unselected material. However various studies of twins where such a bias is less likely to have occurred have reported similar findings.

2. Could the similarity observed be attributed mainly to the intrafamily environment? The greater resemblance between monozygotic than dizygotic twins brought up together, for which there is supporting evidence in the present study, makes this unlikely. The lack of striking differences between monozygotic twins brought up together and those brought up apart argues very strongly against this assumption.

3. Could the resemblance be due to socially determined attitudes about monozygotic twins, reflected in the expectations of friends, relatives and the



twins themselves that they should be alike? Twins may wish to be alike (so it could be argued) and they may influence one another, not only in childhood, but also in later life, the more so perhaps if they have been deprived of their life together as children. Though several pairs in our S group had a fair amount of contact during childhood these were no more alike than the others; and of the few who met only later under dramatic circumstances, the twins S f 10 did not get on, while in the others later contact seemed unlikely to be the chief reason for the similarity. A test case is S f 9, in which the twins knew nothing of one another until they were investigated and they proved to be among the most alike. It has been argued that the close feeling of twins for one another is partly a biological phenomenon.

4. Could the similarity be due to the twins not being separated early enough, or not long enough? Here again, analysis of the material by age at, and duration of, separation did not support this view.

5. Would similarity have been less if the homes had not been so alike, particularly if so many of the separated twins had not been brought up in different branches of the same family with, presumably, a good deal of resemblance culturally? To this objection one must answer 'quite possibly'. It cannot be assumed that the twins would have been just as alike if they had been brought up in homes widely different in kind. One can only point out once again the extent to which these families did, in fact, differ as regards family structure, age and personality of parents and occupation of parents [CHAPTER 5].

6. Could the resemblance be due, not so much to the genetical influences as to the prenatal environment, which is similar for monozygotic twins, whether they are parted later or not? This is improbable according to present knowledge. Dizygotic twins who also share the same birth rank and maternal age are not so alike.

Assuming then that genetical factors are involved in a genuine personality resemblance between monozygotic twins under environmental conditions similar to those of the present investigation, one can go on to ask, 'How it is that genetical differences bring about differences in personality?' One may inquire which traits in particular are influenced in this way and how they are inherited.

If one could answer these questions with any degree of completeness there would be no need for twin studies. However, one can envisage ways in which the genes could be dynamically related to behaviour at the level of personality.

Even in the relatively simple case of phenylketonuria the route from mutant gene, via enzyme deficiency and disorder of metabolism to function of the brain, failure of intellectual development and the associated features in the individual case is difficult to trace, particularly in its later stages. And even here one must keep in mind the environmental setting in which the defect develops. Under certain environmental circumstances, such as a phenylalanine-free diet, it is possible that it might not occur. The genes can be regarded as a kind of blue print which to a greater or lesser degree influences the reaction of the organism according to the specific environment it finds itself in.

In normally variable traits such as height and intelligence, and in minor abnormalities, events will be much more difficult to disentangle than in phenylketonuria. On the environmental side there are likely to be many influences to be considered at all levels, including the social. Genetically, the trait is also likely to be determined multifactorially. Mankind is an extremely variable species genetically. Each gene is thought to be associated with its own particular biochemical product which, in interaction with the products of many other genes, will influence a variety of reactions one way or another. We can envisage variation along a large number of independent physiological traits, each largely determined polygenically and having a bearing on some aspects of personality. It is unlikely that a given individual will be close to the statistical norm in all these traits. In some he will be outstandingly different from other people, and he will have his own characteristic profile of physiological traits. Similar considerations probably hold for psychological characteristics. Though theoretically all genetically controlled variation should be traceable ultimately to differences of a physical kind, there is no reason to suppose that those personality traits which are the easiest to assess will necessarily be linked with particular physiological traits. Further one might have good evidence that some personality traits were strongly determined genetically without being able or obliged to account for the fact in physiological terms. Some psychological characteristics may be more genetical than some physiological or morphological characteristics.

The environmental lability of a trait can also vary according to the genetic constitution. In the case of the thalassaemia trait of the blood, for instance, the homozygotes, whose haemoglobin is either entirely of the normal or entirely of the abnormal type, remain free from anaemia or die from Cooley's anaemia in childhood as the case might be, and differences in environment are of little importance. But the heterozygote, whose blood contains a mixture of two kinds of haemoglobin, is liable in varying degree to a variety of blood disorders. To what extent he does suffer from these presumably depends a great deal on the sort of life he leads. One can imagine that considerations such as these apply quite widely to personality reactions.

It seems likely then that each individual will have a particular set of traits which for him are largely determined genetically. Likewise there will be environmental stimuli to which he will be particularly sensitive or insensitive according to his genetical make-up.

Considerations such as these lead one to think that if one were able to make an analysis of variance of personality traits one might find a significant proportion of the variance to be due to interaction between heredity and environment. In light of the difficulty in measuring traits one would also not be surprised to find a large error factor. It is therefore not surprising that it has been difficult to pick out some traits as more hereditary than others. It may well be that certain basic affective characteristics, such as endogenous tendencies to depression, are more genetical than attitudes to social questions. One would certainly expect them to be closer

to the site of gene action. Yet, given a similar cultural environment, constitutional characteristics do appear sometimes to have far-reaching consequences, affecting odd and seemingly trivial details of behaviour. The women [S f 9] who, though they knew nothing of one another, both kept many pets, played comic parts in amateur dramatics and liked to take on jobs as door-to-door saleswomen is one of many examples that might be cited. Perhaps it is rather surprising that smoking habits should have turned out in the analysis, if one takes it at its face value, to be as genetical as anything else that was examined. Again it would be a mistake to equate the physical with the genetical, the psychological with the environmental.

From the study of twins alone one cannot tell anything about the mode of inheritance. It is unnecessary to discuss here problems that arise in comparing the personality resemblance of other relatives and the degree of likeness one would expect on various hypotheses. Enough has been said to show how genes and personality may be connected.

### *The Environmental Side*

Differences between twins were sometimes quite marked, but on the whole the early interfamily environment did not show up as a very important cause of these. Why was this?

We have already suggested that early physical differences between the twins, polar development in twins brought up together, and social and physical causes after childhood can all be of importance and may have made genuine and lasting, but less prominent, effects of early childhood influences difficult to detect. If we accept the argument of the previous section, the important part played by heredity is a further reason why differences between the separated and control groups did not show up in a sample of this size.

One cannot be certain whether selective factors also have not contributed to the relative lack of positive findings on the environmental side. However, any tendency for twins that were alike to volunteer for the research would, one would have thought, have been at least as strong in the control as in the separated group.

The study may be criticized by some on the grounds that it makes little use of 'depth' psychology. Certainly the specific environmental variables which we have analysed have for preference been such crude but objective ones as 'only child'. Assessing the quality of maternal care is difficult enough in current work with children and subject to many differences of opinion; no claim is made to have unravelled all the psychodynamic factors in the upbringing of a pair of twins perhaps 50 years ago. Hints were not always lacking, and we took some of them. But the investigation would still have been a sensible one had we known nothing but the bare facts of the extent of separation in each pair. An additional difficulty concerning psychodynamic factors, such as parent-child relationships, is that their status as environmental variables is somewhat dubious. They are the result of the interaction of personalities under particular circumstances, and in many cases the innate temperament of the child contributes much to the quality of the relationship.

Such things are well worth examining in twins and further knowledge of them might have illuminated some of the differences in the present twins, separated and control, that were difficult to explain. One could say the same about further knowledge of physical factors.

Though, for some of the reasons suggested above, differences in upbringing and family structure did not stand out as all-important, some meaningful associations between environment and behaviour did emerge from the study. These were generally of a commonsense kind which might have been predicted without any highly conceptualized theory of personality. Temporary difficulties, for instance, were fairly consistently reported whenever twins were reunited in the same home during later childhood after lengthy separation. The association between extraversion and age and size of the family group is perhaps also of a readily understandable kind. Analysis of the case histories did not consistently favour one particular theory (unless it were a multi-dimensional theory) as to which environmental factors are the most important as causes of differences in personality between individuals; nor has the writer been tempted to produce a general environmental theory of his own to compete with others already in circulation.

It is perhaps germane to ask: did the analysis disprove any particular theory? Provided any non-genetical theory allows some variation to be attributed to genetical differences it is always possible for its advocates to argue that a larger sample, or one investigated on different lines, might have provided more support. Most current theories do leave some scope for genetical factors. Let us relate our findings to two of them—conditioning theories and psychoanalytical theories.

Though early behaviourist theories tended to look upon the minds of all infants as being identical *tabulae rasae* on which differing environments impressed different tendencies of response, modern conditioning theories (e.g., those of Eysenck) allow much variation to individual differences in conditionability. How far the present findings fit the relationship between extraversion and conditioning which he hypothesizes is doubtful. If extraverts are less easily conditionable than introverts or their conditioned responses are more easily extinguished, one might have expected the more extraverted pairs of twins to differ less by reason of their early environmental experiences than the more introverted pairs. However, no general tendency of this kind emerged from the SRQ. Clinically, however, twins tended to differ more in hysterical manifestations (associated with high extraversion according to Eysenck) than in those of a dysthymic (introverted) kind.

If difficulty at birth is equated roughly with tendency to brain damage and if brain damage, as on Eysenck's theory, increases extraversion, one might have expected those twins who were reported as having had a difficult birth to have turned out to be more extraverted than their twin partners; but this was not the case [p. 113]. It must be conceded, however, that the nature of the material is not such as to provide any crucial test of conditioning hypotheses of personality development.

We approach rather closer to the heart of the matter when we come to psychoanalytic hypotheses. Freud himself (1937) can be cited as attributing considerable

importance to what he termed congenital factors for neurosis and personality. Psychoanalysis can allow for constitutional differences in the strength of the instincts or ego, or in individual predisposition towards the various mechanisms of ego defence. In many formulations of psychoanalytic theory, however, much greater emphasis is laid on early family environment. Specific factors such as breast-feeding and toilet training are considered important, either in themselves or more indirectly through their influence on the mother-child relationship. This relationship is said to be strongly influenced by unconscious attitudes which the mother carries over from her own early experiences. (Though it is possible for a mother to identify her monozygotic twins with different figures, two different women bringing up a pair of twins would, presumably, have widely differing unconscious fantasies.) Change in mother-figure is regarded as a risk to sound personality development, it sometimes being considered preferable in the interests of future mental health to keep a child with his own mother, even in an apparently poor home, than to place him in a good but impermanent foster-home. It used also frequently to be stated in the more popular expositions of psychoanalysis that it was the first 5 years (or the first 2 years) that were all-important for character formation.

The present study gives no positive support to the above views in so far as they could be examined directly or inferentially. Any effects of influences such as breast-feeding, separation from mother, different unconscious fantasies of the mothers or differences in prelatency development resulting from interfamily as opposed to intrafamily environment have been submerged by other influences and have not shown up in the rather rough and ready assessments of personality by means of tests and later history. These assessments, however, were adequate to give support to genetical hypotheses.

It may well be that the observations on the present groups of twins would, within the framework of some theories, lead to an altered view of the importance both of heredity and of later environment.

One of the more definite conclusions that can be drawn on the environmental side relates to the interpretation of findings of resemblance in monozygotic twins brought up in the same home. The almost equally close resemblance between them and twins brought up in different homes argues strongly against such resemblance being due mainly to the extremely similar ways in which a mother is said as a rule to treat her monozygotic twins or to their mutual influence on one another when living together. Arguments on these lines are sometimes used against accepting genetical conclusions based on a comparison of mono- and dizygotic twins. The present findings therefore vindicate some of the presuppositions of the traditional twin method.

### *Conclusion*

The above discussion of genetical and environmental causes of variation has suggested that on both sides these are multiple and interacting. It is not surprising

that specific, well-defined effects of single elements in the equation are not easily to be discovered. At our present stage of knowledge much human behaviour appears to be the result of individual unpredictability. The existence of twins who are alike in all their genes has nevertheless enabled us, by means of appropriate comparisons, to demonstrate something of the importance of heredity for a wide variety of personal characteristics. The very fact that such twins differ, sometimes extensively, is of itself evidence of non-genetical effects. To some it may come as a surprise that twins brought up together differ so much.

### *SUMMARY*

In this concluding chapter a résumé has been given of the rationale, plan and presentation of the study. Related findings from different chapters have been drawn together. Some possible objections to the genetical conclusions have been discussed and some of the implications of the environmental findings examined.

More briefly we can repeat the following:

1. In the comparison that has been made of genetically identical twins brought up apart and together, significant resemblance between twins in both groups has been found in respect of intelligence, extraversion, neuroticism, and a variety of personal characteristics, ranging from voice and mannerisms to smoking habits.

2. Objective tests and data from interviews agreed in finding a resemblance in personality between monozygotic twins.

3. In keeping with other work on twins, dizygotic twins did not appear to be so alike.

4. According to the writers' assessment of personality, twins brought up apart were a little less alike than those brought up together, but the difference was not statistically significant and its direction was not confirmed by all the tests.

5. A relation between early environment and later findings could be seen in individual cases and in the systematic analysis of the histories; but by and large, differences in early family structure and upbringing did not, in this investigation, stand out as all-important causes of difference in later personality. Influences of other kinds are thought to have been equally important in contributing to the fair degree of difference found.

6. The study has clearly demonstrated the importance of variations in genetical constitution for differences in personality development.

Finally, we may make two very general propositions, for the truth of which there seems to be good support:

1. Family environments can vary quite a lot without obscuring basic similarity in a pair of genetically identical twins.

2. Even monozygotic twins brought up together can differ quite widely.

The interpretation of the findings will depend on how much emphasis one gives to one or the other proposition.

PART II

CASE HISTORIES  
AND  
TEST RESULTS

## NOTE ON PRESENTATION OF CASE HISTORIES

TABLE 40 draws together for all the S group pairs the basic information on childhood separation, ratings and test results. Differences in intelligence are those in the combined tests after doubling the vocabulary score [CHAPTER 8]. The table is followed by the history of each pair.

The names of the subjects have been changed in order to preserve anonymity. In the headings the twin who sent in his name is placed above that of the other twin. The numbers 1 and 2 relate to birth order. 'Grade' relates to the writer's ratings of personality resemblance [CHAPTER 10], Grade I being the most alike, IV the least alike. MHR stands for the mental health ratings [CHAPTER 13]. If the pair was reunited during childhood (other than for holidays), this is indicated in the headings. Unless otherwise indicated in the headings, both twins were interviewed by the writer. Age relates to the age of the twins when the principal data in the histories were obtained. Occasionally the Self-Rating Questionnaire had been completed by one or both subjects up to 2 years previously and sometimes the tests were not all completed on the second twin until a little later.

The sections on the separations and on later environmental histories relate for the most part to the external environment, the twins' reactions being included under 'personality'. Unless otherwise indicated, the personalities of the parents or adoptive parents should be regarded as not outstanding in any way. Similarly lack of mention of personal relationships should be taken as indicating no appreciable difference. The information under 'health' is selective, as indeed is all the information that can be presented here. Under test results the two intelligence and the two personality scores are given. In the section on personality the most notable similarities are generally presented first, followed by the differences, as assessed from all sources. For convenience psychiatric disorders are referred to under this section too.

Following the histories of the twins in the investigated monozygotic S series, very brief accounts are given of other pairs brought up apart—two probably monozygotic pairs whose investigation never passed beyond a preliminary stage, and the separated dizygotic pairs.

For reasons of space case histories of the control twins are not presented here. Many examples were given in CHAPTERS 10, 11, 12 and 15. The basic data (age, sex, ratings and test scores) for the control and dizygotic twins appear in TABLES 41 and 42, following the case histories of the twins brought up apart.



TABLE 40. TABULATED SUMMARY OF MONOZYGOTIC  
PAIRS BROUGHT UP APART

Case Number	Age	First Names	Childhood Separation		Author's Ratings		Test Results (Points Difference in Score)		
			Age	Brought Up By	Personality Resemblance Grade	Poorer Mental Health Rating	More Intelligent	More Extraverted	More Neurotic
S m 1	14	Richard Kenneth	3 months	Mother Maternal aunt	III	*	10	1½	0
S m 2	17	Bertram Christopher	Birth	Paternal aunt Paternal aunt	III	*	6	5½	3
S m 3	18	Russell Tristram	20 months	Adopted Mother	IV	*	23	2½	3
S m P 4	22	Herbert Nicholas	Birth	Maternal grandmother Adopted	(I)	*	(7)	—	—
S m 5	30	Frederick Peter	6 months	Paternal aunt Adopted	I	equal	5	1½	½
S m 6	32	Foster Francis	6 months	Paternal aunt Mother	I	*	2	2	5
S m 7	34	Rodney Barry	Birth— 9 years	Paternal aunt Mother	III	*	25	3	2½
S m 8	38	Edward Keith	2 years	Different children's homes	III	*	1	8	½
S m P 9	39	Alfred Harry	Birth				Father Maternal aunt	(IV)	*
S m 10	39	William Stanley	4 years	Different foster-mothers	III	*	(?)	10	1½
S m 11	45	Timothy Kevin	Birth				Mother Paternal aunt	III	*
S m 12	49	James Robert	Birth	Mother Paternal uncle	II (a)	*	20	0	6½
S m 13	51	Patrick Victor	12 months	Paternal aunt Mother	II (b)	*	12	6	2
S m 14	51	Hubert Brian	12 months	Mother Maternal grandmother	II (a)	*	2	0	6
S m 15	52	Benjamin Ronald	9 months	Mother Maternal grandmother	I	equal	2	2	2
							1		

TABLE 40—contd.

Case Number	Age	First Names	Childhood Separation		Author's Ratings		Test Results (Points Difference in Score)		
			Age	Brought Up By	Personality Resemblance Grade	Poorer Mental Health Rating	More Intelligent	More Extraverted	More Neurotic
S f 1	8	Jessie Winifred	3 months	Adopted Adopted	I	*	0	1½	2½
S f 2	23	A B	6 months	Mother Maternal aunt	—	—	—	3	2
S f 3	30	Valerie Joyce	13 months	Adopted Mother	III	*	?	6	7
S f 4	32	A B	5 years	Aunt Mother	—	—	—	4	1
S f 5	32	Megan Polly	Birth	Father Adopted	I	*	—	1½	3
S f 6	33	A B	Birth	Paternal aunt Maternal aunt	—	—	—	0	7
S f 7	33	Jenny Kathleen	Birth	Paternal aunt Paternal aunt	II (a)	*	8	3	5½
S f 8	35	Olive Madge	Birth	Mother Paternal uncle	II (a)	*	3	3	3
S f 9	36	Madeline Lilian	16 months	Adopted Adopted	I	*	5	2	2
S f 10	36	Marjorie Norah	22 months	Adopted Adopted	IV	*	30	4	9
S f 11	38	Molly Dorothy	8 years	Maternal grandmother Mother	III	*	5	2	6½
S f 12	38	Pauline Sally	7 years	Mother Maternal aunt	II (b)	*	1	1	2
S f 13	39	Viola Olga	Birth— 11 years	Maternal grandmother Mother	II (b)	*	6	2	1
S f 14	40	Millicent Edith	3 months	Paternal grandmother Mother	IV	*	23	1	½
S f 15	40	Joan Dinah	Birth— 5 years	Mother Maternal aunt	II (b)	*	4	12	3
S f 16	41	June Clara	Birth	Adopted Adopted	III	*	10	2	2

TABLE 40—*contd.*

Case Number	Age	First Names	Childhood Separation		Author's Ratings		Test Results (Points Difference in Score)		
			Age	Brought Up By	Personality Resemblance Grade	Poorer Mental Health Rating	More Intelligent	More Extraverted	More Neurotic
S f 17	41	Jacqueline Beryl	Birth	Paternal uncle Distant maternal cousin	II (a)	*	17	1½	1
S f 18	42	Christine Nina	Birth	Father Paternal aunt	II (b)	*	3	2	2
S f 19	43	Herta Berta	4 years	Mother Adopted	II (b)	*	24	9½	2
S f 20	45	Charlotte Laura	Birth	Maternal grandmother Mother	II (b)	*	8	0	1
S f 21	47	Mary Nancy	Birth— 12 years	Maternal grandmother Mother	I	*	4	0	1
S f 22	48	Olwen Gwladys	2½ years	Adopted Adopted	I	*	14	0	0
S f 23	48	Annie Trixie	6 weeks	Paternal grandmother Mother	IV	*	22	1½	2½
S f 24	50	Joanna Isobel	Birth— 5 years	Paternal grandmother Mother	II (b)	*	1	5½	9
S f 25	51	Odette Fanny	Birth— 12 years	Maternal grandmother Mother	II (a)	*	6	1½	4
S f 26	55	Amy Teresa	6 months	Maternal uncle Mother	II (b)	*	7	1	4½
S f 27	56	Dora Brenda	9 months— 12 years	Maternal grandmother Mother	II (b)	*	3	5	10½
S f 28	59	Maisie Vera	A few months— 12 years	Father Paternal uncle	III	*	—	4½	½
S f 29	59	Adeline Gwendolen	9 years	Father Maternal aunt	III	*	2	1	4½

# CASE HISTORIES OF MONOZYGOTIC TWINS BROUGHT UP APART

## *CASE S m 1, AGE 14*

(Both twins seen by colleagues only)

Separated at 3 months

Grade III

Mother

1. RICHARD . . . . . Poorer MHR

Maternal aunt

2. KENNETH

### *Separation*

At the birth of the twins the mother had a nervous breakdown [see below]; she cared for Richard, but says she never bothered about Kenneth whom she has always resented. At about 3 months (not later) mother's sister, who had been helping her, took Kenneth herself, initially for a year but in fact permanently—she did not want to part with him and mother has not wanted him back. Though living only a few miles away, on either side of a small town in Scotland, the twins did not meet or know they were twins till they were 5 or 6. From the age of 9 they met once a week when Kenneth's family came to live in the town. Dick's family has continued to live in a small nearby village close to a steel works. They have not gone to school together. Dick was brought up with a sister, now aged 19; Kenneth with two (foster) brothers now 29 and 27. FATHER: steel worker, very deaf, has had perforated gastric ulcer, no very positive relation with either twin, though mother says he spoils them. MOTHER (seen by P. S. W.): aged 52, herself one of twins, her twin brother dying at 8 weeks; thin, tense, expresses many fears, rarely goes out; shows herself aggressive towards the twins, especially Kenneth, but is overprotective and overpossessive of Dick. During pregnancy feared twins but did not know she was in fact going to have them. Allegedly at the shock of finding there was a second baby (Kenneth) had a 'complete nervous breakdown lasting for years': only within last 4 or 5 years has she approached normality. After the birth, she was restless, could not sleep, lost her appetite, was unable to go out; thereafter chronically anxious, hypochondriacal, obsessionally tidy, constantly chivying her family. She seemed to be of dull intelligence; has had no psychiatric treatment. UNCLE: normal; motor mechanic; Kenneth very fond of him. MATERNAL AUNT (also seen): age 50; fat, cheerful, more at ease, more intelligent and more efficient than the mother, without any sign of aggressiveness; speaks with great affection of Kenneth, though she said that when he was naughty she used to threaten him with return to his own mother; not worrying or fussy, no ill health elicited.

### *Health*

At birth Dick weighed 3 lb., Kenneth 2½ lb. and it was not thought they would survive. Dick had difficulty in sucking and cried a lot during the first year. Though smaller at first, Kenneth was easier to manage and according to our information was earlier in passing his milestones. Both had their tonsils out at 2. Though small (Dick 4 ft. 10 in., Kenneth 4 ft. 10½ in.) neither has had any significant illness.

### *Test Results*

	<i>Richard</i>	<i>Kenneth</i>
Dominoes	22	12
Mill Hill (Junior scale)	19	19
Extraversion	16	14½
Neuroticism	3	3

### *School Reports*

Dick is twelfth in a class of sixteen boys, Kenneth nineteenth in a class of twenty-two, in their respective 'non-language' type secondary schools. Neither has impressed his teachers by any special ability or by reason of his behaviour.

*Personality*

They seemed to be pleasant, easy-going lads. They like going around together when they can, stand up for one another and rarely quarrel. They had normal boyish interests, though the mother tended to restrict Dick's social activities. To judge by the manner in which they tackled the Dominoes they would appear to be somewhat impulsive. The aunt regards them as being 'in many ways very alike', and the psychiatric social worker who took charge of the investigation of this pair found them to be similar in many of their attitudes in a way which was difficult to bring out in the history.

Though Dick gets on well with other boys, Kenneth has more general social contacts. He seemed to be a warmer and more friendly person with more social poise and more observant about what was going on. Dick, on the other hand, was less responsive, more slovenly in gait and somewhat sulky in attitude. There were no other indications of maladjustment.

*Comment*

Similarities and differences in personality are fairly equally balanced, but since the similarities relate to very ordinary characteristics and the differences are rather more easily described, the case has been rated as Grade III rather than II (b). While Kenneth's greater warmth, friendliness and security can perhaps be regarded as reflecting qualities in the aunt's personality and the home she has provided, it is remarkable that Dick shows so few signs of having been brought up in such an unfavourable environment and that the twins are as alike as they are.

*CASE S m 2, AGE 17*

Separated at birth

Grade III

Paternal aunt

1. BERTRAM

Paternal aunt

2. CHRISTOPHER . . . Poorer MHR

*Separation*

The mother died the day after the twins were born. The paternal aunts decided to take one twin each and they have brought them up amicably, living next-door to one another in the same Midlands colliery village. The twins have different surnames. They are constantly in and out of each other's houses. BERTRAM'S 'FATHER': face worker in the pits, friendly, cheerful, fairly sociable, says he gets worked up easily. BERTRAM'S 'MOTHER': normal, hospitable, expresses no strong opinions; has two daughters of her own, a shy girl of 23, who is a solicitor's clerk, and a normal, plump girl of 9. CHRISTOPHER'S 'FATHER': colliery fan attendant, skilled worker but earns £5 per week less than Bertram's father; asthenic build, non-smoker, teetotaler, stresses the great responsibility of his work—peoples' lives depend on him; coach of local football team. CHRISTOPHER'S 'MOTHER': similar to her sister, Bertram's 'mother', in personality, perhaps a little quieter; no children of her own. Bertram's family, but not Christopher's, possess a television set and a car.

*Health and Environment*

Both twins were tiny when born. Though a little heavier, Bertram was very black. Bertram was slightly ahead in physical development, but only he had pneumonia at 2, broke his forearm at 12 and had rheumatic pains at 14. Bertram's voice was the first to break by about 6 months. They went to the same school until 11, when Christopher by a narrow margin passed into the Technical College in the nearby town; but when Bertram left the secondary modern school, Christopher left school too and both twins became garage mechanics. Christopher has been taken on as an apprentice. There is not scope for two apprentices and Bertram is considering joining the Air Force to learn a trade.

*Test Results*

	<i>Bertram</i>	<i>Christopher</i>
Dominoes	36	34
Mill Hill (senior scale)	11	15

The adoptive parents of both twins and Bertram's elder foster-sister also completed the self-rating questionnaire.

	<i>Bertram and his 'parents' and foster- sister (cousin)</i>	<i>Christopher and his 'parents'</i>
Extraversion		
Twins	18	12½
Fathers	8	11
Mothers	13½	9
Foster-sister (age 23)	9	
Neuroticism		
Twins	5½	8½
Fathers	20	8
Mothers	12½	9
Foster-sister (age 23)	18	

Bertram's scores are more like Christopher's than like those of his foster-sister or the mean scores of his adoptive parents. Though Bertram's parents are the more neurotic, it is Christopher who is the slightly more neurotic twin.

### *Personality*

They have always been closely attached to one another, and now go out courting together. This year they are planning to take a holiday together, without their parents. It is claimed that if one twin hurt himself the other one always knew. When they were younger, Christopher used to follow Bertram around 'as if he were a younger brother'. Up till the age of 7 they were both afraid of strange noises and the dark; otherwise they have been very free from anxiety and they appeared to be well-adjusted lads. Their interests are mechanical and sporting ones. They enjoy adventure books and films. They were dressed alike in smart flannels and coloured waistcoats and after the interview left to keep a date with their girls. When their features were inspected they both giggled in a similar way.

Christopher's features are more delicate, almost girlish. Bertram has the reputation of being the more energetic. He would rush in to a fight, where Christopher would hold back. Bertram regards himself as the more sociable, thinks Christopher is 'stuck up'. Bertram was certainly the more forthcoming. Christopher was rather shy, sitting on the arm of a chair and looking away during much of the interview.

### *Comment*

The environment for these twins was as alike as that of most twins brought up together, except that they did not share the same parents. Personality differences were perhaps more distinctive than the resemblances and are not unlike those quite often seen in twins brought up together. The fact that Bertram takes the lead could be related to the fact that in the relationship between the two families it is Bertram's family that takes the initiative. They sent the twins' names in to the B.B.C. and the interviews took place in their home.

### *CASE S m 3, AGE 18*

Separated at 20 months

Grade IV

Adopted

2. RUSSELL . . . Poorer MHR

Mother

1. TRISTRAM

### *Separation*

They are the offspring of a bigamous marriage and, largely for domestic reasons, their mother was unable to look after them much at first. For 3 months during early infancy, Mrs. R., an acquaintance of the mother's, had both babies at her home in London. Then they were looked after by mother and maternal grandmother in a town in North-west England for a few months, returning to London where Mrs. R. had Russell on one or two

occasions. At about 20 months a large Children's Orphanage took Russell (they would not take both twins) and friends of the father near London took Tristram (they also would take one only). The Orphanage would not keep Russell on account of his fits and screaming attacks, and at 2½ he was taken from there by Mrs. R. who adopted him legally just before his fifth birthday. At about 4½ Tristram returned to his mother who had remarried, and he was legally adopted by his stepfather. For a while the grandmother helped to look after Tristram and the mother went out to work. The twins have remained in their respective homes since, except when Russell was in hospital. They first met at 7 when they stared at each other in amazement and wanted to change clothes. They met again at 10 and at 12 during holidays and still see each other only about once every one or two years. They do not correspond, though Russell sends Tristram a Christmas card. Relations between the two families are a little strained. FATHER is said to have been a play-boy. There is no detailed information about the MOTHER (43), though in Mrs. R.'s opinion she is unreliable and insincere. She used to work in a biscuit factory. However, she and the STEPFATHER, a joiner, appear to have given Tristram a normal home life since they have had him. There are no other children. RUSSELL'S ADOPTIVE FATHER is a railway guard and very fond of him. MRS. R. (54) is a normal, rather conventional and very maternal woman who is accused by her own relatives of giving too much attention to Russell. Her own two sons are 17 and 14 years older than Russell.

On account of his epilepsy or its residual defect Russell is unable to work [see below]. Tristram left Secondary Modern School at 15 and is an apprenticed radio engineer.

### Health

Tristram was born first and weighed 5¾ lb., 1¼ lb. heavier than Russell. No information about after-birth. Instruments were not used and according to the mother they were quite normal babies at birth. A report from the Orphanage states that since admission Russell had not been of normal mentality owing to severe screaming attacks. At 2½ when still at the Orphanage, Russell had nine attacks of *petit mal* lasting 2-4 minutes each. When Mrs. R. took him from the Orphanage his thumbs were bandaged, he had bitten them so; he was retarded in speech and greedy for jam. His fits became more frequent. A report from a hospital he attended at the age of 8 states: 'Air encephalography showed some general dilatation of the ventricles. Arms—weakness of grip and flexion of elbow on right side, with slight increase in tone. The knee and ankle jerks were pathologically increased and there was a definite extensor plantar response on the right; the left was doubtful. The abdominal reflexes were diminished on the right side. X-ray of skull shows only a bone defect due to old ventriculography. The electroencephalogram is specific for epilepsy of idiopathic type. Considerable degree of cortical atrophy already present.'

At 14 he was admitted to an epileptic colony, as he was then having attacks nearly every day and night. Until then he had attended the ordinary schools. The admission note stated he had little use of his right hand. He could not tell the time or run errands. 'Response slow. No initiative, I.Q. 72. Right hemiplegia.' Mrs. R. states that on admission he started to wet himself, did not care for his appearance and would not mix. The colony reported that during the first 13 months in the colony he had fairly large numbers of both major and minor fits. Thereafter, following a change of drug, the frequency was greatly reduced; for 6 months he was clear of fits. He left as soon as he was 16. The school report stated he had a mental age of 11 years 3 months on the Binet test (reading age was 12 years, 5 months). He was 'still painfully slow in all things and has a slight complex about it. . . . An introvert and can be moody.' Interests at that time included aviation and aeronautics. Conduct was generally satisfactory but he would not co-operate much to play with others. Since leaving school he may have had a very occasional fit at night, otherwise he has been clear. However, his slowness persists. He has tried three jobs without success. His application to enter a rehabilitation centre has been turned down.

Tristram has had no overt symptoms of epilepsy of any kind. However, when E.E.G.s of both twins were done [full reports below], Tristram, on photic stimulation, was discovered to have an abnormal record, including typically epileptic spike and wave. Russell's record also showed spike and wave and in addition a focal origin in the left front central region.

In Dr. Desmond Pond's opinion this suggested that Russell 'developed epilepsy following birth injuries because of his genetic tendency thereto'.

Apart from his epilepsy Russell has had an operation for pes cavus and he has a spotty complexion. Otherwise his physical health has been satisfactory. He is one inch shorter than Tristram. Tristram has suffered much from catarrh and has been three times in hospital on account of nasal polypi.

Both twins are left-handed.

### *Test Results*

	<i>Russell</i>	<i>Tristram</i>
Dominoes	23*	30
Mill Hill	6	14
Extraversion	6½	9
Neuroticism	10	7

\* Allowed to continue for 50 minutes instead of 20, scored 29 out of 30, i.e., normal intelligence.

### *Personality*

The twins have no close feeling for one another. Russell was a sad-looking boy with a slight stoop and a puzzled screwed-up expression. He was easily discouraged when doing the vocabulary test but most persistent with the Dominoes. At home he cleans out his own room, does some errands and occasionally cooking or washing up. He is affectionate towards his 'mother' and inclined to be jealous of any attention she gives her grandchildren when they visit. He does not like going out to the cinema or to sports. He likes listening to the radio and reading—'it is all there is to do'. His overriding interest is astronomy. He saves up his money for books on this subject. He wrote to the author of one of these books and proudly showed me the reply he received, from which it was clear he had misunderstood some elementary point. He admits he understands none of the mathematics on the subject. (In calculating his fare he persisted in saying twice 1s. 8d. was 3s. 6d.). He is contemptuous of astrology—and also, he says, of religion: if there was anything in prayer God would have made him better. He was painfully slow in speech and in action, particularly in anything requiring the use of both hands together. He was sorry that Tristram, who had come from the north with a friend on a motor-cycle, had declined his invitation to stay with him—'I suppose he wouldn't want his friends to see what I looked like'. Russell has no friends. Mrs. R., on going through the 'normal personality traits' section of the booklet, describes him as slow, cautious, silent, reserved, quiet and thrifty. He is not often excitable. He can be obstinate and moody.

Tristram appeared to be a normal boy for his age. He said he was quite happy at home—'not regimented the way some people are'. His main interest is his job—radio engineering. He has passed the first of his exams in his subject. He spends most of his spare time with radio sets and with his motor-bike. He lives in a large seaside town, but he likes to get out into the country with a friend and shoot rabbits and watch birds. He denies any great difficulty in making friends. He says he is not seriously interested in girls yet. The information in the booklet describes him (apparently quite well) as shy, silent, quiet and thrifty like Russell, but he is not slow or lacking in confidence. Tristram says he has no nervous tendencies and none were noticed. Both twins independently express a strong disapproval of smoking.

### *Comment*

In as far as the twins show a resemblance in personality, it seems to lie in their being placid, quiet, determined, persevering and greatly interested in scientific subjects. Tristram might be described as an introvert, as Russell was in his school report [see above]. However, the similarities are greatly overshadowed by the differences caused by Russell's organic brain disease, cerebral atrophy, hemiplegia and epilepsy.

Both twins had an unsettled environment for part of their early years, but a satisfactory one after that. The effect of the different environments has probably been slight, relative



to the importance of the brain damage, as a cause of the differences between them. Russell's home environment appears to have been in no way detrimental to him, rather the contrary.

Evidence as to monozygosity is less secure in this case than in most others on account of differences in the finger-prints. This is discussed on page 43.

### *E.E.G. Reports*

Both twins were tested in 1954 by Dr. D. A. Pond, who reports:

'TRISTRAM shows a low voltage regular alpha rhythm at 11-12 c./sec. which blocks well to eye opening. It is distributed symmetrically over the head. The traces of faster and slower activity present are within normal limits for the age. Low voltage lambda waves can be seen. On over-breathing there is a general increase in the rhythmic activity of the whole record with the appearance of theta activity and sharp waves in the right posterior region. Photic stimulation at one frequency only (20 c./sec.) produces massive generalized high voltage symmetrical spike and wave.

'RUSSELL shows dominant alpha rhythm about 1 c./sec. slower and of slightly higher amplitude. Faster and slower rhythm is also more prominent and in the resting record there are several bursts of irregular spikes and slow waves which focus in the left fronto-central regions although spreading to involve both sides of the head. Overbreathing produces high voltage symmetrical 2-3 c./sec. activity. There is normal following to photic stimulation, in contrast to his twin.'

Since Russell's response to flicker was thought to be due to anticonvulsants he was taken off drugs and retested one month later by Dr. G. Pampiglione, who reports:

'This patient had a seizure half an hour before the test with generalized clonic movements (observed by Dr. Edwards) with loss of consciousness. The record is rich in artefact. In addition to some 10-11 c./sec. alpha rhythm in the parietal regions blocked by eye opening there is a great deal of 5-6 c./sec. activity. This appears maximal at the vertex and perhaps at the occiput. Several bursts of mixed spikes, sharp waves and slow waves are seen generalized or with variable asymmetries. No overbreathing was done. Photic stimulation seemed to facilitate the appearance of the complex bursts. This record is abnormal with clear paroxysmal features, as found in some epileptics. There are no localizing features.'

### *CASE S m P 4, AGE 22*

(Ascertained through Herbert's admission to The Maudsley Hospital)

Separated at birth. Reunited temporarily at 5 for less than a year Grade I

Maternal grandmother	2. HERBERT		
Adopted	1. NICHOLAS	. . .	Poorer MHR (marginally)

### *Background*

The twins are the illegitimate children of a half-Chinese girl, who was aged 19 at the time and working as a waitress in a Chinese restaurant in Limehouse, and an Englishman who used to come to mend the pin-tables in the restaurant and is now proprietor of a roadhouse, but about whom there is no more information. Their maternal grandfather was a Chinaman who was deported from London for infringing the gaming laws. Their mother spent part of her childhood in a hostel and her younger sister, who has since married a Jamaican, was brought up mostly by foster-parents. On the grandfather's death the grandmother married a second Chinaman in 1939 when the twins were 5. During the war the mother married an American, reported to be someone in the film world. Although never responsible for the twins she appears to have favoured Herbert. Nicholas says he remembers her being unkind to him when she came to say goodbye when he was 7. A few months before Herbert's admission to the Maudsley, the mother paid a short return visit to this country, living with the grandmother and Herbert, but not seeing Nicholas, who only heard of her visit after Herbert fell ill. Though one-quarter Chinese the twins would pass for white.

### *Separation*

Herbert was very small at birth and, after being kept in hospital at first, was brought up until the age of 4½ first in one and then, when it closed down, in another Roman Catholic

residential nursery. He was then looked after for 9 months until outbreak of war by his maternal grandmother. Up till then Nicholas had a succession of about three foster-homes about which there is no information. It was at the beginning of the war that the twins first met and they were evacuated together to a country town. They did not get on and, on account of various difficulties, were parted, within a year, to separate foster-homes in the same area. In about 1941 Herbert returned to the grandmother and about a year later, aged 7½, Nicholas too was sent home from evacuation. The grandmother, however, said she could not manage them both. She therefore asked the family who some years earlier had brought up her younger daughter if they could take Nicholas. The daughter of this family, Mrs. M., then a married but childless woman of 41, was delighted to do so. Her husband, a building contractor working for the army, was not consulted at the time but made no difficulty about semi-officially adopting Nicholas. A year after taking Nicholas Mrs. M. became pregnant herself; Nicholas is attached to his young foster-brother and has remained with the M.'s ever since, at first going by their surname. He has lived in a dormitory suburb on the fringe of Greater London, while Herbert continued to live in Inner London. When the house in which she was living was bombed, the grandmother moved to a poor district in South London. There were no other children in the house. The twins have had only occasional meetings of short duration and there is no close feeling between them. STEP-GRANDFATHER: Chinese cook, aged about 70, speaks little English, very quiet, takes little interest in Herbert. MATERNAL GRANDMOTHER, aged 63, Londoner, reserved, undemonstrative, did not bring up her own children and did not want to take Herbert, but has not been ill-disposed to him and said to have given him a clean home but one lacking in amenities. NICHOLAS'S ADOPTIVE FATHER: manager of firm of building contractors, aged 56, active in Trade Association in which he has held responsible positions, keen gardener; takes a fatherly interest in Nicholas; normal personality. NICHOLAS'S ADOPTIVE MOTHER: large, florid woman of 56, talkative, excitable, histrionic, warm-hearted but probably inconsistent; very lenient and protective with Nicholas, said by her husband to be like a hen with her brood of chicks; Nicholas is said to idolize her. Her mother, who died when Nicholas was 15 and also lived in the home, was stricter but he idolized her too.

### *Later Environmental History*

Both have had a number of jobs, Herbert as a printer's messenger and then a labourer with various building firms, Nicholas as greengrocer's roundsman, in the scrap metal trade and in engineering factories as fitter's mate. Both did their National Service in the Army, not sent overseas.

### *Physical Health*

Herbert's birth was by forceps delivery after 2 days' labour. He was smaller and more delicate and is described as being less robust. Herbert had two or three accidental falls as a child in which he injured himself. At the age of 10 he was 6 days in hospital with mild concussion and laceration of the scalp. He is also said to have had concussion at the age of 12. Both had appendicectomy at about 18.

### *Test Results*

(Not included in statistical analysis.)

	<i>Herbert</i>	<i>Nicholas</i>
Dominoes	10	13
Mill Hill	11	6
SRQ not administered		

### *Personality and Psychiatric History*

HERBERT. At school Herbert was dull at his lessons, he truanted and he stole. He was enuretic until about 12. On return from evacuation the neighbours complained because he used to set paper alight in the garden. He also set fire to papers in a cupboard, at 10 he set fire to the curtains of a neighbour's house, and there is a story of his setting light to paper

which he had tied to a dog 'because the devil told him to'. On more than one occasion he injured himself through falling from a height. He talked a great deal in his sleep.

At the age of 15 he was put on probation for stealing; 4 months later he broke probation and absconded from the remand home. I.Q. was 87. In the opinion of a consultant psychiatrist he was 'a boy with a poorly formed character, self-absorbed, impulsive and subject to periodic depression in which he is careless what happens to him'. He was committed to an Approved School for a year and there were further attempts to abscond. From the age of 17 he was reported as being quiet, not a good mixer, a day dreamer, clean and particular, conscientious at his work; never had a girl friend. He was a heavy smoker. On return from National Service he had spells when he would be aggressive or resentful, particularly towards his grandmother with whom he still lived.

At 22, 3 months before admission to the observation ward, and about 2 months after his mother's visit, his behaviour was first noticed as being odd. He would break off in the middle of a meal, stare into space, sit inactively in a chair sometimes in awkward positions, whereas previously he was fairly active. He began to neglect his appearance. He grimaced and laughed to himself. Eventually he was sent home from work. The sound of cars passing he interpreted as aerial activity indicating the imminence of war. When in this state he was visited by his twin (22 December, 1956). He referred himself for treatment and was sent to the observation ward on 8 January, where he was thought to be schizophrenic and was sent on to The Maudsley Hospital 9 days later. At first he answered 'don't know' to questions even about his name and address or showed the syndrome of approximate answers, as in the following:  $2 + 3 = 6$ ;  $3 + 3 = 5$ ; pence in one shilling = 13; shillings in £1 = 21. Later he showed himself to be extremely sensitive about his background and lack of education (cannot write). Wechsler I.Q. 76. Though there was suggestive evidence of thought disorder, ideas of influence and catatonic signs, and though more than one consultant thought he was schizophrenic, the final diagnosis gave him the benefit of the doubt and he was classified as a case of hysterical pseudodementia, borderline intelligence. He absconded from hospital after 13 weeks as soon as he heard his previous job was still open to him (8 March). But on 5 June he was readmitted to the observation ward—for 3 weeks he had sat at home and refused to go out and he had recently struck his grandmother. On examination he smiled for no apparent reason and showed some degree of thought blocking. He said he felt out of place: 'It's like an experiment. You feel the people are deceiving you. . . . I'd be reading people's thoughts when I concentrate. A person can talk straight and it can be straight talk. Some people talk backwards and some people you have to get along on top of their talk. My face doesn't fit, I must have shiny teeth.' He had spells when he was aggressive and resistive. While in the observation ward the twin investigation was completed. He was transferred to a mental hospital as a voluntary patient. He improved slightly on chlorpromazine, but remained emotionally flat and took his discharge against advice after 1 month.  $4\frac{1}{2}$  months later, on 21 January 1958, having not worked in the meantime, he was taken back to the observation ward after smashing the television set at home. He could give no reason for this behaviour. Asked how it was that people upset him, he said: 'Yes, sir, I try to avoid that. I live in what you might call a politicians' quarter. I think I've been fixed under politicians' suspicions. (Suspected of?) . . . Don't know. I'm sure an interdiscrete society could help you. (Interdiscrete?) Communist aggression mixed with racial intolerance. That's why I don't—why I've lost confidence through jumping into the air.' He was sent to a mental hospital under certificate, where the diagnosis of schizophrenia was confirmed. There was thought blocking and grimacing, and he heard voices because of the will-power of others; he used neologisms. A month later he was considerably improved, but emotionally flat and unable to appreciate his position as a certified patient. He did some work in the upholsterer's shop and gave no trouble. 5 months after admission there was no essential change.

NICHOLAS. When Nicholas was adopted he was sent to a private school but had to be removed because he shouted and swore. At the elementary school he was also in trouble on account of backwardness, truanting and misbehaviour. He was referred to a child guidance clinic and at the age of 10 sent to a school for the educationally subnormal until 14, so that a better eye could be kept on him. He was enuretic until about 14. He frequently walked

in his sleep. When Mrs. M. first took him he could not be trusted on his own because of his love of playing with fire. At 9 he set fire to some gorse bushes, at 10 he tried to set fire to some dry leaves and a fence but was caught by the police; no action was taken. A little later he was suspected of lighting a bonfire on the common. On a few occasions after his grandmother's death when he was 15 he said he had heard her talking to him, warning him about something.

Nicholas had to leave his first job because of dishonesty. At the age of 17 he was convicted of stealing lead, which he buried in the garden, and was put on probation. He repeated his offence, was remanded to prison and sent to live under supervision in a probation hostel for a year. He was reported as being of an independent nature, did not work well with others, kept doubtful company; his parents, though well-meaning, did not give him the supervision and guidance he needed. In the hostel he impressed the probation officer as being 'a strange, detached boy, thinks quite deeply in a queer sort of way, claims he cannot write, afraid of making a fool of himself'. After his National Service he worked for his father, but left because he thought the other workmen were spying on him. In the following year he had four different jobs but was thought to be a good worker. He never made friends with girls. He was a heavy smoker.

For about 3 months before the onset of his illness his father noticed him to be more irritable than usual. When the family heard that Herbert was ill, a friend suggested that it might be because he had been separated from his twin. Nicholas was taken to see him on 22 December and heard of their mother's recent visit. That evening he was found to be crying and the following day seemed abstracted, making clicking noises with his tongue. He was then his usual self for 2 weeks. Then, on returning home from work one evening, he amazed his father with strange, unintelligible talk. He felt he had special powers, but when the works manager threw away an empty cigarette packet Nicholas felt all the power go from him. Usually clean and particular, he walked through the house in muddy boots. 2 days later he smashed the bathroom window with a china dog—'the devil was there and it was either him or me'. Looking out of the window he said he saw a mass of flames and heard voices singing *Hark The Herald Angels*. Everyone's face looked different. The next day (5 January, 1957) he was admitted to mental hospital after he had run across a ploughed field with arms outstretched as if in prayer. On admission he seemed confused and agitated. 2 days later he was noted as being a blank-looking young man with a puzzled expression; no contact except for brief periods, after which he slips off again into his own thoughts. He denied he was worried about his brother's breakdown, attributed his illness to (1) laziness at work and (2) overwork. He said he had been doing bad things (unspecified) since leaving the army. He thought the other patients were doctors and knew all about him. There were some overactive spells, in one of which he absconded in his dressing gown. He was brought back and certified. Wechsler I.Q. 75. At this point the twin investigation was made. He was treated with tranquillizers, made some improvement and after 4½ months was discharged on the application of his foster-parents. 5½ months later, having done some work in the meantime, he had to be readmitted (30 September) and was again certified. He had cut his cheeks with a razor blade in four places, resulting in bizarre superficial scarring; he said he wanted to remove a beauty spot. He was euphoric in an incongruous way. At times there was marked blocking and withdrawal. It was thought he was probably aurally hallucinated. Again he settled down, but there were episodes of absconding and on one occasion he bought a bottle of aspirin and took thirty, he said because he did not like O.T. 10 months after readmission he was still in hospital. On both admissions the diagnosis was one of schizophrenia.

In June 1960 there was no basic change in either Herbert or Nicholas. Both twins were still in hospital, now aged 26.

#### Comment

The similarities in this case are discussed in the chapter on psychiatric disorders [p. 127]. Personal examination of the twins brought out still further points of resemblance. Nicholas, just like Herbert, answered 'don't know' or 'can't remember' to many questions about his past history. They spoke in the same way of their lack of education, said they could not write,

though they were persuaded to write their names; there was also a puzzlement over the meaning of words which seemed to go beyond simple ignorance. ('Words don't mean what they say'—Herbert.) Herbert turned some words into others, using neologisms—'think, shthink, stink', in the vocabulary test. Nicholas asked if it was true Herbert was a fitzoscene (schizophrene). Nicholas is not recorded as showing the syndrome of approximate answers, but his response to PTC tasting may indicate something similar: after much hesitation he said solution 3 was 'not all that bitter' (it had not been suggested that he might find it bitter); he later indicated to his parents that he had been suspicious of the test and thought it better not to admit how bitter the substance was. At a more superficial level of behaviour, they both tried to cadge cigarettes.

Accounts by their relatives brought out other small likenesses, such as a fastidiousness about their appearance—they both liked to wear clean white shirts even when doing dirty work. They share a love of gambling—their last meeting, 18 months before they fell ill, was a chance encounter at the 'dogs'. While similarities extend to trivialities, no consistent differences in personality emerged. The relatives seemed to think Nicholas was the more cheerful and outgoing, a probation officer who knew them both thought the opposite. The resemblance rating is clearly Grade I. Herbert had the poorer adoptive home. On the grounds that Nicholas became a social problem earlier than Herbert (sent to a school for the educationally subnormal largely because of disturbed behaviour) and because his illness necessitated certification sooner than Herbert's and was never considered to be primarily hysterical, Nicholas has been given the poorer mental health rating. But clearly the distinction is an artificial one. There seems no reasonable doubt that, despite the big difference in social environment, the twins are concordant for a variety of behaviour disorders and for a true schizophrenic psychosis.

NOTE: Herbert is Proband MZ 11 in the series of twins described by Slater (1961).

*CASE S m 5, AGE 30*

Separated at 6 months

Grade I

Paternal aunt	2. FREDERICK . . . . .	} Equal MHR
Friend of family	1. PETER . . . . .	

*Separation*

At 6 months, on death of mother. The large family—they were the youngest of eleven—was split up among relatives and Children's Homes. Frederick was taken by a paternal aunt who at 44 felt too old to take both twins; he called her Auntie. Peter was brought up at the other end of the same Kent town by a widow of about the same age, a friend of the family, whom he called Mother; the father, who took little interest in the twins, paid her 10 shillings a week. In both the homes there had been three other children, but the youngest was 10 or 12 years older than the twins. They attended different schools. No regular meetings. Between the ages of 8 and 12 Frederick lived with his family in a town some 20 miles away. PATERNAL UNCLE: plasterer; had been in mental hospital as a young man, but is recalled by Frederick as having been homely and placid, 'a lovely man'. PATERNAL AUNT: kindly, lenient; she and her husband kept much to themselves. PETER'S FOSTER-MOTHER: cheerful, placid; Peter speaks highly of her.

*Later Environment and Health*

They have worked mostly as window cleaners and milk roundsmen in their home town. From 16½ till 18 they were working together, but they were then called up into different branches of the Services and saw little of one another during the war. They are at present in the window cleaning business together, combining this with erecting television aerials. Peter, who has three children to support, still does a milk round, rising at 4.30 a.m. Frederick starts later. They married rather similar girls at 21. Frederick's wife had her first child only 4½ months ago, having feared she was to be childless; their daughter has a suspected congenital heart disease. Until her birth they lived in lodgings but now have a council house on the same estate as Peter. Neither has had any illness of note.

*Test Results*

	<i>Frederick</i>	<i>Peter</i>
Dominoes	25	30
Mill Hill	10	5
Extraversion	16½	18
Neuroticism	6½	7

*Personality*

As children, they were happy, lively boys, with many friends; in the B stream of their respective schools, being weakest at English, best at maths; fear of the dark till leaving school, no other neurotic traits. Frederick impressed me as a friendly, cheerful, efficient young man, rather lacking in introspection. Peter made a very similar impression indeed, and, interviewed separately, described things just as Frederick had done. They dislike planning in advance. They have had numerous interests—a three-wheeler car, a radiogram and popular records, keeping pets—but they usually lose interest after a while. They never read. They used to go dancing a good deal. They live mostly for their business, getting home in the evenings and enjoying a few pints of beer at the weekends. The twins and their families seem to get on well: 'we follow each other'. Frederick's wife confirms the similarity. No differences of any significance could be elicited. Neither has had any psychiatric illness.

*Comment*

These twins were brought up quite separately, one of them without a 'father', but they are nevertheless strikingly alike in their extraverted temperament. They have been in business together for the past 8 years and this must contribute something to the similarity of the lives they lead.

*CASE S m 6, AGE 32*

Separated at 6 months

Grade I

Paternal aunt  
Mother1. FOSTER. . . . Poorer MHR  
2. FRANCIS*Separation*

When the twins were 6 months their mother went to hospital with scarlet fever. Francis was looked after by a paternal uncle and aunt until the mother returned from hospital. Foster went to a childless paternal aunt and her husband. This aunt persuaded the mother to let her adopt Foster as the mother already had eight children to look after, five of them by a previous marriage; a ninth was born 3 years later. The twins have continued to live in the semi-industrialized villages on the outskirts of a large northern town where they were brought up about 5 miles apart, but meet only occasionally now. The separation created no ill feeling in the family, but Foster came to regret he had no brothers. In childhood they would meet in each other's homes during the school holidays and sometimes their aunt would take Francis as well as Foster away for a week's holiday; their mother was unable to afford to go away for a holiday with the children. They went to different schools. FATHER: quarryman, jovial, outspoken, generous; impressed on his children the value of work well done and of socialist principles. MOTHER: very strict, a big woman who would hit the children and swears freely; believed in teaching children the difference between right and wrong (by punishment) from the age of 4 or 5 months. UNCLE: foreman tailor and at one time professional cricketer; animal lover, left upbringing of children to his wife; quick-tempered if anyone got across him. AUNT: 2 years younger than mother, good-natured, generous, strong principles; not so harsh as mother, but more particular about tidiness in the home, no children of her own. Foster had more individual attention and his home was better off.

*Later Environment and Health*

Both had difficulty in getting suitable work on leaving school because of the depression. Francis wanted to do engineering but settled down as a painter. During the war he was

sunk at sea and injured his back. In 1949 he set up a painting business with a partner, but on account of suspected lead poisoning and gastric trouble gave it up and now enjoys doing outdoor work as a postman. The gastric symptoms continued for a while but are now improved. At 30 he married a country girl who was herself a twin and until a year ago has been living with his in-laws. No children yet. Foster was eventually apprenticed to an electrician and he has worked mostly doing maintenance work in a tractor factory. During the war he was a Naval Artificer working at the docks. He married a town girl at 25, more fiery than Francis's wife. They have a girl of 6 and a boy of 3 and live in their own house. Foster has had some stomach trouble also, diagnosed as duodenal ulcer; still has symptoms and is thinner in the face than Francis. Otherwise neither has had any notable illness. Identical height and weight.

### *Test Results*

	<i>Foster</i>	<i>Francis</i>
Dominoes	32	28
Mill Hill	20	23
Extraversion	7	5
Neuroticism	14	19

### *Personality*

As children they both say they enjoyed school. They were both nail-biters and had frequent bad dreams. Foster was taken to the doctor on account of his fear of the faces he thought he saw behind the curtain, while Francis had recurrent nightmares of being surrounded or trapped. They both used to get the feeling, for example when running to school, that someone was following them. From childhood onwards they have regarded themselves as being very bashful and lacking in push. They never lose their temper. They are slow workers because they do not want anyone to feel they have turned out a shoddy piece of work. They prefer to read non-fiction to fiction—'You're no better off when you've read a novel', as Francis puts it. They are constantly obliging others. Foster's wife complains he will do odd jobs for friends when he ought to be helping at home. When in the army they both smoked forty to fifty cigarettes a day, but have cut down consumption now. Each considers his gastric troubles have been aggravated by worry, e.g., responsibility of running a business (Francis) or going on night work or row with the aunt in whose house he was living just before the birth of his son (Foster). Like their father, they believe in socialist principles, and neither 'agrees' with religion. These personality resemblances are described separately by the twins in very similar terms. Francis feels closer to Foster than to the brothers with whom he was brought up, but the limited extent of the contact between the twins is insufficient to account for the degree of resemblance. No important differences could be elicited. According to their opinions, Francis was said to be even more lacking in drive than Foster. However, it was Francis who once set up in business and Foster who, on interview, stressed his worrying nature a little more and was perhaps a little concerned that he was being seen in a mental hospital. Foster, who (it will be recalled) was still having gastric symptoms, had the fiery wife and was not quite so satisfied in his job. The influence of family tradition is seen in the fact that Francis, like other members of the family in which he was brought up, was taught to play the cornet and other brass instruments. He now plays the B-flat bass in a band, while Foster's interest in music is confined to listening. Foster, however, like his cricketer uncle, has been more interested in sport.

### *Comment*

These twins are remarkably alike in personality, both being dysthymic introverts. Though some environmental effects can be detected, these are of a minor kind. Francis' harsher upbringing in a larger, poorer family has made no apparent difference.

### *CASE S m 7, AGE 34*

Separated from birth to 9 years

Grade III

Paternal aunt

1. RODNEY

Mother

2. BARRY . . . . . Poorer MHR

*Separation*

Rodney was born at home. The mother was then taken to hospital where Barry was born. Rodney was taken straight away by the paternal aunt with whom he remained until the age of 9 when, as the result of a letter from the mother's solicitor, he was returned to mother against his will. Barry was breast-fed, Rodney not. Until then they were brought up about 3 miles apart, Rodney in an industrial town in the Midlands, Barry in a small village, but without contact. Rodney knew all along that he was a twin. The AUNT was elderly with a grown-up daughter who had a son the same age as the twins. The UNCLE was retired and had an allotment. They were better off than the parents and, unlike Barry, Rodney was taken on holiday each year. The aunt was lively but 'the sort that kept a tight rein on you', old-fashioned, very strict but not cruel: Rodney said he would not leave her for the King. He was threatened with being sent back to his mother if he misbehaved. FATHER was a hosiery worker, well-respected and patient, both twins equally devoted to him, whom they are said to resemble. The home atmosphere was also strict. There were eight elder and one younger siblings and not enough chairs to go round at meals. Later on MOTHER had diabetes and could not stand noise. Rodney considers that mother treated the twins fairly.

*Health and Later Environment*

Barry had a difficult birth—was black and blue and was almost given up for dead—and was very delicate for a while. Rodney lost much schooling on account of colds. Otherwise good health. Rodney is the bigger and portlier. Both entered the hosiery trade and earn good money, but Rodney has done better for himself. He has a car and a more luxuriously furnished home. They were in the Services together as driver mechanics. Only Barry went to Normandy and had a leg wound for which he was sent home. Rodney married at 25, 2 years before Barry who married a second cousin with the same surname who had been brought up with him from the age of 10, her mother having died. They have three and two children respectively. Rodney's two younger children were Rhesus babies and it was this fact which led him to volunteer for a scientific research. Rodney's wife is the livelier. Both live in council houses about 10 miles apart. No very close contact since the war.

*Test Results*

	<i>Rodney</i>	<i>Barry</i>
Dominoes	26	17
Mill Hill	15	7
Extraversion	12½	9½
Neuroticism	7½	10

*Personality*

They are stocky young men who look young for their age. The twins consider themselves to be very much alike in character, as does Rodney's wife who says they are both easy-going, good-natured, not aggressive, but fond of teasing people. They are ambitious to get to the top of their line and earn more money. They dislike smoking, but drink moderately and enjoy playing darts in the pub. Rodney is the best bowler in the local cricket team and played in goal in the football team till last season. Barry also is a cricketer and footballer. Only Rodney has been interested in boxing, Barry in dancing, Rodney disliking the latter on account of shyness. Barry has a pleasant tenor voice.

The most notable differences between them seemed to be in intelligence and drive. Barry's poor score on the tests is in keeping with his school record and clinical impression. Though neither of them liked school, Rodney got on better, and at work he operates a more complicated machine than Barry. From the time he came into his own mother's home until joining the army Rodney was the shy one. He had a stammer as a child which still shows occasionally now. However, since the war he has developed more push and bravado, whereas Barry seemed a good deal shyer and lacking in confidence. He has a nervous habit of shaking his head when worrying about something. Both admit to a fear of heights but neither has had a neurotic illness.



*Comment*

This pair was separated before the second twin was born. Rodney's superiority may be due to a real possibility of brain injury in Barry at birth and to a better start in life. His shyness and stammer in childhood could have been the result of a change of home under difficult circumstances.

*CASE S m 8, AGE 38*

Separated at about 2 years

Grade III

Orphanage } Orphanage }	(different cottage homes)	1. EDWARD . . . . . Poorer MHR
		2. KEITH

*Separation*

Although one account has it that the father died before they were born, it seems more likely that the large family was broken up when the twins were about 18 months or 2 years old on account of the parents being alcoholic. The twins were sent to a large orphanage, and as soon as they left the nursery they were put into separate cottage homes, a mile or two apart, because they always quarrelled and fought when they were together. One account has it that they did not meet till they were 11. At this age they were in cottages next door to one another and attended the same school, but they continued to fight and were soon moved farther apart again. Keith seems to have had more changes of housemother than Edward. They were transferred to a training school at 13 to learn land work, but Edward escaped after a few months, worked in London as a page-boy for 9 months and then, when old enough not to be recalled to the school, returned to the town near the training school, where he worked in factories or as an electroplater. Keith, however, continued to work on the land. They met again at about 20, when they again fought, then no more until some years after the war, since when they see each other once every year or two.

*Health and Later Environment*

Keith is said to have been treated in hospital for concussion when his pram was knocked down before the twins went into the orphanage. Edward was the bigger child, though both are of slight build. Keith was hospitalized for measles at 6; he had mumps and pneumonia at 21, and pleurisy at 31. Recently he has had some neuritis. However, Edward looked in poorer physical condition and has had various ailments—weak chest, indigestion, headaches, black-outs, rupture, ear trouble, athlete's foot—and others, of which he gives an exaggerated account. In the war Keith served as a batman in the Navy and was torpedoed once. Edward was in the cookhouse and in a photographic unit in the Army; not wounded. Keith has had a good many land jobs, mostly as pigman, for some time living in poor conditions in a hutted camp. He has very recently moved into a small farmhouse to run a pig farm owned by a business man. Until then Edward was always considerably better off. Since the war Edward has been living on a housing estate. He was once foreman in a small factory, but is now working on the bench in a large engineering works.

Keith married a servant at 21 and has four children, aged 5 to 15. He also looks after the illegitimate child of his wife's sister. His wife is very protective towards him. Edward married a housemaid at 18 by whom he had a daughter now aged 16. He divorced her at the end of the war and had a child by the housekeeper who came to look after his daughter. He turned her out when he discovered she was unfaithful and then married his present wife. She brought a child by a previous marriage into the home, a boy now aged 13, and they live with him, Edward's second child who is a girl now aged 9, and an unrelated foster-child of 3. Edward's eldest girl has returned to her own mother. Edward's present wife is a more sophisticated woman than Keith's wife, but admires everything Edward says and does.

*Test Results*

	<i>Edward</i>	<i>Keith</i>
Dominoes	20	24
Mill Hill	11	13
Extraversion	10	9
Neuroticism	15	15½

*Personality*

They are notably alike in their quick temper and their poor capacity for making good social contacts. Their temper and aggressiveness shows up in the reasons for their separation and the violent fights they had with each other as late as the age of 20. Edward's wife considers the twins must have foreign blood in their veins because of their tempers. Each is quick to take offence if his ability as pigman or electroplater is called in question and resents any kind of interference. 'If Keith doesn't like the Governor', writes Edward, 'he'll tell him so and pack up and go all in the same breath. He has a habit of moving.' Keith himself admits he prefers not to make friends—'they find out your business'. Edward also likes to keep himself to himself. He says he has no sympathy for other people who he generally feels are just not worth knowing. If Keith's instability shows itself in his frequent changes of job and the poor conditions in which he has lived much of the time, Edward's is more evident in his chequered domestic life; at one time the N.S.P.C.C. were called in. Though not very literate, they both seem to have good practical intelligence. They are quick in their movements and their wives have commented on similar mannerisms. They have both taken up as hobbies collecting brass, making framed silver-paper pictures and gardening, both having won prizes at flower shows. The first two hobbies were taken up by Keith in imitation of Edward, but it is interesting that he too should have found them congenial. As children both suffered from enuresis until about 10. They have both been fairly heavy drinkers at one time or another.

Marked though the similarities are, the difference in personality is even more outstanding. As a child Keith, but not Edward, had a very bad stammer, attributed to a fall from his pram; it is still evident at times. While Keith enjoyed his agricultural training, Edward—who had always misbehaved himself, so he says—absconded and got in with bad company. At 19 he was convicted for housebreaking and put on probation for 2 years. A charge of taking and driving off a Wolseley car was not proceeded with. He has never been in prison. When he was interviewed Edward said he believed that if you wanted to tell a lie it might as well be a good one. He was evidently putting this principle into action when he boasted of having been sent to prison for stealing a Bentley. He said he had always wanted to see what the inside of a prison was like: 'Try anything once, is my motto'. The account he gave himself was clearly full of exaggerations. He was casual and off-hand in manner and seemed anxious to impress or to shock his audience. His admiring wife supported his story.

This was in contrast to the behaviour of Keith, who had been seen with his wife earlier the same day. Keith had married a woman who had taken pity on him on account of his stammer. She deals with his correspondence and Keith let her participate in the interview more actively. Keith is a sun-tanned countryman, healthier and more muscular than Edward who is weedy-looking, has a thin moustache and is known by a foreign nickname. Keith persevered with the intelligence tests, Edward rushed at them impulsively. Edward has hypochondriacal tendencies; he is afraid of getting tuberculosis, and in an erratic manner has taken various remedies from his chemist for his chest or stomach complaints, sometimes drinking a whole bottle of medicine at once. His stomach trouble he attributes to drinking too much, and the bad dreams, headaches and black-outs from which he suffered about 8 years ago to the domestic trouble he had at that time. In the booklet he wrote that his left arm and leg sometimes felt as if they did not belong to him, but when seen he could not remember this. However, he said he used to be able to make green sparks come out of him—he shook his arms, as if shaking water off them, and said, 'but it's no good, can't do it now'. Keith is quite different in these respects.

*Comment*

Though there are unreliabilities about the story, the twins were certainly parted for most of their childhood and the nature of their personalities seems clear enough. Their institutional environment may have contributed to the similarities. The final differences in social adjustment are very great and there are hysterical features in Edward's make-up. Keith's stammer, his wife and their respective occupations seem to account for some of the interesting differences between the twins.

## CASE S m P 9, AGE 39

(Ascertained through Alfred's admission to Belmont Hospital)

Grade IV

Separated soon after birth

Father and stepmother	2. ALFRED	. . .	Poorer MHR
Maternal aunt	1. HARRY		

*Separation*

At 3 weeks on account of illness of mother. Harry, the stronger twin, was taken by a maternal aunt, Alfred remaining with the parents, both living in the same mining village. The mother died when the twins were 2 and the father remarried a year later. Since then the families had no contact, but the twins went to school together—no close relationship. At 10 Harry discovered he was a twin but his aunt, whose surname he bears, has never referred to the matter to this day. UNCLE: died at 63, pattern-maker, held responsible position in Chapel and Trade Union, believer in strict discipline. AUNT: rather domineering, inclined to spoil Harry, no children of her own. FATHER: stoker in mines, now road sweeper, some minor paranoid traits. MOTHER: ? tubercular, invalid from time of twins' birth. STEPMOTHER: nagged, especially at Alfred, preferred her own children. Alfred was eventually one of ten children in the home, including three elder stepsibs and three younger half-sibs. Before remarriage father was threatened with proceedings for child neglect. There were very marked social and psychological differences between the two homes.

*Health and Later Environment*

Instrumental delivery. Alfred had 'consumptive bowels' as a baby. He had a mild concussion at 15. He had malaria when in the Middle East. Harry had headaches and rheumatism as a child. At 24 he had a facial paralysis which cleared up quickly. Over the past 9 years he has put on an excessive amount of weight; his life is more sedentary than previously, otherwise no cause known. He is now  $3\frac{1}{4}$  inches taller and  $4\frac{1}{2}$  stone heavier than Alfred.

Apart from service in the R.A.F. during the war when he was abroad and was once nearly drowned, Harry has lived in the mining village, working as a garage hand, bus conductor and, since the war, bus driver. He married at 24; wife works as a canteen assistant; no children. He lives with his wife and 'mother'. After previous attempts to leave home at 14 and 17 Alfred left home at 18 and since 21 has lived in London. At 20 he joined the Army but was discharged after a year as not suitable for military service. However, he served successfully from 1939 to 1945. Like Harry he went to the Middle East but saw more action. He has worked mainly as hotel porter and labourer in the building and electrical industries, but has recently obtained light clerical work in a government office. He also married happily at 24 and has two daughters. As a result of the research Harry decided to visit Alfred and both were delighted at meeting. Until then they had had no contact since leaving school, though Alfred says he thought a lot about Harry.

*Test Results*

(Not included in statistical analysis.)

	<i>Alfred</i>	<i>Harry</i>
Dominoes	1 (unreliable)	16
Mill Hill	10	10
Extraversion	14	12
Neuroticism	11	10
Sutton booklet test of neuroticism	99	123
	(i.e., a little below normal)	(i.e., well above normal)

Alfred was retested on the Dominoes but did no better the second time. Though perhaps dull, he is certainly not mentally defective as the result suggests. He may have been inhibited by lack of confidence and perhaps an underlying unwillingness to try.

*Personality*

There are certain similarities. Compared with their other brothers they are regarded by the family as unenterprising and are inclined to be dependent on their wives, in Harry's case on his 'mother' also. Both wives consider their husbands to be lacking in confidence. In the tests the only time Harry's composure appeared to be ruffled was when he came to words he did not know in the vocabulary tests. Their voices are still alike. In spite of having lived in London for 22 years Alfred's regional accent is quite as marked as Harry's. Each had the same way of nodding his head as he spoke, and when the families met they were much impressed by their similarity in mannerisms, such as closing their eyes when they turn their head, and in habits such as the similar way they have of sprucing themselves up before going out. When Alfred first met Harry he says 'it looked like myself walking towards me' (this in spite of the big difference in size).

However, their similarities are not so outstanding as their differences. Harry is of a much more easy-going disposition and, contrary to Alfred's fears, he co-operated in the research in a good-natured, rather matter-of-fact way. Though, like Alfred, he says he is afraid of heights, Harry is free from major neurotic traits and has had no neurotic illness. His doctor describes him as a level-headed, calm, imperturbable type of fellow. Alfred has always been of a worrying nature. As a child he used to shake and tremble as a result of the harsh treatment he received and his father describes him as having been sullen. He is much preoccupied by his unhappy childhood. His stepmother used to shut him up in a room without food: 'I could write a book about it', he says. He is reserved about the circumstances of his discharge from the Army except for saying that it had something to do with his being struck by a sergeant. He showed considerable suspicion, for example concerning his treatment in a hospital for nerves, how we had heard about him, what his family thought about him, even over divulging what his duties were in the tax office where he now works. The difference between the twins also came out clearly in the Normal Personality Traits section of the booklet. Here the twins' wives also rated their husbands. All accounts agree in showing a marked difference in the following traits: Harry is a heavy sleeper, a big eater, his feelings are not easily hurt and he can relax easily. Alfred is the reverse of all these, and is also more excitable and at the same time more timid than Harry.

At the age of 36, when working in a new job where the hours were long and work heavy, Alfred complained of a pain in the heel and was off work for 5 weeks. Returning to work the pain became worse and in all he lost about a year's work. He had much hospital treatment for sprained tendons, including an operation, with little improvement and was finally admitted to a neurosis centre with the diagnosis: hysteria in an inadequate psychopath (early environment). On admission he was walking with two sticks and complained of faintness. He received abreactive treatment in which he recounted with fear his unhappy childhood experiences. He was persuaded to discard his sticks and was soon doing physical training. He was in hospital 6 weeks. His return to work was delayed by compensation affairs. 18 months after discharge he was rather better, but still liable to pain in the heel and fainting attacks.

*Comment*

The question of the large difference in height and weight was discussed on page 43 and some of the psychiatric aspects on page 127. On the physical side, the difference in height may be largely due to Alfred's being neglected in childhood. Harry was a wanted child and received normal love and affection. Alfred was harshly treated and grew up with the feeling (perhaps justified) that he was not wanted, and he has gone through life with a chip on his shoulder. His much greater self-concern made it easy for him to become an invalid. In assessing the case for another purpose Dr. Eliot Slater wrote: 'We have here a real and important difference brought about by the environment, chiefly psychogenic.'

*Postscript*

The case was followed up after almost 6 years, in June 1960, when the twins were aged 45. Alfred had put on nearly 2 stone in weight; he had had an appendicectomy not long after he was last seen; he was still working at the same job; he had lost much of his anxiety and

self-concern and was very pleased to have renewed contact with his twin and other members of the family, whom he had visited, after so many years. The twins had now met on about five subsequent occasions. Harry was much the same. His weight was probably stationary. He had recently suffered from mumps and occasionally went to his doctor for pruritus ani. He was still a bus driver. 3 years ago his vehicle had been in collision with a car, the driver of which was killed (Harry was exonerated from any blame for the accident); Harry was uninjured, but for a fortnight he was unable to walk because of 'shock' [cf. Alfred's hysterical disorder centred on his heels]. The follow-up thus shows the twins to be rather more alike now than they were at the time of the investigation.

NOTE: Alfred is Proband MZ 8 in the series of twins described by Slater (1961).

*CASE S m 10, AGE 39*

(Stanley seen by colleague only)

Separated at 4 years

Grade III

Foster home

2. WILLIAM . . . Poorer MHR

Foster home

1. STANLEY

*Separation*

At 4 years, when they went from their mother's home to different Poor Law foster-homes for financial reasons. The twins came home again to mother at 14. FATHER: postman, died before they were born. MOTHER: cleaner, hard-working, dogmatic, inclined to exaggerate and to be self-pitying, has had a hard life. STEPFATHER: horse-driver; has served prison sentence for car stealing; frequently used to quarrel with mother whom he deceived into thinking he had more money than he actually had. Two elder brothers and elder sister also brought up partly in foster-homes, not together. One brother was difficult as a child and was sent to a nautical training ship; is said now to be argumentative and emotionally immature. There is also a younger half-brother.

Stanley was most of the time with the same foster-mother, a single woman, conventional, efficient and exact—she would have made a good R.S.M., says Stanley who is himself one. William recalls having had four different homes and in one he says he lived an *Oliver Twist* existence, and the foster-mother had religious mania. However, he still corresponds with the foster-mother he had most of the time from 8 till 14, also a single woman and strong-principled but, in his opinion, a more human person than the other foster-mothers he and Stanley knew. Both twins say they thought a lot about one another as children. They went to different schools in the same north of England town.

*Later Environment and Health*

After working mostly in a bakery, Stanley joined the Army at 21 'to get out of the rut'. In the Medical Corps he did well as a nursing orderly and has now risen to be R.S.M. of a military hospital abroad. He was in the evacuation of Dunkirk and in campaigns in the Near East and after the war decided to stay in the R.A.M.C. He was abroad at the time of the investigation and was seen for us by an army psychiatrist.

At 21 William also felt he was making no headway and left home to take a better job as a cinema operator in a town in the Midlands. He volunteered for the Army at the outbreak of war, becoming a sergeant in the R.A.O.C. mostly at home stations or headquarters. After the war he returned to his old job, supplementing his earnings by driving a bakery van. For the past 4 years he has worked for higher wages entirely at the bakery where he has recently received promotion as a checker.

Stanley married at 32 and has a son of 5. William married at 29 and has a daughter of 9 and a son of 5; the latter is troubled with asthma. There is a big difference between their wives. William's wife is the driving force behind him—'she is almost hard on people, while I am soft. You need to be hard in this city'. Stanley's wife, 7 years younger, is, in his own words, 'typically rural-Irish in her outlook' and is not domineering. Both twins are nevertheless happily married. They have had little contact with each other since marriage.

William has had good health apart from hay-fever which cleared up in his 20's, rheumatic

knee joints (better now) for which he was down-graded in the Army, and an operation for a deviated septum. Stanley had poorer childhood health including diphtheria. He has had attacks of rheumatic fever at the ages of 11, 16, 22, 23, 25 and 28. He considers he is overweight. He is taller and stouter than William. Both are colour-blind.

### *Test Results*

	<i>William</i>	<i>Stanley</i>
Dominoes	26	30
Mill Hill	22	25
Extraversion	10	10
Neuroticism	10½	9

### *Personality*

William says he was a well-behaved child, but inclined to burst into tears on little provocation. He tells how the boys from the Children's Home were not allowed to play with the other children at school. When he returned to his own home he felt a stranger. Stanley on the other hand regards himself as having been an independent, saucy child, and is less preoccupied with his institutional background; but he used to walk in his sleep till he was 15. They were both plodders at school. At 16 they were both converted to an Evangelical movement and laughed at by their other brothers for this. As a young man Stanley was a lay preacher for 2 years, but now takes only a passive interest in religion. William was never a lay preacher, but he teaches at Sunday School and is secretary of the Junior Mission. They have rather serious interests, Stanley mentioning human problems, politics and lecturing on first aid; but 'my main interest lies with the family', he writes in the booklet. Similarly William describes himself as a home bird.

Stanley impressed the psychiatrist who interviewed him on our behalf, and who has had the opportunity of knowing him in his work, as being a pleasant, co-operative man of average intelligence and a mature outlook, who appeared to be doing a good job of work. He had a tendency to worry about his work and he did not lead a very active social life, but his recurrent attacks of illness had led to no morbid preoccupation with his health.

William stressed the differences between the twins. He has always regarded Stanley as being less serious than himself and less ready to take on responsibilities. William is active in collecting funds for the Mission. He is very anxious that his children shall be well-mannered and do well at school, while Stanley feels confident his son will be able to make his own way. William can feel very upset, particularly if one of the children is ill. He attributed what success he has achieved to his wife. There seemed to be some conflict between his natural inclinations and his strong competitive drive to do well for himself and his family.

### *Comment*

On the whole the differences seem more important than the similarities. There may well have been some features in their childhood experiences, such as William's more frequent changes of foster-home or his unhappy experiences in one of them, that have caused their different reactions. However, they might have grown more alike had the personalities of their wives not been so different. The characters of the twins are in marked contrast to those of the other institutionalized pair, S m 8.

### *CASE S m 11, AGE 45*

Separated at birth

Grade III

Mother

2. TIMOTHY

Paternal aunt

1. KEVIN . . . . . Poorer MHR

### *Separation*

The mother was thought to be too ill to look after two babies. Kevin, the first-born and presumed stronger and better able to be bottle-fed, was taken by a paternal aunt. UNCLE was a miner, of jolly, happy disposition; AUNT, who was 19 years older than mother, was

active, sociable, hard working and always bringing up children—other people's children after her own had grown up. There were four other children in the home but the youngest of these was 10 years older than Kevin; they all thought the world of him. Two of them died, of T.B. and pneumonia, when Kevin was a child. The family was Roman Catholic, unlike Timothy's parents, but no attempts were made to bring him up as a Catholic. Kevin got on well with his foster-parents. He thinks his home was better standard and had more money coming in. FATHER: plate-glass blower, had to retire at 58 on account of blindness due to a war injury; was active in a Friendly Society, used to sing at concerts. MOTHER: quieter, less sociable; poor health. There were five younger sibs, one of whom died when Timothy was 10, and he had to spend much of his time scrubbing floors and running errands. Timothy was probably breast-fed, Kevin not. The twins lived a few roads away from each other in same northern industrial town. They were dressed alike 'so that there should be no ill feeling'. They attended the same school but were not closely attached to one another. They were members of different gangs, this being decided by the roads in which they lived.

### *Later Environment and Health*

Until 36 they worked in skilled trades in different departments of a glass factory. Then Kevin bought himself a small grocery shop; and for the past 4 years he has been running a boarding house in a seaside resort. Timothy has remained throughout in the same job. Kevin married at 21, Timothy not until 32. Kevin has one daughter and a grand-daughter who is as old as the youngest of Timothy's three children. From about 18 both have had stomach trouble, recently diagnosed as gastric ulcer, for which both have had operations, Timothy at 36, Kevin at 39. Timothy has been six times in hospital and still has symptoms. He also suffers from neuritis in the arms, and anaemia. They both consider that their ulcers are aggravated by worry and also that the state of their stomachs affects their nerves.

### *Test Results*

	<i>Timothy</i>	<i>Kevin</i>
Dominoes	35	29
Mill Hill	22	17
Extraversion	14	13
Neuroticism	11½	18

### *Personality*

They are both of an independent, sociable, reliable and perhaps rather irritable personality. Timothy is a shop-steward and secretary of his Trade Union branch sick club; people come to him with 'grudges they want sorting out'. Kevin is treasurer of a local dancing and drinking club, where he spends most of his evenings, and he is proud of his position of trust. They prefer to do things such as home decorating themselves rather than get help. As young men they were both lively and had many girl friends. They have become more serious as they have grown older. They are fond of reading (rather serious tastes) and express an interest in the technical literature on the shelves.

The difference on the intelligence tests is in keeping with the history of Timothy's doing better at school; but on interview Kevin did not seem any less bright. Kevin did most of the talking when they were together and gave the impression of wishing to appear more forceful and more a man of the world than Timothy. As a man in the catering trade himself he appreciated the Maudsley lunch and insisted on paying for all three of us. He was more emphatic in his gestures. He disliked working for others, and since having his own business he considers he has developed a new outlook and is better at talking to people. Timothy would also like to go into business on his own but thinks that, unlike his twin, he is inclined to be on the soft side. The difference in neuroticism was also confirmed. Kevin says he has always been a nervous sort and, unlike Timothy, his nails were badly bitten. When he was 5 or 6 he saw in her coffin the body of a child who had been burned to death. Particularly during childhood, thoughts of death would come into his mind. He is inclined to worry, but does not confide his worries to his wife. He seeks relief from tension in alcohol but does not, he thinks, drink more than is good for him; but he has 3 pints of beer a night, which is twice as much as Timothy drinks.

*Comment*

They were not so alike in personality as they were in appearance, both being very bald with bony facial features. Kevin has greater anxious drive and has succeeded, at some risk to his security, in bettering himself financially. Though more neurotic and formally less intelligent, Kevin does not seem to have had the more stressful early home life and the cause of the difference remains obscure. The pair is concordant for peptic ulcer, but severity of ulcer does not go with greater neurotic traits.

*CASE S m 12, AGED 49*

Separated at birth

Grade II (a)

Mother	1. JAMES . . . . .	Poorer MHR
Paternal uncle and aunt	2. ROBERT	

*Separation*

There was a triplet sister, born after the twins, who died at 14 months. The mother was advised she could not look after all three and at 3 weeks Robert, who was the sturdiest, was taken by a paternal uncle and his wife, Jim remaining with the mother. While Jim was brought up all along in the same mining village, Robert lived in five different villages in the same county on account of his uncle's changes of job. Robert was brought up in ignorance of his adoption and twinship until, on the occasion of their first meeting at a family wedding at the age of 10 or 11, Jim, who knew all along, told him. His first reaction was to want to run away to his own mother. He had always wanted brothers and sisters for company, though he never had the feeling he was one of twins. However, after the first shock of the news he continued to live happily with his adoptive parents. Jim did better at school and was allowed to leave at 13 years 3 months, having passed a proficiency test. Robert stayed on at school till 14. Robert missed more school on account of health and had more changes of school. The twins met about once a fortnight during adolescence. Since 24, when Jim came south, they have rarely met, the last occasion being 4 years ago.

FATHER: coal miner, hasty-tempered, heavy drinker, but hard-working, fairly strict. MOTHER: placid, devoted to family, did not make favourites; left father on one occasion for 3 weeks to frighten him. Six other brothers and sisters brought up in the home; finance meagre. Younger brother described as 'eccentric—lives in a world of his own'. UNCLE: farm labourer, like father in looks and disposition, but drank more heavily and inclined to be moody and sullen; when Robert was 12, he threatened aunt and Robert with a gun (drunk at the time), after which incident Robert was taken to stay with another aunt for a few weeks. AUNT: milkmaid on farm, used to overwork herself, had fear of travelling especially in buses, made a great fuss of Robert, having no children of her own, had ambitions for him, would give him anything he wanted, except a motor-bike; financial side good.

*Later Environment and Health*

They both worked in the coal mines until the industrial depression of 1929. Robert found work in a limestone quarry not far away, but returned to face work in the coal mines after the Second World War. He is the senior member of his squad of six. Jim came to London on a government training scheme and found work in a safety-glass processing factory. After 1945 he tried better-paid work repairing railway rolling stock but did not like his fellow workers, and in 1950 worked for a friend in a galvanizing shop, but night work impaired his health. In 1951 he returned to his old job in the glass factory and is an under-foreman supervising ten men. He lives in a new semi-industrial suburb. As a miner Robert's wages are £6 or £7 a week more than Jim's. Both twins married happily, Robert at 24, Jim at 26. Robert has two sons, Jim two daughters, one of them at university. Robert's wife is in poor health.

Both were delicate babies and had pneumonia, Robert twice. But Robert was taller as a child and thought to be more robust. Both have had rheumatic troubles: Robert lost 3 months' work through lumbago when working in damp conditions. Jim has recently been having severe pain around the heart which on examination was put down to rheumatism:



Robert says he has also had rheumatism of the chest. They also both suffer from gastric trouble, Jim the more severely. He had a duodenal ulcer diagnosed in 1945; it was attributed to irregular eating habits (the chemicals with which he worked destroyed the appetite) and worry (he was much concerned with his children who were evacuated). He had a recurrence 4 years ago when on night work. He has still not regained the weight he lost. For some years Robert has had fairly severe stomach pains and acidity through which he loses a day or two's work about every 3 months, and which his doctor has called gastric catarrh. These pains began when he returned to indoor work in the pits and also coincided with his wife's failing health. Both twins have tried unorthodox remedies for their stomach troubles. Robert is a stone heavier.

### *Test Results*

	<i>James</i>	<i>Robert</i>
Dominoes	26	20
Mill Hill	21	14
Extraversion	9	9
Neuroticism	13	13

### *Personality*

Similarities were marked. They say they were rather docile children—they joined in with other boys, but 'no rough stuff'. Both were mildly enuretic as children. They had nightmares when they first started working in the pits. Each had two or three girl friends before marriage. They are content to leave domestic arrangements to their wives, but like to see that their children are well turned out and well behaved. When seen on their own both turned the conversation round to their children of whom they talked at some length and with pride. In work they have risen to positions of minor authority. Jim is in charge of work on a conveyor belt and criticized men at his previous job who did not pull their weight. In the pit Robert is sometimes accused of interfering too much with the others. He, too, has high standards: 'What's all right by them is not all right by me'. They regard themselves as being serious-minded. Their smoking and drinking habits were similar until Jim cut down his not excessive beer drinking when he was ill recently. Both have been strong Labour supporters, but have not extreme political views. Since last meeting they have both developed a taste for science fiction, otherwise they read little. They admit to the family trait of being hasty-tempered when they are tired. This history suggests some hypochondriasis in both, but it is not marked. Both feel that as they are getting older they are unable to do as much hard work as formerly. Their sexual activity is also less than it used to be. Jim has consulted his doctor about this and says he has been given hormones. On interview they were friendly but deferential. The similarity in gesture was remarkable, both tapping on the table in an emphatic way, flicking their fingers when unable to think of an answer straight off, and nodding their heads in strong approval with what the other twin said. They say they always agree with one another. Each insisted that both should have an equal say. When asked whether one had ever been mistaken for the other, Jim replied: 'Yes, I'll tell you a story about that and then let Bob cap it with another'. Both checked themselves in expanding on their replies in order to allow the other twin to make his point. Similarities were also observed when they were on their own.

Jim's face looked very drawn, presumably on account of his poorer health. He was a little more intelligent. His table manners were more polished. His musical tastes are a shade more sophisticated—he likes ballet music and Tchaikovsky, Robert prefers Strauss waltzes. If he won money on the football pools Jim would go for a trip round the world. Robert would buy his own home, take things steady and not flash his money around. Robert is more socially inclined, as is his wife. He enjoys watching football with his friends and spending an evening in the pub. Jim has greater difficulty making friends. He likes listening to music, gardening and decorating the house.

### *Comment*

Robert's interrupted schooling was sufficient to overcome whatever intellectual advantage he may have had in being the physically stronger and coming from the smaller and financially

better off home. Robert's early home life was perhaps the less satisfactory, in that his 'father' was more alcoholic, his 'mother' a little neurotic and over-protective and he himself had the potentially traumatic experience of hearing suddenly he was an adopted twin. But this has produced no noticeable difference between the twins in emotional stability. It is perhaps Jim's decision to come south in 1929 at the age of 24 that is the most critical cause of difference. It is tempting to attribute to their different social environments Jim's greater sophistication and Robert's greater sociability. The one lives on the outskirts of Greater London, and other in a closely knit mining community. The SRQ bears out the basic similarity.

*CASE S m 13, AGE 51*

Separated at 12 months

Grade II (b)

Paternal aunt

1. PATRICK

Mother

2. VICTOR. . . . . Poorer MHR

*Separated*

At 12 months because mother was pregnant again. A paternal aunt took Patrick who was stronger and he remained with her, Victor with his parents in the same town. The AUNT was 50 when she took Patrick, 26 years older than mother. She was single but was already looking after a cousin of Patrick's, 12 years his senior. She was father's partner in a dairy business. Although he knew he was a twin, Patrick felt towards his aunt as to a mother—he had only to be threatened with return to his mother to keep him in order. The aunt was a solitary but bustling and vigorous woman. MOTHER was friendlier but more easy-going and lackadaisical. FATHER took an interest in both twins, but was liable to bouts of temper and Victor came in for more of these. When Victor was small father sold his share of the dairy and took up farming, but he lost money and had to return to the family business. Later on he made money which he invested in shops. There was a younger brother and sister in the family. The twins went to the same school but did not get on well together. Patrick preferred his younger brother to Victor. Patrick thinks he had a better life as a child and that Victor was jealous of him.

*Later Environment and Health*

On leaving school father had Patrick apprenticed as a watchmaker and put him into one of his shops. He has remained in this trade to the present day. Victor was not apprenticed as he was less intelligent, more extravagant with money and not interested. He soon found himself in hotel work and has spent most of his life as a hotel porter. Patrick was rejected by the Army on health grounds. Victor was a driver in the R.A.O.C. for 5 years but not sent abroad. They both married at 21 or 22. Victor's wife was 19½ years older and a domineering woman, Patrick's wife 3 years older. When they came together for the research the twins had not met for 9 years. They still do not get on well together.

The mother had a bad time at the birth of the twins and both were probably instrumental births. Victor, the second born, was smaller at birth and almost given up for dead. Both have hammer toes and a minor deformity of the finger-nails. Although living in different homes both had rheumatic trouble as children. While Victor lost a good deal of schooling because of growing pains in the knees, Patrick had rheumatic fever and (?) valvular heart disease. Since childhood he has been liable to fainting attacks in which he turns blue, drops to the ground, and revives after about 20 minutes feeling tired and with a pain around the heart. He did not play games at school, while Victor was able to rush around as much as he liked. Patrick has a thinner and longer face and his upper arms are extremely emaciated. Patrick is 3½ in. taller but 6 lb. lighter than Victor. Victor had to wear glasses at school and wears stronger glasses than Patrick now.

*Test Results*

	<i>Patrick</i>	<i>Victor</i>
Dominoes	28	22
Mill Hill	25	22
Extraversion	5	11
Neuroticism	13	11

*Personality*

Perhaps their most outstanding similarity is their liability, like their father, to outbursts of rage. They are normally slow to anger and all for peace and quiet, but when an attack occurs 'everyone around knows about it'. Both have thrown china about the room. Patrick feels as if he would die if he did not give vent to these feelings. Victor considers he really does not know what he is doing at the time. Before an attack they perspire excessively. Afterwards they are ashamed. Patrick relates an instance when he considers he nearly murdered his assistant who had criticized him in front of a customer for being forgetful. He picked up a box of old watch-parts which he could normally hardly lift and threw it at his assistant, just missing his head. Patrick then fell down in a faint.

Another similarity is the fact that both are doing less well in their work now than they did before the war. Victor used to be head porter but is now night porter and earning less than he used to receive in tips. Patrick used to have a jeweller's shop but now restricts himself to repairing watches which is less profitable. In his repair shop he used to have four assistants but now has only his wife. He says he earns less than Victor. Patrick, however, is quite contented at this restriction of his activities—he feels it less of a physical and emotional strain. Victor feels disgruntled and his wife does not approve of his doing night work. They both complain of being very forgetful, and this together with their tempers may be one reason for their lack of success; but whereas Patrick attributes this forgetfulness to 'living in another world' and says 'my brain never stops', Victor says his trouble is that his brain has never started working. Both are probably very self-absorbed.

There is a certain rigidity about their natures. Victor thinks they both have a tidy nature. He likes things to be 'just right'. He says he has a bee in his bonnet about 'please' and 'thank you' and he has got into trouble at work for his obstinacy over this. Patrick has concentrated on watch repairing rather than selling because he says he loves detail and precision. Although his tastes in reading are light now, he says they were once very 'sticky': he read all of Walter Scott's works, working up the footnotes systematically. He thinks he is mean about money.

Both are musical. As boys they sang solos in the church choir. Both have collections of gramophone records and Victor lists concerts as one of his favourite interests. Patrick took singing lessons and is organist and choirmaster at his local church. Both are artistic and 'love nature and simple things'. Patrick has drawn still lifes, fish and small animals—Victor does profiles in charcoal. Both play chess; Victor considers he has given a well-known chess champion a run for his money.

They have also had rather similar neurotic symptoms. Patrick remembers vividly a childhood experience in which it seemed there were devils in the room; he used to wake up at night crying. Victor does not recall childhood night terrors but says that when he was in the Army he had an irrational fear. There was a certain avenue of trees down which he could never bring himself to walk. He had the feeling that something terrible would happen if he did and whenever he was near this avenue he would turn and flee. He has often had the sensation, when working at night, that there might be something leaning over the bannisters looking down at him.

There are also differences in personality. Victor is less intelligent. This was noticed at school where Patrick won prizes and Victor not; but there may have been an element of obstinately not trying in Victor. Patrick takes a longer view of things, he is more cautious with money, saving more and thinking twice before he gives any away. Victor says: 'Do it now in case I forget. Live one day at a time—after all said and done tomorrow is not yours'. He thinks he has been extravagant with money, giving too much away to his son. Victor scores more highly on Extraversion. Patrick is interested in ideas, including psychiatry and telepathy. At the age of 29, after years of careful deliberation about the meaning of the Sacrament, he embraced the Roman Catholic faith. He feels he must have a 'path laid out before him' and the Catholic church has done this for him. It is perhaps not fanciful to see in the reason Victor gives for appreciating his much older wife a similarity to Patrick's reasons for becoming an R.C. Victor says 'she is wife and mother to me . . . she knows better than me'.

In appearance and manner Victor was more tense, energetic and determined-looking.

As a child he used to bite his nails. He says he is inclined to bottle up his worries, whereas Patrick must tell. Patrick had a nervous laugh not observed in Victor.

### *Comment*

In view of their different up-bringing, occupation, intelligence and health, the similarities are all the more striking. But Victor's more difficult birth, his less settled home and his jealousy of Patrick may, together with Patrick's emaciated physical condition, account for some of the difference in intelligence, social career and energy.

### *CASE S m 14, AGE 51*

Separated at 12 months

Grade II (a)

Mother	1. HUBERT	.	.	Poorer MHR
Maternal grandmother	2. BRIAN			

### *Separation*

The father died before the twins were born. When the mother remarried when the twins were a year old, the stepfather said he would take only one of them. Hubert was brought up by the mother and stepfather in a large city, while Brian was taken by the maternal grandmother in a country village. They were known by different surnames, but met for their summer holidays, knowing they were twins. STEPFATHER: cost clerk, had bouts of drinking, took little interest in Hubert, had frequent rows with mother. MOTHER: a worrier, but rather easy-going about discipline. There were two younger half-sisters. GRANDFATHER: hairdresser. Though there were no other children, Brian had a happier childhood in a financially better-off home.

### *Later Environment and Health*

Hubert married at 26 and has sons aged 22 and 9. Brian married only 1 year ago, making a good match with a local widow; he is better-off and runs a car. They are still living in the localities where they were brought up, Hubert working as an inspector in the motor industry, Brian, previously a motor mechanic, now in charge of a large store, issuing spare parts for motors. They still try to meet once a year.

Both complain of catarrh and slight rheumatism. At 18 Brian had heat stroke and at 20 he had successful treatment for a film of skin which grew over the eye. Hubert is a stone heavier.

### *Test Results*

	<i>Hubert</i>	<i>Brian</i>
Dominoes	21	27
Mill Hill	21	19
Extraversion	9½	9½
Neuroticism	18	12

### *Personality*

Similarities were very marked—they are both slow, ponderous, self-contained. They are easily teased on account of their glum expressions. 'It will never happen, Bert', Hubert's workmates tell him, —'Just look at his face!'. Brian is told he looks as if he were looking for sixpence and had found threepence. They also readily show by their faces whether or not they like a person. It is interesting that in spite of their different backgrounds they have both gravitated to similar jobs in the motor industry, involving checking of parts, etc.; this is perhaps in keeping with some minor obsessional traits. Their libido has always been low. They agree in their dislike of loud music and of 'the television habit'. At home they are very domesticated and do not go out much. They fit in naturally with each other and have a high regard of each other's capabilities. They swap books on their annual visits in the knowledge that what one likes the other will like too. On interview, after a slow start, they were both surprisingly grateful for the interest taken in them, Brian offering to put

me up if I should ever visit his part of the country, Hubert writing an appreciative letter of thanks afterwards. On leaving, both took out of their pockets pipes of identical shape.

Less happy as a child, Hubert used to 'bear it inwardly'. If anything, depressive traits have been more marked in him than in Brian. For the past 2 years he has had difficulty in getting off to sleep, unpleasant memories of his childhood coming into his mind. When talking of the quarrels between his mother and stepfather his lower jaw trembled and a slight tendency to stammer became noticeable; he spoke resentfully of his early lack of opportunity.

### *Comment*

The twin from the poorer home is the more neurotic, but the basic resemblance in personality is very evident and relates mainly to traits of a depressive kind.

### *CASE S m 15, AGE 52*

Separated at 9 months

Grade I

Mother	2. BENJAMIN	.	.	} Equal MHR
Maternal grandmother	1. RONALD.	.	.	

### *Separation*

The mother was pregnant again and the maternal grandmother had just lost her youngest son who was one of twins and wanted to replace him. Both brought up in the same fruit-growing village, Ben by the parents, Ron by the grandmother, Father and grandfather were both small market gardeners. MOTHER and GRANDFATHER were kind but FATHER and GRANDMOTHER, who disciplined Ben and Ron respectively, were very hasty-tempered. At maternal grandmother's death when Ron was 13 his aunt, who had always helped, continued to run the home. The parents were first cousins once removed and three other sibs, one older and two younger, all appear to have suffered eventually from some neurological disease, possibly cerebral ataxia. No other children were brought up with Ron. The parents quarrelled; there was not so much quarrelling in the grandparents' home and Ron thinks discipline was better. Ben was breast-fed, Ron not. They were at school together, Ben leaving one term earlier at 13 to help on the land. They have continued to live in the same village.

### *Later Environment and Health*

Both have worked mostly as gardeners. Ron was head gardener on two estates for 8 years each, and when these were sold on outbreak of war he joined Ben who for a few years had been a labourer on a local aerodrome. Both have worked as stokers at the aerodrome or in a fruit canning factory, but find this bad for the health and during the summer months prefer to do outdoor work. Ben has recently been doing night work, two nights a week, and cycles 8 miles to work.

Ron married a local girl 6 years younger than himself at 26 and has three children. Robert married a woman from another part of England 4 years his senior when he was 32 and also has three children. The wives accept their husbands' way of life and the children are said all to be doing well, all probably more intelligent than the twins themselves.

Little information about early years. Ben lost 7 months' work in 1945 with septic stomach ulcers and was advised to drink less. Ron had an empyema in 1953. They both complain of backache from time to time. Both are red-faced, Ben a little more so. Ben is a little bigger.

### *Test Results*

	<i>Ben</i>	<i>Ron</i>
Dominoes	4	13
Mill Hill	10	6
Extraversion	15	13
Neuroticism	10	8

*Personality*

Neither showed any interest in school. They used to truant together and smoke cigarettes on the sly. They were always in mischief and were known by a clergyman as the two Turks. Good at sports, they both played for the village football team till their 30's, but were often sent off the field for foul play—'Brash by name and Brash by nature', it was said. They have always got on well together, but neither took the lead. They claim they get the same ailments at the same time. 'My back's bad', Ben will say. 'Funny, mine's been bad too', Ron will reply. Their wives regard them as hypochondriacal. Both have been heavy drinkers of cider for many years. In the booklet Ben admitted to drinking 32 pints a week, Ron 24, but on questioning he apparently drinks just as much as his twin. They do not go drinking together. When they have had a few pints they raise their voices and bring up the past. Though never in serious trouble on account of their drinking, they are both rather a burden on their families, most of the money and all the work at home being contributed by their wives and daughters. The twins themselves were unable to suggest any ways in which they might be different, and Ben's wife, who seemed to be a reliable informant, thought there was little to choose between them. 'They are serious, not the frivolous kind. When one is crabby, the other is crabby. They both swear and drink a good mouthful.' Tests and clinical impression agreed in considering them to be of very dull intelligence. They seemed pleased to be visited, but were unable to grasp what it was all about. (It was Ron's daughter who had sent in their names, and their families helped with the booklets.) They were both very awkward when their finger-prints were taken.

Objectively, Ben did more of the talking and seemed sprightlier, Ron more sheepish. This could be explained by the fact that Ben was acting as host and Ron was feeling sleepy—he almost fell asleep at one point. From the history it is possible that Ron has shown a little more responsibility. He was captain of the football team. Ben never became a head gardener. Ron was made a corporal in the cadets after the First World War; however, when the stripes were sewn on Ben's tunic by mistake, Ron did not mind.

*Comment*

Dull and bordering on the psychopathic on account of their heavy drinking, these twins could hardly be more alike. The effects of the different early environments are mostly negative. Ron was not breast-fed, he was separated from his mother at 9 months, the grandmother who looked after him died when he was 13, but none of these differences has had any obvious effect. If Ron is regarded as the more responsible, this could be because the grandparents' home was more harmonious and better disciplined than the parents'. Their adult environments have been very similar.

*CASE S f 1, AGE 8 YEARS 6 MONTHS*

(Names of both twins sent in by teacher)

Separated at 3 months

Grade I

Adopted

1. JESSIE

Adopted

2. WINIFRED . . . . . Poorer MHR

*Separation*

They are the illegitimate children of an American serviceman and a London woman; born during the war in a town in the Midlands where both twins still live. Winifred was adopted at 3 months by Mrs. T., Jessie 2 months later by Mrs. E. Brought up within a few hundred yards of one another, but no contact between the families. Attracted to each other at the age of 2, but meetings not encouraged by Mrs. E. Told they were twins after girls discovered it for themselves, having gravitated to one another at school at the age of 5. In order to separate them Mrs. E. removed Jessie to another school but they continued to meet in the park. Just before their eighth birthday they found themselves in the same school again for administrative reasons. Winifred had moved into this school one term earlier and as a consequence is one class higher. THE E.'s came from the north to the Midlands on account of the depression 17 years ago. Mr. E., 49, is a stoker in a steel works, quiet, patient, fond

of reading, does not share his wife's social interests, very fond of Jessie. Mrs. E., 47, is a well-built woman, describes herself as the noisy type, has many social interests and is a prominent member of the local Labour Party. They have a son of 20, a radar mechanic in the R.A.F. Following his birth, Mrs. E. had four miscarriages. She made an unsuccessful application to adopt a Basque child in 1938; would have liked to take both the twins; fond of Jessie. Though at one point she said, 'you can't spoil children enough', she believes 'they should be treated like puppies right from the beginning to know who's boss'. Jessie has come in for stricter discipline and more spanking than Winifred. Mrs. E. taught her her letters before she went to school. She believes in teaching her to 'do for herself' and she has gone to stay with relatives in the north on her own. Until recently Mrs. E. had made attempts to stop them from seeing each other, but has not been unkind to Winifred; seems resigned to their going about together now. She had Jessie's hair permed a year ago to make her look different from Winifred. Sends Jessie to ballet dancing classes. When Jessie was 4, told her she was adopted but not that she was a twin. Has gone out to work in a laundry full-time since Jessie was 6½. The E.'s have a slightly larger house; Mrs. E.'s father lives with them. They earn a little more than the T.'s. THE T.'s are local people. Mr. T., 45, is a presser in a shoe factory, a lively man but inclined to be irritable, for example, when Winifred is untidy, but very fond of Winifred. Had originally wanted to adopt both twins. Mrs. T., 41, of slight build, quiet, placid, main interest dressmaking, no social interests. Has had no children of her own. Did not at first feel she could cope with both twins but was disappointed later that she had not taken them both. Has not such decided views as Mrs. E., lets events take their course and made no attempt to prevent the twins from meeting; thinks she may have spoiled Winifred, letting her have too much of her own way. Did not teach her her letters before school, or send her to ballet classes. Did not tell her she was adopted but admitted it when she discovered Jessie was her twin, at the age of 5. Mrs. T. went out to work full-time in a shoe factory when Winifred was 2. Her sister-in-law looked after Winifred when she was out. When Mrs. T. came to the E.'s home for the interview this was the first time she had been inside.

### *Development and Health*

Winifred was a little bigger at birth. Mrs. T. adopted her as she was said to be the better baby. No significant difference in early development, though Mrs. E. who has higher expectations thinks Jessie was a little late in giving up baby talk and was small for her age until recently. Jessie had whooping cough and pneumonia at 14 months and measles at 5. Winifred had whooping cough less severely at 4 and measles at 3. Since infancy both have been liable to extensive heat spots in the summer. Winifred is still very slightly bigger.

### *Test Results*

	<i>Jessie and adoptive parents</i>	<i>Winifred and adoptive parents</i>
Dominoes		
Twins	23	21
Mill Hill		
Twins (Junior scale)	11	12
Mothers (Senior scale)	12	11
Extraversion		
Twins*	18½	17
Fathers	3	21
Mothers	18	7
Neuroticism		
Twins*	9½	7
Fathers	11	8
Mothers	6	10

\* Twins rated independently by their adoptive mothers.

*School Reports*

Both are in 'A' streams. The average age of Winifred's class is 9 years 3 months, of Jessie's 8 years 5 months. Last term Jessie was seventh out of 41, Winifred ninth out of 42. Their behaviour is described as 'excellent, most co-operative'. In their relationship to each other they are 'perfectly normal and friendly—no undue dominance noted. They play together quite a lot at school and during the evenings. Jessie often goes to tea with Winifred. Both are quite artistic. They are equally bright, cheerful and most happy in disposition and pleasingly wholesome and charming in appearance.'

*Personality*

Interviewed separately, the two mothers, in spite of their own different personalities, described the twins in very similar terms. They say they love racing and tearing about; they are talkative and lacking in shyness, have minds of their own; inclined to show off; are sometimes bossy or spiteful with other children. Their school teachers regard them as potential scholarship winners; they are leaders in their Houses, are good at reciting, take an active part in the Brownies. They 'talk with their hands'. They crave excitement and are inquisitive, often asking questions which the parents cannot answer. They are also very fond of reading and both like religious stories. Jessie likes dancing and Winifred acting. Both got their mothers to ask for the 'Dance of the Sugar Plum Fairy' to be played on the B.B.C.'s *Children's Choice* programme. They are particular about cleanliness. They like to tell their worries. They cry little and seem normal, happy girls.

They are very closely attached to each other and they ask for the same presents. Jessie wants a bicycle like Winifred, Winifred wants a puppy like Jessie. When together Jessie generally decides where they shall go and tends to do things first. In Mrs. E.'s opinion Winifred is the rather more unruly of the two, but 'Jessie is a very determined girl and needs firm handling'. Mrs. T. also implies that Winifred can be unruly. She is rather untidy at home and has some minor food fads but is usually willing to help. Since going to her present school she has sometimes complained of headaches.

When seen together their behaviour was much alike. When going to be weighed they walked down the street together hand in hand, and when at the doctor's they sat together swinging their feet in the same rhythm. Their eyes lit up in the same way when asked if they liked being twins. They said 'ough!' at the same moment and with the same expression when the finger-print ink was rolled out. Jessie tended to take the lead, e.g., when asked who would like to be photographed first Winifred said 'you go first'. Winifred needed more encouragement to complete the written tests. It is reported that she does not like school so much now; she finds long division difficult (though she got 95 per cent. in the last test). There were no other differences of note.

*Comment*

The very different personalities and attitudes of the mothers have made almost no difference. The parents have perhaps in their own ways given the twins a chance to develop normally and happily, and being identical twins they have developed along similar lines. However, Winifred's slightly greater untidiness might be attributed to her 'mother's' more *laissez faire* attitude, and Jessie's tendency to take the lead might be due to her 'mother's' greater encouragement of independence. Winifred's lack of confidence in the tests may be partly due to her having had to do work at school which is rather advanced for her years. The case is of interest in showing the attraction of the twins for each other in spite of Mrs. E.'s strong opposition at first. Their teacher at the time reports that when they first attended the same school, not knowing they were twins, 'they were never apart, wanted to sit at the same desk and progressed at the same rate'. One is reminded of the finding with cattle twins! It is also interesting that it has been possible to interview—and to test—the 'mothers' and to observe the twins while they are still in different homes. (For photograph see PLATE 3, opposite page 50.)

*Postscript*

Followed up aged 16, Jessie is working in a bank, Winifred is at a technical school and hopes to become a physical training teacher. They still show considerable personality



resemblance, though Jessie is perhaps the better adjusted at home. The twins themselves completed the SRQ with the following result—Extraversion: Jessie 15, Winifred 17. Neuroticism: Jessie 15, Winifred 15.

*CASE S f 2, AGE 23*

(Booklets only)

Separated at 6 months (together from 5 to 7 years)

Not graded

Mother	1. Twin A .	} No MHR made
Maternal aunt	2. Twin B .	

*Summary*

The mother could not manage both twins. A remained with parents (father, dustman) and elder brother. B was taken by maiden aunt (warehouse fore-mistress) in a neighbouring town. They were reunited from 5 to 7 years, then parted again. They meet every weekend now. A has worked mostly in a leather factory, B in a warehouse. Both are still single. B is taller but lighter in weight and has had more illness; she is left-handed. In their booklets both make special mention of sporting interests and abilities. They both underline 'uninterested in the opposite sex', A double-underlining this item. B considers herself to be very shy. A claims telepathic experiences between herself and her twin. EXTRAVERSION: A, 15; B, 12. NEUROTICISM: A, 12½; B, 10½. They both live in the north and when pressed decided they could not find time for the trip to London.

*CASE S f 3, AGE 30*

(Joyce seen by colleagues only)

Separated at 13 months

Grade III

Adopted	2. VALERIE
Mother	1. JOYCE . . . . . Poorer MHR

*Separation*

At the birth of a younger brother when the twins were 13 months, an acquaintance took Valerie, the bigger baby, to help out temporarily, but he became so attached to her that he kept her permanently with mother's full agreement: she felt both twins would have a better chance in life that way than if they were brought up together in poor circumstances. Joyce remained with the parents. Valerie was in a nearby small town in southern England 'only a fourpenny bus ride away'. Though attending different schools, the twins met about twice a week and sometimes spent holidays together. FATHER: gardener, energetic, rather impulsive, but easy to get on with, died when twins were 13. MOTHER: 'terribly sweet', never miserable, died recently. FOSTER-FATHER: carpenter (own business), slow, placid, bronchitic—'he was my rock' (Valerie). FOSTER-MOTHER: 5 years older than mother, stricter, more reserved and particular 'there were things you could not ask her', no children of own, 'idolized' Valerie; home considerably better financially. Joyce wore Valerie's cast-off clothes.

*Later Environment and Health*

Valerie took a secretarial training and worked as secretary to the Assistant Director of a factory. Since marriage at 22 to a machine designer she has worked part-time for hospitals and welfare organizations. She had four miscarriages before her daughter, now 2, was born; since then she has put on weight and thyroid trouble is suspected. Joyce did domestic work and for several years has been housekeeper to a doctor. After two broken engagements she married a tool-setter a year ago, a quieter and less ambitious man than Valerie's husband. Only Joyce had whooping cough at 2. Valerie's periods started a month or two before Joyce's and she has usually been bigger; she is left-handed.

*Test Results*

	<i>Valerie</i>	<i>Joyce</i>
Dominoes	27	1*
Mill Hill	17	11
Extraversion	15	9
Neuroticism	7	14

\* Joyce evidently did not understand the instructions of the Dominoes, giving answers of 7 or 8 to some items; though less bright than her twin, she did not give an impression of low intelligence, and, as in other pairs where a subject gave a score of only 1, the Dominoes scores have been excluded from the statistical analysis.

*Personality*

They were happy as children but 'felt' the separation. However, each preferred living in her own home and when staying with her twin would cry to go back there. Nevertheless they were 'blissfully happy' in each other's company. Joyce says she did not resent Valerie's better chances in life, rather it was Valerie who felt guilty about this and the fact that she did not care more for her real parents. As children they both had at one time a fear of pulling the lavatory chain. Joyce occasionally walked in her sleep and at 9 or 10 had a habit of rolling her eyes; later she had a fear of tunnels.

As adults they are like in their soft, affectively labile nature, prone to ups and downs of mood, sensitive about other people's opinions and liable to anxiety. They talk and laugh alike. On interview they both spoke in a quiet, confiding, rather tense manner. They like housework and claim they furnish their homes in the same way, both, for instance, liking to have a vase of flowers in every room. Each speaks of the other twin's generosity. Following her mother's death Joyce had well-marked symptoms of anxiety and depression lasting 2 or 3 months and almost amounting to an illness. Valerie describes a similar reaction to her difficulty in conceiving.

Valerie's sensitivity and liability to guilt feelings are probably greater, and her feelings about her twin, towards whom she feels protective, are more complicated. She is extremely solicitous for her small daughter's welfare and afraid of upsetting her. She is sensitive about her increasing plumpness. She has discussed some of these problems informally with a woman psychiatrist at a hospital where she has worked. The biggest difference, however, is Valerie's greater liveliness and wider interests—'I do feel I am brighter, I have mixed more and can converse more, she has been so cooped up'. Joyce has less ambition, seeming content with her domestic duties, knitting and embroidery. Valerie enjoyed doing voluntary work for a Darby and Joan Club and is looking forward to the time when she can get back to social work and 'keep in touch with people and things'. The difference also shows up in their choice of husbands and in the test results.

*Comment*

The social advantages of Valerie's home are seen in her apparently better intelligence and the greater demands she makes on life, but the lack of understanding shown by the foster-mother may have been responsible for her feelings of guilt and insecurity. On balance, however, Joyce seems to have done less well (more childhood neurotic traits, two broken engagements, less 'bright' and more restricted in her social life), though there may be a case for considering Valerie to be the less well adjusted and also for rating the personality resemblance as Grade II (b) rather than as Grade III.

*CASE S f 4, AGE 32*

(Booklets only)

Separated at 5 years

Not graded

Aunt

2. Twin A .

Mother

1. Twin B .

} No MHR made

*Summary*

Separated at death of father (gentlemen's outfitter) and brought up in same town, not always same school; met regularly. Three other sibs in parents' home, none in that of aunt and uncle (painter and decorator, quick-tempered). A worked as typist, B as shop assistant. B married at 18 and has two sons. A married at 22, and emigrated to Australia. Her husband died a year later, leaving her with a daughter. She developed a 'spot on the lung' which cleared up. Remarried at 26 and returned to England. Said to be alike in tastes. Normal Personality Traits section of the booklet reveals a fairly close similarity of a not very remarkable kind. EXTRAVERSION: A, 14; B, 10. NEUROTICISM: A, 11½; B, 10½. They live in different towns in the north of England, and personal problems (unspecified) led A to withdraw from the investigation.

*CASE S f 5, AGE 32**Separated at birth*

Father, stepmother	2. MEGAN
Adopted	1. POLLY . . . . . Poorer MHR

*Separation*

The mother died at the birth of the twins. She had toxæmia and delivery was by Caesarean section. Polly was brought up by friends of father who moved from the south coast to an Outer London suburb when she was 2. Megan was looked after first by a housekeeper, then by foster-parents, returning at 20 months to father's home in the south coast town, father having now remarried. The stepmother wanted to have both twins and this led to a breach between the two families. The twins did not meet knowing themselves to be twins until they were 17. Megan discovered the true facts about her adoption and twinship from a school friend when she was 12. Polly found out at 17 when she had to produce a birth certificate. They met a good deal aged 20–22 when Megan, who was in the A.T.S., was stationed near Polly. Since Polly's marriage at 22 they have met less often (2 years since their last meeting), but they correspond weekly. FATHER: police sergeant, had to retire from the force 2 years early on account of a nervous breakdown, possibly precipitated by the air raids; very conscientious and particular with set ideas. STEPMOTHER: sensitive and reserved, encourages people to think Megan is her own child. POLLY'S FOSTER-FATHER: stoker in the Royal Navy, later factory foreman, placid, few interests. POLLY'S FOSTER-MOTHER: very shy and self-effacing, later had cerebral arteriosclerosis. No other children in either household. Megan's family were financially better off and they entertained more; there was probably a greater emphasis on routine. Polly was allowed much more freedom as an adolescent. There were better educational facilities in the London area. Megan left elementary school at 14 and went into a draper's shop where she became cashier. Polly left central school at 16, having learned shorthand and typing.

*Later Environment and Health*

Megan joined the A.T.S. at 20 and says she enjoyed the broader outlook on life it gave her. After the war she was a part-time school secretary and assistant infants' teacher. She enjoyed this better than the clerical work which she took up for 2 years on moving to the London area following her husband's promotion. She married an accountant at 24 whom she had known since she was 15. After having five miscarriages she gave birth to monozygotic twin daughters, now aged 15 months. Her husband is serious, precise and particular. He makes her keep household accounts and sees that she goes to the dentist regularly. They have a hobby of indoor photography. They live in a suburban house which Megan manages to keep spotlessly clean in spite of having twins at the toddling stage.

Polly worked as a shorthand typist in London till her marriage at 22 to a university student of agriculture whom she had known since 18. She went with him to the provincial university town where he was studying and, after a number of changes to gain experience, he has now a permanent, responsible post in a distant rural area. He is very different from Megan's husband—cheerful, carefree, sociable, loving outdoor life—a 'grown-up schoolboy',

Megan calls him. They now live in a fairly large house (also kept spotlessly clean) with a big garden, but until recently had no home of their own. They have no surviving children. Polly's only pregnancy ended 18 months ago in a male infant, delivered by Caesarean, who died at 7 weeks from spina bifida.

Polly was more delicate as a baby and has always been thinner, though slightly taller. Like their own mother, both twins have been liable to toxæmia in pregnancy and both have been under medical care for hypertension. After her first miscarriage Megan began to suffer from hay fever (symptoms associated with dust and 'getting het-up'). Polly thinks she is subject to very mild attacks of the same thing.

### *Test Results*

	<i>Megan</i>	<i>Polly</i>
Dominoes	33	32
Mill Hill	20	22
Extraversion	10½	9
Neuroticism	17	18

### *Personality*

From childhood onwards they were both shy, but have made a few close friends. They had a fear of the dark which persisted into adult life, Megan, for instance, giving up membership of a music club because she did not like walking home at night on her own. Neither had the idea she was a twin, though Megan sensed she was a stepchild and Polly used to play imaginary games until quite late on in childhood in which she was one of a large family. Neither can recall her reactions to discovering their twinship, but one of the first things they did when they met was to exchange clothes. Shortly after meeting there was a serious difference of opinion between the two families which was eventually healed by the twins themselves. This caused Polly to go through an emotional period during adolescence. Megan, too, speaks of emotional disturbances in adolescence which took the form of antagonism towards her stepmother. They regard themselves as having 'inferiority complexes'. Both at one time kept a diary. They are highly conscientious, going to great trouble, for instance, in filling in the booklet accurately and with much detail. They both took an interest in the scientific side of the research. They have difficulty in making social contacts. Polly's husband participates in many local activities which she finds a strain, though feeling at the same time that she should broaden her outlook. Megan, on the other hand, finds life in a dormitory suburb lonely and asked whether I knew any other twins locally whom she could meet. There is a strong bond of sympathy between the twins. Megan does not feel her lack of secondary education has made any difference. Each speaks with gratitude of the support she has had from the other. Thus Polly was able to help Megan in her sexual adjustment when she got married, having had similar difficulties herself. Megan worries excessively before any unusual event. Polly is liable to become 'hysterical' or emotional after anything she has found a strain. But when seen they both present an undemonstrative, placid exterior, seemingly reserved at first, anxious not to say anything misleading, intelligent but lacking in confidence when doing the tests. They have similar tastes in clothes, books and classical music. When they lived near London they liked to visit the ballet together. When I called, Polly was listening to the *Morning Recital* on the wireless in preference to *Housewives' Choice*. They knit and embroider well. They like the same kind of people and are intolerant of the same things (e.g., snobs). They like their food served piping hot. They walk with a similar, slightly waddling gait. They speak in the same flat, low-pitched voice. Their husbands have commented on similar mannerisms.

Differences are very slight. Influenced probably by their husbands, they support different political parties. Polly's new life in the country is giving her the opportunity of activities such as mountain walking, fishing or spending an hour in the pub with her husband, but she is not yet quite at home in these surroundings. From remarks about lack of sympathy shown by some friends and disillusionment with the church, there were signs of a somewhat cynical attitude not noticed in Megan. This seems to have developed since the loss of her child 18 months ago. Since then, too, she regards herself as having had a minor nervous breakdown. She has been in a state of indecision whether or not to have another child in

view of her hypertension and previous Caesarean. At one time she could not get the thought of babies out of her mind; she became so worked up about her problem that she and her husband decided it would be better to sleep apart. When seen, she felt she was well on the road to recovery.

### *Comment*

Similarities are extremely well marked in spite of different upbringing and lack of contact before 17. Though Polly has had an obsessionally coloured illness, Megan is possibly more obsessional and routine-bound in personality; this could be related to her having a more obsessional father and husband.

### *CASE S f 6, AGE 33*

(Booklets only)

Separated at birth

Not graded

Paternal aunt	1. Twin A .	} No MHR made
Maternal aunt	2. Twin B .	

### *Summary*

The mother died when the twins were born. A was with grandparents at first, later with paternal aunt (very strict). B was with maternal aunt, at first in the same town, from the age of 5 in another northern county. They never meet now. A was a nurse till marriage to a foreman engineer; they have one daughter. B was a domestic till marriage to a chef; they have two daughters and claim to be better off. A says she gets hay fever. B thinks they are alike in most ways. Their writing and method of filling in the booklet were similar. A mentions reading as her main interest, B cycling. According to their statements in the booklets A is more reserved, moody, impulsive and worrying, and this comes out in the questionnaire. EXTRAVERSION: A, 10; B, 10. NEUROTICISM: A, 17; B, 10. When the investigation was taken up again in 1956, B was willing to be seen but lived in the west country. It is uncertain whether A, who had moved house, was correctly traced or whether she did not reply to letters.

### *CASE S f 7, AGE 33*

Separated at birth

Grade II (a)

Paternal aunt	2. JENNY . . . . .	Poorer MHR
Paternal aunt	1. KATHLEEN	

### *Separation*

At birth, the mother having died. They were looked after by different paternal aunts, Jenny in a London suburb, Kathleen in a small seaside resort, where she was visited regularly by Jenny during the summer holidays for as long as they can remember. Though calling their respective aunts 'mother' and known by their aunts' surnames until leaving school, they knew from an early age that they were adopted and had a twin sister. JENNY'S UNCLE died when she was a baby. Her AUNT owned a drapery business and Jenny was looked after partly by a housekeeper. Her elder sister, 7 years older, was brought up with her. The aunt, herself childless, died suddenly when Jenny was 15 and, after spending a few weeks with an uncle, Jenny then lived with her sister who had just married. KATHLEEN'S UNCLE: retired grocer, cheerful, regular church-goer, respected in the community. Her AUNT was much like her sister who brought up Jenny, happy, kind-hearted and hard-working. She had a daughter of her own, 12 years older than Joan, and had been foster-mother to two other children.

### *Health and Later Environment*

At birth Jenny weighed 6½ lb., Kathleen only 3½ lb. Kathleen was a more delicate baby but since the age of 14 she has been a little heavier than Jenny and has recently put on more weight and is now 1 st. heavier. Jenny had a squint in the right eye, Kathleen one in the

left eye, both now corrected. They both had rheumatic pains in childhood. Only Jenny is reported to have had pneumonia. Adult health has been very good in both. They cannot recall how old they were when their periods started. Both are liable to stabbing pains half way between their periods.

Jenny worked as an order clerk and book-keeper, Kathleen as a bank clerk, in their own localities until they joined the women's services during the Second World War. They were stationed together for a while at their own request. Kathleen has returned to her own home town. She works as secretary to a nearby farmer and helps to look after her uncle. She was once engaged to a foreign airman but broke off the engagement. Jenny married a commercial representative, described as a sporting type, when she was 21. She hoped, for the first time since a child, to have a home of her own, but owing to the war did not achieve this till 1946. She has two sons aged 7 and 4. They live in the same district of London where Jenny was brought up.

### *Test Results*

	<i>Jenny</i>	<i>Kathleen</i>
Dominoes	34	30
Mill Hill	21	19
Extraversion	9½	6½
Neuroticism	14½	9

### *Personality*

They were alike in their ways as children. At 7 they were serious, fat, bespectacled children, at 18 attractive, rather bashful girls. They have always enjoyed each other's company. As children Jenny, who was then the bigger of the two, tended to be the managing one, although it was generally in Kathleen's home that they met; Jenny was the first to take an interest in boys. They are now heavily built but look young for their years. They find they laugh, giggle or weep at the same things, for example weeping together when they came across an old letter referring to the death of one of the aunts. They say they often start to do the same things at the same time or find themselves sitting in the same position. Relatives have confused their voices over the telephone in spite of a regional difference in accent. Jenny's husband has noted how neither finishes her potatoes, however little she has been given. Many similarities were noted in their booklets, independently filled in, e.g., their small, neat handwriting, their remarks about being sorry to leave school, about not having enough time to follow their interests, among which they have art and swimming in common. They consider they are even more alike in character than in looks, and are more like one another than like the sister or cousin with whom they were brought up. Of slightly above average intelligence, they like to be competent and systematic in their work. They are both rather self-conscious, emotional and worrying women—'too soft-hearted to get on in the world'. Jenny gave up voluntary nursing during the war because she was too squeamish. She fears the worst if she or her children have any ailment and has been to the doctor fearing she might have tuberculosis or cancer. Kathleen, who works on a farm, says she is hardened to the sight of pain. Though not quite so concerned about her own health as Jenny, she nevertheless decided to give up smoking as soon as she heard of the association with lung cancer, and if anyone else has anything wrong with them she thinks they are going to die. Jenny cannot bear being spoken to sharply. Kathleen finds it hard to ask her employer, rather a fierce man, for time off work. Jenny feels she is 'never as good as the next person'. If anything is missing on the farm, Kathleen feels she is somehow to blame. They are both sentimental; Kathleen, for example, avoids going to church because singing hymns makes her cry.

Of the two Jenny is the more anxious. She is very indecisive about small things and seems to be very dependent on her husband, whose opinion she is fond of quoting ('He always says I get in a flap at the slightest thing'). She smokes about twenty cigarettes a day. Kathleen has more country interests, such as riding. Jenny's life is tied up with her children. Kathleen says she is no longer keen to marry and does not want to leave her uncle. The most notable difference was that Kathleen appeared to be more affected or sophisticated in manner. She wore long ear-rings, had red finger-nails and had her hair in a fringe. She

types her letters in brown typing ink and signs them in ink of the same colour. Her accent was more 'refined'. She is very attached to her poodle which she takes with her to work, to concerts and even to church. She nearly brought it with her to the interview.

### *Comment*

There are notable similarities, particularly in anxiety and emotionality, extending down to many details, but the differences in personality are distinctive enough to exclude Grade I. Jenny's slightly greater tendency to anxiety could be linked with her lesser degree of security as a child (no 'father', no settled home after aunt's sudden death). Kathleen's more affected manner is more difficult to explain, but it could possibly be connected with the difference in marital status.

### *CASE S f 8, AGE 35*

Separated at birth (not met since 3)

Grade II (a)

Mother	? Birth } order }	OLIVE	. Poorer MHR (?)
Paternal aunt		MADGE	

### *Separation*

7 days after birth on account of serious illness of mother. Madge was stronger and (unless they were accidentally mixed up at the time, as one account has it) she was looked after by a paternal uncle and aunt, Olive remaining with her parents in the same town. Until the age of 3 Madge was taken every week to visit her twin, but at that age the aunt suddenly refused to bring her any more. The mother had expressed a wish to have both twins, but the aunt, childless herself and having cared for Madge for so long, insisted on keeping her. Since then the two branches of the family have not been on speaking terms. The aunt succeeded in preventing the twins from meeting. When they were 9 Madge was sent to a different school for this purpose. Madge was passed off as the aunt's own child and was 9 before she was told of her true circumstances. After that age she had a fear of being kidnapped by her own parents. Olive knew all along she had a twin and made unsuccessful attempts to meet Madge. **UNCLE:** linotype operator. **FATHER:** engineering fitter. Both tended to be ruled by their wives. The **AUNT** was inclined to be excitable and obstinate. The **MOTHER** was of a more worrying disposition and Olive thinks that she coddled her too much. The aunt was 19 years older and her home was regarded as being more old-fashioned. It was more strongly 'chapel'. She had greater ambitions for Madge who was sent to a private school and encouraged to become a teacher of the pianoforte. Olive was brought up with a brother 1 year older than herself, Madge as an only child. Olive says she missed much schooling before the age of 9 on account of delicate health. The twins left their respective schools at 15.

### *Health and Later Environment*

Both had frequent colds and ear trouble when children. Madge has worn glasses from the age of 9. She suffers from occasional severe headaches. Olive had headaches and blackouts in her teens. At 15 she had an illness with partial paralysis of the left side of the face, left arm and left leg from which she had a gradual recovery over a period of 2 years. It left her with double vision. She has a slight weakness of the left arm. The illness has been attributed at different times to chorea and to poliomyelitis. Later she had headaches, throat trouble and suspected myocarditis, but physical investigation was apparently negative. Madge is a trifle plumper and shorter.

At 20 Olive left hairdressing to train as a nurse in London. At the outbreak of war she had to give up for health reasons. After an unsuccessful attempt to take up shorthand and typing she joined the Nursing Reserve and did orthopaedic, maternity and T.B. nursing in different parts of the country until at 29 she married a policeman. She has had three miscarriages and has two small daughters, the second born 3 months before the interview for this research. She lives on a new council estate on the outskirts of Greater London. Madge completed her training as a piano teacher (A.L.C.M., A.T.C.L.) and, apart from clerical work in a factory during the war, she has worked in this profession all along. At one time

she tried to learn typing but did not like it. She lives with her elderly forster-parents in a large, rather untidy, working-class house in the town she was brought up in. She is single.

### Test Results

	Olive	Madge
Dominoes	35	30
Mill Hill	25	26
Extraversion	5	8
Neuroticism	17½	14½

### Personality

Although they have never met since they were 3, they were alike in many details. When seen they both wore brightly coloured summer frocks. An initial shyness revealed itself in their remaining standing for a few minutes at the beginning of the interviews in their own homes. They both had much to say spontaneously about their shyness, but the impression they made was not a reserved one. Each expressed strong personal wishes: Olive wanted me to persuade Madge to see her, while Madge made it a condition that I should make no attempt to do so. Their speaking voices were much alike and both liked to use short, telling phrases; both have been told their singing voices are too weak for choral work. They made the same kind of face when given the Dominoes to do. They were very similar in the ways they described their shyness, their liking for sport, their tastes and their irritability.

Olive was scared of a trap-door on the landing until she was 12. She spoke of a 'horrible shyness' that would come over her at school and later when, having been kept an invalid for long, she first started work. She felt sure Madge would be much less shy than she was. She has always loved sport—doing gymnastics, playing table tennis, watching football matches, also dancing. Madge spoke of her fear of being kidnapped as a child. At school she did not make friends easily and usually had her nose in a book. She has always been shy with strangers, stiffening up especially when approached by young men. But she loved sport, missed it when she went to her private school, likes to watch football matches on her own, is thrilled by gymnastic displays and tattoos, likes dancing itself but not the social aspect of going to dances. The twins describe similar tastes in clothes, books (especially the dramatic and imaginative) and music. One mentions Tchaikovsky's first, the other Rachmaninov's second piano concerto as among her favourite compositions. Olive likes the *Messiah* best of all. On top of a pile of music in Madge's room was a copy of the *Messiah*. Although she plays only very little herself, Olive says 'music is a big influence in my life'. Both are of good intelligence, but found they could not settle down to learning shorthand and typing. At about the time that Olive took up nursing, Madge had the wish to be a missionary. They both describe moods of irritability and tenseness in which they feel they want to cry or scream and both are liable to get headaches. They have been to their doctors for pains in the back and Madge has had treatment for nervous dyspepsia. Both are non-smokers and non-drinkers. Neither is particularly religious, though Madge does some Sunday School work.

The most marked difference is in their attitude to one another. Olive was brought up to wish that Madge was with her and dwells on episodes in her childhood when her attempts to see Madge were thwarted by her aunt; she dreams about Madge; her letters to Madge have remained unanswered. Madge was brought up to ignore her twin and in some respects to fear her, and this attitude persists. Though saying she cannot see why Olive makes such a fuss about it, she admits a fear that contact with her twin would in some way interfere with her identity and independence as an individual. She hoped they were not 'identical' twins. Her co-operation in the research was complicated by her dependence on her adoptive parents. She changed her mind more than once about participating, fearing she would upset her uncle and aunt. This attitude was maintained even after they had themselves raised no objection, provided there was no direct contact with 'the other side'. Madge was unreasonably afraid to go to a doctor or hospital for blood grouping in case the information would get about that she was not her 'mother's' real daughter: this might 'kill' her 'mother'. Madge says she is an untidy person—at one time had the nickname of 'the messer'; she hates housework; is apt to let things slide and then worry at the last minute. In manner and according to statements in the booklet she is probably more vivacious and light-hearted—



perhaps more casual—than Olive, and it was thought she was perhaps less mature. However, Olive, though married, had also apparently had difficulties with the opposite sex, for she had had three broken engagements before marrying against her mother's advice. It was also noted that she never spoke about her children in the interview.

#### *Comment and Postscript*

Some of the resemblance is of a kind which, had it occurred in twins brought up together, one would have been tempted to ascribe to their close mutual contact. That can be ruled out as an explanation in the present case. The influence of their different upbringings on their attitude to one another has been commented upon. Madge seemed to have a neurotic tie to her adoptive parents. The dramatic nature of their story may have helped to bring out latent hysterical traits in their personalities.

Some follow-up information was obtained when the twins were 39 and the blood-grouping was finally done. Madge's 'mother' had now died, Olive was divorced, had returned to her home town, and the twins had met on two brief occasions. Both were surprised how alike they still were. Olive comments on the similarity in their voices. Madge writes about Olive's first unannounced visit: 'When I walked into our living room and saw her standing there, although I had never seen her before, I knew her instantly'. After the second visit, for which she had been prepared, she thought they both had in common a 'reluctance to any great demonstration of affection', a tendency to be absent-minded, 'an extreme aversion to making up our own minds on important business decisions. . . . It looks as if we both suffered from too much protection and have in consequence developed a lack of confidence in our own ability. . . . We seem to think along very much the same lines, too—and reach the same conclusions—but on so short an acquaintance that can only be conjecture. . . . (But) it does look as if we were very much alike in spite of our different environments'. Madge seems to put it very well.

Further information was obtained when at the age of forty-three an opportunity was taken to test the twins with Wing's Standardized Test of Musical Intelligence. Madge, the piano teacher, scored 110 points, which places her well within the top ten per cent. of the population, while Olive who did not take up music scored 90 points, placing her in the top 20—30 per cent. Madge, however, has given up teaching, and both twins are now assistant nurses in the same hospital ward, one on day duty, the other on nights. Olive still likes to lay more emphasis on their twinship than does Madge.

#### *CASE S f 9, AGE 36*

Separated at 16 months (seen on day when they first met)

Grade I

Adopted

1. MADELINE

Adopted

2. LILIAN . . . . . Poorer MHR

#### *Separation*

They were probably illegitimate children. There is no information about their parents. They were admitted to a non-conformist Children's Home probably at about 1 year and adopted from there by different families who were not told they were twins. Madeline was adopted at about 16 months, Lilian at about 18 months. Madeline has lived all her life in a large town in the north of England noted for its heavy industry and railway station, Lilian about 150 miles away in a rather smaller town in the south Midlands noted for its light industries. Madeline was told she was adopted when she was 21 but did not discover she was a twin until her marriage at 23 when the registrar noted that a time of birth was recorded on her birth certificate and told her this indicated twinship. Following the television programme she wrote to inquire whether her twin could be traced. The G.R.O. was able to establish that she had in fact had a twin sister. The Children's Home was located and the matron confirmed that they had dealt with both twins and wrote to Lilian's adoptive family for us. Lilian discovered after starting work that she had been adopted but receipt of the matron's letter from the home at the age of 36 was the first she had heard of having a twin. A meeting was arranged 10 days later at the Children's Home, after which the twins came to the Maudsley where the major part of the investigation was done by Dr. Slater. They

spent the night together at Lilian's home and now correspond frequently and meet at holidays. They were seen again 7 months later by the writer, together with their husbands. **MADLINE'S ADOPTIVE FATHER:** fitter on the railways, easy to get on with, fond of children, thought the world of Madeline. Her 'MOTHER': aged 35 when she took her, rather stricter. They had no children of their own. **LILIAN'S ADOPTIVE FATHER:** retired baker, and her **ADOPTIVE MOTHER:** aged 54 when she took Lilian, were 'good in their way', but very old-fashioned and perhaps a little unfeeling. They were restrictive, and Lilian says she was not allowed to play with her friends at home. They had had three boys and a girl, but the youngest of these was 10 years older than Lilian who was taught to call them uncle and aunt. Both twins had a religious upbringing, Madeline Methodist, Lilian strict Baptist. Lilian's parents were better off. Both left elementary school at 14, but Lilian had attended at one time a private school.

### *Later Environment and Health*

Madeline did sewing in a factory till the Second World War, then packing in a munitions factory, leaving to have a baby in 1944. Since then she has helped her husband in his music shop and done other part-time work. Lilian first worked as a shop assistant and was in the office of a munitions factory during the war. For 12 years she has also done part-time work. They married within 6 months in 1942, Madeline first. Madeline has two sons born in 1944 and 1948, Lilian a daughter and a son born in 1946 and 1950. Their domestic life is happy in each case. The husbands find they get on well together, and do not resent the intervention of their wife's twin into their lives. Madeline's husband is a railway clerk and also runs a small music shop. Lilian's husband is a commercial traveller in builders' materials. Both twins had measles, chicken pox and mumps only as children, and no serious illness in adult life. Menarche: Madeline at 12½, Lilian at 13½. Both had irregular periods with pain and faints. Lilian still has some of these troubles, whilst Madeline has been better since having her first baby. Madeline's first and Lilian's second births were difficult, labour lasting 3 days in each case. Both have worn glasses for eyestrain; Lilian still wears them. Lilian is taller and heavier and is left-handed.

### *Test Results*

	<i>Madeline</i>	<i>Lilian</i>
Dominoes	27	24
Mill Hill	14	13
Extraversion	16½	14½
Neuroticism	10½	12½

### *Personality*

Each preferred her 'father' to her 'mother', confiding in him if she was in trouble. Both felt lonely as children. After the age of 8 Madeline used to turn down the bolster, pretending it was a sister, and talked to it. She liked company and was happy when staying with her friends at weekends; but Lilian was not allowed to do this. She, too, longed for a sister. She would take her Teddy bear to bed instead and tell him all her troubles. Neither felt she was, or specially wanted to have, a twin. Madeline was about average at school and was popular—she made everyone laugh. Lilian did not do very well. She was frightened of everyone and at times would sit and cry for hours in class, she cannot say why. She was very sensitive to rebuke. However, she could also be lively and was good at sport. 'I was a giggler', she says. 'So was I', says Madeline. 'I was once sent home for setting the class off giggling during an inspection.' Both liked elocution but were weak at arithmetic, and they were scared of swimming. They were told off for speaking too loudly. In Madeline's case her loud voice was put down to her shouting at grandfather who was deaf, while Lilian was told she took after her father. They are both now talkative and still have rather loud voices. The timbre of their voices and the manner of their talk are so alike that the fact that Madeline speaks with a north-country accent and Lilian not was not immediately apparent.

On interview separately by Dr. Slater they resembled one another as closely mentally as physically. Rapport was immediate and warm. They appeared to be of normal extraverted temperament, both probably a bit cyclothymic and affectively labile, possibly with mild

hysterical traits in each. They make friends easily. Madeline says she is very emotional, sheds tears of pleasure (for example over the discovery of her twin), cries at the pictures, used to have spasms of depression, lasting no more than a few hours, and still does, for no apparent reason. Lilian says she is of a very lively temperament, as a rule gay; in younger life she would have moods in which she would sob. She easily gets worked up and will cry. She got very excited to the point of being ill at the news about her twin. This past week she had hardly slept, she had a sick feeling in her stomach, she had told her news to comparative strangers—she could hardly believe it was real. They say they are useless in an emergency—their husbands have to take over. The husbands have been struck by similarities in mannerisms, such as a habit they have of rubbing their noses and of rocking themselves when tired and they remark that they get easily flustered. Both have taken part in amateur theatricals, and like parts as comic servants where they can play the fool. They are not self-conscious. They sing in chapel choirs. They prefer light music, though Madeline's husband, who is a cellist, prefers symphonies and Lilian has played hymns for a Sunday school (Madeline has not had piano lessons). They are good at talking to people and have taken up strikingly similar occupations where their ability at salesmanship is put to use. Madeline has been a sales representative, selling television sets and vacuum cleaners on hire-purchase, and runs an insurance book for which she collects the subscriptions. Lilian has for 12 years been organizer of a Christmas clothing club, calling on members to collect their subscriptions. They love animals. Madeline keeps a rabbit, a tortoise, a goldfish and a dog. Lilian has had all these and at present has a tortoise, a budgerigar, a hamster and a dog. They were in a state of great excitement at their meeting and were extremely delighted with each other. When they first met it was noticed that they had the same hair style. They dress smartly but do not use make-up. One of the first things they did when they met was to go out and buy themselves similar dresses. They confide in one another, enjoy dressing alike and, when together, will say 'we' instead of 'I' as if they had lived all their lives together. 'We are making up for lost time', they say. On the occasion of their first meeting they had a good deal of press publicity, probably through Lilian's telling so many people the news. Neither of them resented this. 'Honestly, we've thoroughly enjoyed it all', wrote Madeline. 7 months after being reunited they were still thrilled with each other and pleased at the way everything had worked out.

Similarities are thus about as great as they could be. Differences were very hard to elicit and cannot be great. Lilian's sensitivity at school which she attributes to a sheltered environment and lack of parental encouragement had no major effect on her personality. 'I felt much better when I got out in the world', she says, '—showed some ambition and gave up thinking about my childhood'. However, she regards herself as 'the second twin' and feels that Madeline is more intelligent than she is. Madeline has no such feelings about Lilian. Lilian had apparently got more worked up at the prospect of meeting her twin; the news was more sudden in her case and one of the 'uncles' was opposed to her meeting Madeline. Lilian likes helping in Sunday school, is an officer in the Girls' Life Brigade and enjoys church work among young people. This is perhaps a reflection of the greater stress laid on religion in her upbringing. Madeline probably reads more (light romances). Madeline takes sugar in her tea; Lilian gave this up in the war. Both are non-smokers.

### *Comment*

The twins remained in complete ignorance of their twinship until reunited by the investigation. Their environmental backgrounds were similar in some respects, though not of a kind that one would associate with the personalities into which they have developed. Lilian's adoptive parents were older and more restrictive. This may have had some effect on her happiness at the time, but at the age of 36 the twins appeared to be, if anything, more alike in personality than in appearance.

### *Postscript*

Followed up at the age of 42, the close similarity persists. The twins and their families have formed a strong attachment to one another for which Madeline was grateful when her husband died recently. Madeline has now bought a fried fish shop.

## CASE S f 10, AGE 36

(Norah seen by colleagues only)

Separated at 22 months

Grade IV

Adopted

1. MARJORIE . . . Poorer MHR

Adopted

2. NORAH

*Separation and Childhood History*

They are illegitimate children and were adopted from an orphanage by different families, Marjorie at 22 months, Norah at 28 months. They first heard of their twinship when they were 19 and at this age they met for the first time on the initiative of Norah. They have met on only three subsequent short occasions, the last time 3 years ago. MARJORIE was adopted by a medical practitioner, himself an adopted child, a stable man for whom she formed a very strong attachment. He died from the effects of asthma at 54 when Marjorie was 20. She did not get on with her adoptive mother, a difficult woman with hysterical traits who had not originally wanted to adopt her and who showed her little affection; and the 'parents' themselves did not get on well. The 'mother' was 44 when she took Marjorie. Marjorie heard of her adoption when she was 11 after a row with her 'mother'. There were no other children in the home. Marjorie went to a convent school (family not R.C.) where she was a boarder from 10 to 17½. Though naturally left-handed she was taught to write with her right hand. She was an unruly child. NORAH'S 'FATHER' was a minister of the Church with evangelical leanings. Norah was attached to him. He had a number of different churches, at none of which he was a success; Marjorie attributes various moral failings to him. At 56 (Norah 27 at the time), not long after his first wife's death at 67, he remarried a woman of 24 and has had five children by her. He has retired from the Church and is earning his living as a music teacher. Norah says this is because of the unsuitability of his second wife; Marjorie says he was unfrocked. Norah had a strict upbringing, but her adoptive mother (same age as Marjorie's 'mother') had a great affection for her. She regards her home life as having been much happier than her twin's. Knowledge of her adoption did not come to her as a shock. There were no other children in the home. Norah left her third private school (a well-known academy) when she was 14 and soon after went with her 'parents' to another part of the country where she helped her mother at home. She was not apparently a difficult child but says she was not very bright.

*Health*

Marjorie claims the twins both had congenital syphilis. Presumably, however, she had no signs of this when adopted by a doctor. Childhood health was fairly good, except that since a child Norah has had many bronchial colds and Marjorie chronic asthma. Norah had an appendix operation with complications at 16 for which she was 2 months in hospital. Marjorie had a burst appendix and a D and C at 20. Norah had dysmenorrhoea from the age of 11 and eventually had a hysterectomy for fibroids when she was 34. Marjorie had a hysterectomy at the same age. At 25 Norah was 4 months in hospital with subacute rheumatism. Both have had trouble with their eyes, but whereas this is attributable to congenital syphilis in the case of Marjorie, this is not so with Norah. Soon after her appendix operation at 20 Marjorie lost her vision. Interstitial keratitis was diagnosed. (This was confirmed on examination by a medical colleague.) After a year the vision of her left eye returned, but this is now growing weaker. At 30 she had penicillin treatment and her blood Wassermann, previously positive, became negative. In her booklet Norah says she had had blepharitis. For the past 8 years she has worn glasses. On examination by a medical colleague there was no evidence of interstitial keratitis or other signs of congenital syphilis, and since she is a blood donor it is hardly likely that her blood has been Wassermann positive; there was some presbyopia only. Norah, who has recently put on weight, is 2 stone heavier. As already mentioned Norah is left-handed, except for writing.

*Later Environment*

MARJORIE started a medical training but her father's death when she was 20, her subsequent ill-health and war-time circumstances made it impossible for her to continue this, though it

has always been her ambition to follow in her father's footsteps. She worked at various times in the Ambulance Service, as a chiropodist and as a governess. For a short while she was in the W.R.N.S. but was discharged on medical grounds. Ill-health (asthma) also terminated her war-time work in the Civil Service. From 24 to 31 she had posts organizing an agricultural camp and as secretary and as biology mistress in progressive schools. Threatened with failing vision she then decided to take up social welfare work and after appropriate training she worked with handicapped persons, among other things teaching handicrafts and the elements of Braille to people who are going blind—mostly elderly people, but some children. She has recently been appointed to a more responsible post in the same field, and in her spare time she is studying for higher qualifications. She has a strong sense of vocation. She is single. NORAH went in for nursing. She became Assistant Nurse in a Children's Shelter and found she liked the work with babies and young children, partly because she herself had been put in an orphanage. She has continued working as a nurse—in a private house, in a maternity home, at a children's convalescence hospital and, for the past 10 years, in tuberculosis sanatoria. She is a State-enrolled Assistant Nurse. Illness in 1943, followed by difficult domestic circumstances, prevented her from taking her S.R.N. In 1943 her fiancé was killed and her mother died. Her father, before his remarriage, decided to adopt Roger, the illegitimate child of a friend of the family, and Norah took on the responsibility of looking after him. The second wife made difficulties in the home and early in 1945 Norah left with Roger, for whom she still cares, while continuing her own work. She is on night duty and has her weekends off.

#### *Test Results*

	<i>Marjorie</i>	<i>Norah</i>
Dominoes	32	18
Mill Hill	24	16
Extraversion	18	14
Neuroticism	9½	18½

The direction of the difference in intelligence score is in keeping with their amount of education and the impression on interview, but its magnitude is surprisingly large and it is the twin who is said to have had congenital syphilis who is the more intelligent. Both twins were co-operative, but the tests were not administered by the same person. The difference in neuroticism is also very large and is not in the direction expected by the clinical history.

#### *Personality*

The twins are of a plump build with a friendly, open expression and a rather highly coloured complexion. Marjorie says they are alike in gestures and mannerisms. They are good with their hands. After initial hesitation on Marjorie's part both were highly co-operative. They appeared to be frank and were inclined to be talkative. They are sociable, outspoken, energetic people. Each had an ambition to enter the medical world, though Marjorie's ambition was greater, and they have been interested in work with children, Marjorie listing Girl Guides as one of her chief interests. In their recent troubles—Marjorie being threatened with blindness, Norah having difficulties with Roger ('A lot of trouble but he's worth it!')—they have both shown considerable efficiency and determination, including some tussles with authority, and have met with a large measure of success. Though sociable they are rather critical of others, in particular Marjorie. Norah does not like the southern English and disapproves of the habits of foreign nursing orderlies. Her strongest disapproval is reserved for women who part with their own babies. Perhaps on account of her unsatisfactory adoptive home, Marjorie also stresses in many ways her loyalty to the part of the country she was born in, though she has never lived there. They are both single. Marjorie has had emotional entanglements with other women, and in her open-necked shirt and with cropped hair she was rather masculine-looking in appearance; she is generally known by a masculine nick-name. When she came to London on the death of her father a woman doctor took a great interest in her, took her to live with her and financed her medical studies. There is the strongest suggestion that the benefactress at

least had homosexual inclinations. Marjorie was very upset at being unable to renew this relationship after outbreak of war. A little later she threatened to leave a school on account of the attentions paid to her by another woman teacher but later became a close friend of hers. Any homosexual element in Norah's make-up, if present, is much more latent. However, her engagement did not appear to have been a very important event in her life. Although she says there is a possibility of her getting married (this, if it occurred, would make Roger's care easier) she is not sure she would like to give up her freedom. She has made close, though not so far as is known exclusive, friendships with women, such as another nurse and the single sister of a nurse, with whom she has shared flats, sometimes in exchange for help in looking after Roger. She is a kindly, demonstrative person, not averse to touching other people—for example, she gave the female colleague who interviewed her a friendly but unnecessary shove as they were boarding a tram-car.

Their differences in personality are much greater than the above similarities. It has been noted that Marjorie is the more critical. This trait is indeed not very marked in Norah who is able to make good relationships within her own circle. Marjorie demands high standards from others including her twin. She is critical of her employer whom she regards as less intelligent than herself. She has always been less ready to conform than Norah. She tells the story how as a child she got into trouble for deliberately saying a High Church grace when the Presbyterian minister came to tea, and Norah relates how, on the occasion of her visiting Norah's home, Marjorie defiantly smoked a cigarette in front of Norah's 'father'; Norah herself would never have acted like this, she says, although she might have had a cigarette on the sly if she had wanted one. Marjorie claims that beneath her extraverted exterior she is a very complicated person, and this appears to be the case. Norah is more easily satisfied and more tolerant and seemed to be a more straightforward person. Marjorie does not get on with her twin, while Norah would like to have a closer relationship. Norah takes a greater interest in dress and likes to knit her own clothes, while as already mentioned Marjorie has more overt homosexual traits. According to the history, she is also more neurotic. She has exceedingly high standards for herself as well as for others and gets teased by her colleagues for being over-conscientious. When moving into a new flat she tells how she stripped off fourteen coats of old paint before applying a fresh one: Norah, she feels, would have been content with putting a single coat of paint on top of the fourteen old ones. She lays great stress on self-control which she says she achieves only with an effort. Her meetings with her twin have not been a success from her point of view, perhaps because she sees in Norah faults which she tries to correct in herself. At first she was thrilled with the idea of meeting her, but each time she feels she has been let down. She is afraid Norah will try to visit her, which would make for difficulties; and she asked that her address should not be passed on to her. Norah, however, made no request to be put in touch with her twin. Marjorie said disapprovingly that Norah would probably refuse to have a blood sample taken, when in fact Norah agreed and Marjorie, when pressed, showed some reluctance. She lays great stress on the fact that she has got where she is by her own efforts. She acknowledges the great help she has received from a lady doctor who treated her when she was 30, but she stills feels dependent on her good opinion. Her attacks of asthma she considers are brought on by emotional stress. Asked what sort of emotion would bring on an attack, she answered, 'If Dr. X were to criticize me . . .'. In addition to her rebelliousness, her high standards, her complex relationship with her twin and her conflicting needs to be both dependent and independent, Marjorie's complexities are also seen in the various forms in which she gives her own name. She is normally known by her own mother's surname. On occasions she prefixes it with the name of her adoptive parents. She has given her initials of her forenames as both M.B.A. and M.A.B.; she has signed letters to me as A, Mabel and Tommie. One letter she has left unsigned, and another unanswered.

Marjorie has had three attacks of amnesia. The first occurred on the eve of her twenty-fifth birthday. She thought she was 19, her father was still alive and someone was keeping him from her. It lasted 3 weeks. The second attack, which lasted about 1 week, occurred a year or two later after an attack of asthma and pneumonia (this may also have been at the time of difficulties in her relationship with her teacher friend); a psychiatrist diagnosed hysteria. The third attack at the age of 34 lasted only a few hours. She was in trouble for

parking her car in the wrong place; she said she did not know she had a car, and she did not know her name; she recovered when a sympathetic colleague, whose telephone number was found in her diary, came round and sorted things out.

Though she regards herself as highly strung, Norah has had no neurotic illness and on examination by a psychiatrist and a psychiatric social worker on our behalf she gave no evidence of being excitable or easily made anxious or neurotic in any other way.

### *Comment*

Though similarities in personality can be seen, they are easily overshadowed by the important differences in intelligence, social ambition, personal adjustment and psychiatric history, so that the case has been classified as Grade IV. Problems of interpretation centre on the possible effects of the syphilis (presumably congenital) which Marjorie has evidently had but which Norah has apparently escaped. (Cases are known in the literature of monozygotic twins that are discordant for congenital syphilis, e.g., Penrose, 1937; and there are no good grounds for doubting the monozygosity of this pair.) Although it is difficult to say what aspects of Marjorie's psychiatric history have been influenced by the disease, it remains a likely explanation of some of the difference between the twins, such as the tendency to hysterical dissociation shown by Marjorie. One wonders why it is Norah who is the less intelligent. A very conjectural explanation on organic lines might be that both twins were infected but in different ways, Marjorie developing symptoms of interstitial keratitis and little else, Norah never showing organic signs but nevertheless undergoing some slight cerebral impairment during development which shows itself in diminished intellectual capacity compared with her twin. However, much of the difference could be explained along psychogenic lines. Only Marjorie had a disturbed relationship with her 'mother' (a difficult woman), learned of her adoption in an unsatisfactory way, and at the end of a stormy adolescence lost her 'father' to whom she was perhaps over-closely attached. The career on which she had laid so much store was then interrupted and she was seriously handicapped by her ensuing illness and loss of vision. On this basis she developed a more complex and disturbed personality, but in some ways could be regarded as having reached a higher, if somewhat more precarious, level of adjustment than her twin. Norah had a less ambitious man for a 'father' and, in so far as he was inadequate, was protected by a sympathetic mother. She never developed the ambition of neurotic drive shown by Marjorie.

### *CASE S f 11, AGE 38*

(Both twins sent in their names)

Separated at 8 years

Grade III

Maternal grandmother 1. MOLLY . . . . . Poorer MHR

Mother 2. DOROTHY

### *Separation*

When the twins were 8 their maternal grandmother, whose husband had just died and who suffered from rheumatism, wanted one of them for company and help. The father was out of work at the time. Dorothy was sent first and would not stay. Molly was then sent to grandmother's and was made to stay. Until then the twins had done everything together; thereafter they continued to attend the same school in the village where both families lived, but the grandmother did not like Molly to mix with other children and she saw little of Dorothy. Molly did a little better at school. After 14 they saw still less of each other when Dorothy went away to work, but since marriage they have lived in the same Midlands town and meet regularly. FATHER: coal miner, later farm labourer, shy, peace-loving, well-liked, liable to headaches and stomach trouble, poor vision, may have favoured Dorothy who was 'dad's pet'. MOTHER: cheerful, independent, very strict. GRANDMOTHER: lived in a farm cottage, handicapped by arthritis, very demanding as she grew older, tried to keep Molly from marrying. Till she left her at 20 Molly had to be home by 8.30 p.m. and sleep in the same bed as grandmother. Like mother, grandmother believed strongly in keeping children

active and out of mischief; reading was not encouraged; but she was even stricter, disapproving of dancing and believing that children should never complain—'they should not know the meaning of pain'. Dorothy was brought up all along with an older and a younger brother. Molly was in effect an only child from the age of 8 and made friends with older people.

#### *Later Environment and Health*

Dorothy met her husband whom she married at 18 when she was working as a waitress in a seaside hotel. He is now a van driver for the Post Office. Molly never had a job of her own but had to continue working in the village as her grandmother saw fit. Molly's husband was a friend of Dorothy's husband and she met him when he drove her to Dorothy's wedding, marrying him 2 years later. He is 20 years older than she is, Dorothy's husband being 7 years older. He is a skilled factory worker, but was out of work for a while shortly after their marriage. Both marriages are happy but Molly's husband is much quieter than Dorothy's. Dorothy has a son of 16 and a daughter of 13, Molly has a daughter of 16 and a son of 13, in addition to a son of 9 born the same year as Dorothy had a surgical abortion.

As babies the twins were less trouble together than either of their brothers singly, but Dorothy was regarded as the more delicate and had double pneumonia at 6 and diphtheria at 9. Molly's periods began at 13, Dorothy's not till 15½. Both had anaemia in their teens. On account of dysmenorrhoea Dorothy had the first of six abdominal operations when she was 20, the last being a total hysterectomy at 32. At this age—indeed, it is said, at the very moment when Dorothy was taken to the theatre for her operation—Molly had a haemorrhage which turned out to be a premature menopause. Both had septicaemia with their third pregnancy and, though Molly has had no abdominal operations she says she has been putting off going into hospital for operation on a prolapsed uterus. Both twins wear glasses for myopia, as did their father. Molly is 1¾ in. taller and 9 lb. lighter than her twin.

#### *Test Results*

	<i>Molly</i>	<i>Dorothy</i>
Dominoes	27	28
Mill Hill	19	16
Extraversion	5½	7½
Neuroticism	9½	16

#### *Personality*

Their similarities relate mostly to ordinary qualities. They responded in a similar friendly manner on interview. Their way of laughing was similar and friends comment on their similar mannerisms. They were simply dressed in fresh-looking linen costumes made by Molly, and neither wore make-up. There was perhaps something rather spinsterish about them. Sexually they are frigid. Neither is active in social activities but they are fond of travelling and natural scenery. They like to talk about the similarity in their child-bearing histories.

People who know them comment on their difference in character, and as the interview progressed differences became more apparent. Even before they were separated Dorothy had the reputation of being the less tidily dressed and she found it easier to get her own way. She was considered to be the more delicate. Molly wore glasses from the age of 8 because she was told to. Dorothy should have done but would not until she was 13. Their separation accentuated the difference, Molly at her grandmother's becoming more worrying, bitter and self-sacrificing. She missed Dorothy and had fits of depression when she was 12. During the war, when her husband was on night work and she was left alone in the house during the raids she 'went to pieces' and could not stay on her own; she was treated for neurasthenia and improved when her husband was taken off night work; she related the episode to an occasion at the age of 16 when she was frightened at being left alone with her grandmother when the latter had injured herself. 'That sort of life pulls you down. You've got to grin and bear it.' She never felt one of the family. When her father died she was 'too



busy' to attend the funeral. (Dorothy would have 'gone to the end of the earth' for it.) She is not so fond of children as Dorothy. 'I carry the love side', as Dorothy puts it. Molly mixes more with older people. She is handier than Dorothy at some practical things; she has learned to drive a car, while Dorothy would not like to learn. Dorothy considers herself more idealistic. Over the last few years she has taken an interest in the Plymouth Brethren and believes strongly in the powers of love to conquer all difficulties. But, while Molly 'would never say a thoughtless word', Dorothy will argue more. Since her hysterectomy, Dorothy finds she gets more irritable and has been liable to sudden unexplained periods of depression (untreated), lasting 1 or 2 weeks, in which she is weepy and her sleep is affected.

### *Comment*

Not separated until the age of 8, some of the differences probably arose before that age in the original family home, among them character traits that determined that it was Molly rather than Dorothy who was subjected to what seems to have amounted to mental cruelty at the hands of the grandmother. Again some of the difference may be due to Dorothy's hysterectomy. However, the major cause must surely be the life Molly led at the grandmother's between the ages of 8 and 20.

### *CASE S f 12, AGE 38*

Separated at 7 years

Grade II (b)

Mother

1. PAULINE

. . . Poorer MHR

Maternal aunt

2. SALLY

### *Separation*

They were brought up together till the age of 7, when Sally left the small town where the parents lived to be looked after by a childless maternal aunt and her husband in a larger town some 30 miles away. The reasons for the separation were the aunt's wish for a child and some degree of overcrowding in the parents' home. The parents later came to regret parting with Sally. Pauline's school was more old-fashioned and crowded and she disliked it. The twins met only occasionally until after leaving school, when they liked to spend a week's holiday together each year. FATHER: aged 72, labourer in steel works for 47 years, contented, placid, relied too much on his wife, very clean and methodical, but not very sociable; at age 68 he had four short admissions to mental hospital, diagnosed as 'recurrent depression in a man of low intelligence', recovering each time with E.C.T.; for past 3 years living with Sally, reasonably well but showing senile changes. MOTHER: aged 35 at birth of twins, healthy, cheerful, sociable; neighbours came to her with their troubles; firm but not too strict with her children. UNCLE: engine driver, heavy drinker but rarely to excess, ill-tempered and unpopular, not fond of Sally and insisted that until 21 she should be home by 9 p.m. AUNT: 3 years younger than mother, sympathetic and fond of Sally but never took mother's place in her eyes, quarrelled with her husband. Financial circumstances were easier in Sally's home. Pauline was brought up with two older and two younger brothers and sisters, Sally as an only child and she felt lonely. Their youngest brother, aged 31, has been continuously in mental hospital since the age of 27, having been discharged from the Army on psychiatric grounds 9 years previously; now diagnosed as a case of long-standing schizophrenia, probably simple type.

### *Health and Later Environment*

At birth Sally weighed 4½ lb., Pauline only 3½ lb. Sally has always been bigger. Pauline had jaundice at 14, Sally at 34 possibly associated with gallstones. Both are liable to fibrositis. Pauline had peritonitis at 15. She says her periods started at 11, while Sally's did not begin until she was 13.

After trying office work Pauline worked at a card loom in a weaving factory until her marriage and again during the war. Sally was trained as a dressmaker and worked mainly in this capacity. Pauline married a grocer's assistant at 22, a quiet, thoughtful man who has recently

become a branch manager of his shop. They have a son of 10. Sally first married at 23, having been fond of her husband since 17; he was an accountant. Very soon after the marriage he went abroad in the services and was killed in action 3 years later when expected home on his first leave. A year later she met a farmer who was expecting a divorce. Their daughter, aged 10, was born 3 years before they were able to marry. For the past 10 years she has been living the life of a farmer's wife, looking after a large old-fashioned house near the town where she was brought up. Her husband is lively and fond of entertaining, liking to be the centre of attraction. Sally has her father and maternal aunt living with her. Pauline looks after her father-in-law. The twins meet about once a fortnight when they visit their brother in hospital.

### *Test Results*

	<i>Pauline</i>	<i>Sally</i>
Dominoes	22	23
Mill Hill	11	10
Extraversion	10	11
Neuroticism	14	12

### *Personality*

Although one of their brothers is a schizophrenic both the twins make a warm, frank, and friendly impression. They were smartly turned out and dressed alike for the occasion. They like to talk of their children. Similarities in voice, laughter and gesture were noted. They claim they cook alike, have the same taste for clothes, and have a liking for outdoor games, and they have discovered they have done things at the same time: e.g., one Christmas each bought a pair of identical slippers from a branch of the same store in different towns. Both are members of the Women's Institute and have been elected to the general committee of their respective branches. Pauline is also a member of the entertainments committee, Sally of the social committee; they joined independently. Each takes pride in the fact that she had been trained in the best dress shop in the city or had worked in a factory of special distinction. Independently they say that irritability is one of their weaknesses and that they are sensitive to thoughtlessness on the part of others. As children they were popular but did not seek out company.

The main difference is Pauline's greater timidity and anxiety. As a child she felt inferior to Sally, considering her to be the cleverer and letting her take the lead. Sally was surprised to hear this and also Pauline's confession that she had felt a bit apprehensive about the interview. Pauline had felt restless when working in an office but Sally never felt this way when sitting down to her dressmaking. Pauline is inclined to fuss over her boy, e.g., fearing he might fall, or getting worked up over his untidiness. He is more highly strung than Sally's daughter and if she shouts at him it makes him sick. She is more easily put out than Sally if her daily routine is upset and she finds the one old person she has to look after more of a strain than Sally finds her two. She is more squeamish than Sally, e.g., over handling animals. She feels she could not stand up to trouble the way Sally has done and thinks that Sally's misfortunes have made her less likely to worry over trifles the way Pauline does. In their teens Sally was more of a flirt. She has always liked a man with a stronger personality than does Pauline. She speaks more positively of enjoying the sexual side of marriage. Pauline spoke more disapprovingly of drink and thinks smoking 'a terrible habit'.

### *Comment*

Although the differences are well marked, it was not felt that they overshadowed the similarities. Sally was brought up from the age of 7 onwards in a less happy home which she felt never took the place of her original home. Her first husband was killed in the war and she had the stress of having a child born out of wedlock before she could marry her second husband. She has more domestic responsibilities than her twin. Nevertheless, as Pauline herself remarked, these hardships appear to have had a bracing effect on Sally. The reason for the greater degree of anxiety which Pauline has shown right from the beginning is not clear from the history.

*CASE S f 13, AGE 39*

(Both twins sent in their names)

Separated from birth till 11 years and again at 16 Grade II (b)

Maternal grandmother 2. VIOLA . . . . . Poorer MHR

Mother 1. OLGA

*Separation*

When the mother was 19 she married a widower with a daughter of 7, and soon afterwards the twins were born. The maternal grandmother thought they would be too much for the mother and suggested taking first one twin, then the other, on alternate nights; but the grandfather decided they should take the weaker twin or neither. Viola was therefore taken by the grandparents, while Olga remained with the parents, living nearby in the same industrial area. The mother and grandmother did not get on and at times the mother would demand Viola's return. There were occasions when she was taken back to mother, but until she was 11 she was always returned to the grandmother before the day was out. At that age she went to live with the parents and was forbidden to see her grandmother; the mother favoured Olga who was sent to spy on her if it was thought Viola was breaking this rule. At 16 Viola ran away to the grandmother and lived with her till her marriage at 18. FATHER: labourer, moody, preferred his sons to his daughters. MOTHER: changeable, ill-tempered, at times viciously aggressive; it was 'do this, do that, or else—' all the time; improvident manager. GRANDFATHER: painter, used to be aggressive to his own children; was kind to Viola though strict. GRANDMOTHER: placid, 'kindness itself', poor, but practical manager. In the parents' household were the half-sister, two brothers and a sister. One of the brothers went to an open-air school (weak chest), deserted during National Service, is described as a Teddy-boy. The sister was backward and sexually irresponsible, had a psychiatric illness when her child was born, is unhappily married. Sharing the grandparents' house was an aunt, one of whose two boys had fits. Viola had more toys than Olga. Various relatives tried to play one twin off against the other. They attended the same school but in general had 'utterly different lives'.

*Later Environment and Health*

For a short while after leaving school the twins worked together in a laundry, otherwise they have had only casual contact during adult life and as a rule do not get on. They each had a variety of jobs in factories or as a hospital ward orderly until marriage, and since then have taken on part-time domestic and other work. Viola married a builder's tradesman at 18—the grandmother wanted to see her happily married before she died. They have two sons. The elder one was a problem from the age of 9 on account of educational backwardness, school refusal and delinquency; was jealous of brighter younger brother; was probably discriminated against by Viola; had Child Guidance treatment, at 13 was sent to approved school for 2 years. During the early years of her marriage Viola had relatives of her husband to care for. Olga married a sailor at 20, later Chief Petty Officer, now employed in engineering factory. They have three children, none of them serious problems, and after 11 years Olga is pregnant again and greatly pleased about it. 5 years ago Olga and her family left their neighbourhood to live in a New Town. Both husbands (seen) appeared to be of normal personality. Physically, Olga kept the lead she had at birth. Menarche: Olga at 13, Viola not till 17. Viola had some trouble with the glands of her neck in her teens. Both have varicose veins. Viola has had hospital investigation for a throat affection and mastitis, Olga for gastric trouble. Viola has been losing weight [see below] and Olga was 6 months pregnant when seen; she was 3 stone heavier than Viola.

*Test Results*

	<i>Viola</i>	<i>Olga</i>
Dominoes	9	15
Mill Hill	19	19
Extraversion	10	12
Neuroticism	17	18

*Personality*

The twins and their husbands describe their personalities in very similar ways. They are over-talkative, vivacious in their mannerisms, Viola's husband cannot distinguish their voices, they are easily made emotional, anxious or irritable, but not so violently tempered as their mother and other sister. With their moods and insistent demands they dominate their families. Viola says, 'I get het up, little things worry me, I've got to have things tidy that would not worry others, if there's any trouble nothing can hold me'. Olga says, 'I'm very quick but it soon goes—but it's got to be said. I'm a terrible worrier over silly things. Things have got to be done *now*.' She will get up and straighten a picture on the wall that annoys her, whatever the company. They speak in similar terms of their restlessness and irritability. They display much anxiety about their health, both having had hospital investigation for complaints for which no definite abnormality could be found (e.g., Olga for burning pain in chest and between shoulders in 1949, told it was due to worrying and she should relax; Viola in the same year for right abdominal pain, D and C performed, N.A.D., but patient felt better) or which are aggravated by anxiety (e.g., Viola's moderate fibroadenosis of left breast, 'symptoms made worse by anxiety about cancer' according to hospital report). Both complain of severe recurrent headaches over many years, possibly of the migrainous type in Viola at least. At the age of 25 Olga started having sudden attacks of panic in which she had the idea she was going to choke, was afraid to swallow even her own saliva, but felt better as soon as she could drink some water; the doctor told her it was nerves; the attacks cleared up without treatment after about 6 months. Viola knew nothing of this at the time. At the age of 32, Viola developed similar symptoms, described below, which have continued to the present. The antagonism of the twins towards each other is mutual—as Olga says, 'She makes me bristle'. The circumstances of their upbringing did not encourage good relations. It is therefore perhaps surprising that at the age of 11, following a visit to a convent, they should both decide they wanted to become Roman Catholic, which they did, and have kept it up. On interview they seemed to be colourful, neurotic personalities of a very similar kind in spite of the differences below.

As a child Viola showed more anxiety. She developed a fear of walking with a stoop: if someone was walking behind her she thought they were criticizing the way she walked, would stop, pretending to tie up her shoe lace and let the person overtake her. She was sensitive about the late onset of menstruation, about which Olga taunted her, and was afraid she was turning into a man. Olga can recall no such traits in herself. She (Olga) walked in her sleep on one occasion. She used to get into trouble for staying out late, and if forbidden to go anywhere, such as the regatta, she was sure to go. She has grown up to be less concerned about what other people think and has the reputation of being the less sociable. She contested her mother's will. She showed more confidence in doing the tests and worked faster (Viola's low Dominoes score is an underestimate of her intelligence). Just as talkative as Viola, Olga laughed about her past troubles until the tears came. Viola was more anxious and bothered. The most outstanding difference is the greater severity of Viola's neurotic disturbance. Her first breakdown was at 27 and followed concern for her elder son's eyesight after an accident. She had fainting fits, preceded by headaches and a feeling of swelling in the throat, and sometimes accompanied by jerky movements of the limbs and loss of consciousness, diagnosed at a psychiatric clinic as hysterical; other symptoms were crying without knowing why, a fear of going out and much anxious anticipation ('my mind seemed to go ahead of me'); admission to mental hospital was suggested, her husband returned on compassionate leave, and after about 9 months the illness cleared up. 3 years later, following a throat infection, she had difficulty in swallowing and a fear of choking, she thought she would die 'and never see my son again' (he had gone to an approved school 2 months previously). Hospital investigation showed some diffuse enlargement of the thyroid but no evidence of hyperthyroidism. For the past 7 years she says she has not eaten solids for fear of choking. When in hospital recently for investigation of the lump on her breast she was just able to manage some stewed fruit, but at home her husband has to strain tomato soup for her. However, on interview she produced some chocolate from her bag to take away the taste of the PTC. She has lost much weight over the years. She

realizes her trouble is 'just nerves' and looks to hypnotism for a cure. Relations between her and her husband are now strained.

*Comment*

Though very alike in basic personality, only Viola has a very chronic hysterical disorder. She was the weaker twin at birth, the later to mature sexually and, though brought up in what was superficially the better home, was subjected to much greater uncertainty during childhood. She never knew when she might not be reclaimed by her mother. When she was reclaimed at the age of 11, she was forbidden to see any more of her grandmother and had to live with the aggressive and changeable mother who preferred Olga and to whose ways Olga had in some measure adjusted. It is probably this more than anything that predisposed her to a more severe illness than her twin.

*CASE S f 14, AGE 40*

Case came to notice of Sir Aubrey Lewis in 1931 (non-psychiatric volunteers)

Separated at 3 months

Grade IV

Paternal grandmother 2. MILLICENT

Mother 1. EDITH . . . . . Poorer MHR

*Separation*

When father went to the war mother felt she could not cope with both twins. The original plan was that they should be looked after in turn by mother and grandparents but their separation at 3 months when Millicent, the bigger and more vigorous baby, was taken by the paternal grandmother proved permanent, although at various times mother suggested that Millicent should return to parents' home. There was a good deal of antagonism between the mother and her mother-in-law, who were very different in their views. Millicent was brought up as an only child, two maiden aunts (both rather prim civil servants) assisting the grandmother. Edith was brought up with four elder sisters, a brother 18 months younger and another sister 8 years younger. One of the elder sisters has had two illegitimate children and is an alcoholic, another had a nervous breakdown at adolescence. The twins went to the same school but had no very close contact. They did not feel at home in each other's houses and Edith who was smaller was compared unfavourably with Millicent. PATERNAL GRANDFATHER: master tailor, died when Millicent was 3. PATERNAL GRANDMOTHER: Victorian in her ideas but Millicent found her understanding; very strong emphasis on good manners, regular habits and importance of taking care of minor ailments; High Church; grandmother and aunts regarded themselves as socially superior to mother. FATHER: tailor, still working at 80; took an interest in both twins; exceedingly placid. MOTHER: 'highly strung', changeable, said to have moved home twenty-seven times in all, though Edith spent nearly all her childhood in the same house, inconsistent in discipline; at times would take an interest in Millicent, e.g., ask for her back, insist that the twins should be dressed alike—at others lose interest; may have preferred younger brother to Edith herself, had hoped for son when twins were born. Parents' home financially less well-off. Edith led a much less sheltered life than Millicent and was encouraged earlier to go dancing and take an interest in her appearance; in mother's home the children were allowed to help themselves to sweets, have as much cake as they wished, and suck their oranges if they wanted to.

*Health and Later Environment*

Edith was breast-fed longer. She was the weaker baby and had more childhood illnesses, including scarlet fever, whooping cough and diphtheria which Millicent did not get, and she had eye trouble after chickenpox. Menarche occurred about a month earlier in Millicent than in Edith, at 14½. Millicent has had sebaceous cysts and a verruca, and over the past 8 years spider naevi associated with an enlarged liver discovered on hospital investigation recently to be due to mitral stenosis. When in hospital she was found to be anaemic due to fibroids and when first seen she was recovering from a total hysterectomy. Both twins had to have many teeth extracted at about the age of 25. In her twenties Edith had an illness in

which she lost her toe-nails, otherwise she has had fairly good physical health as an adult. Millicent is  $1\frac{1}{2}$  inches taller but a little lighter than Edith. Edith is left-handed.

Millicent stayed on at school till  $15\frac{1}{2}$ , Edith having left at 14. Like her aunts Millicent worked in the Civil Service where she has received promotion to Chief Superintendent, supervising routine work done by a large number of girls. For 13 years she was transferred to the north of England but now lives with her aunts in the same house in which she was brought up. She is still single. A boy friend was killed in the Second World War but they were not engaged. Edith worked as a clerk and telephonist in an engineering firm till marriage at 21. Her husband is now a manager of a shoe shop and she assists him. They have one son aged 10 who is at boarding school. The husband's business has necessitated their living in nine different places since marriage but they have been in the provincial town where they now live for the past 8 years. Edith is better off financially. There has been little adult contact between the twins who last met 6 years ago.

### *Test results*

	<i>Millicent</i>	<i>Edith</i>
Dominoes	33	24
Mill Hill	21	14
Extraversion	$13\frac{1}{2}$	$14\frac{1}{2}$
Neuroticism	$4\frac{1}{2}$	5

### *Personality*

There was no marked similarity. Differences were noted from an early age, Edith being less intelligent and more neurotic. She sucked a dummy until she went to school at 5. She walked in her sleep till she was 14. She found school work hard, disliking in particular comparison with her twin, and stayed away on the slightest excuse; she left from Standard Five. She cried very easily. In early adolescence she was particular about neatness and tidiness to an obsessional degree. A little later she became more outgoing and was more knowledgeable about clothes and the ways of the world than Millicent, but at 22, after a change of job and at the time of her engagement, she had what she describes as a nervous breakdown in which she felt depressed and 'run down' and 'howled if spoken to'. She improved after a holiday. At 25, after exposure to bombing, she had another breakdown; she moved to the country where she was lonely; had an illness in which she lost her toe-nails; was referred to a psychiatrist, complaining of burning sensations in the stomach, crying spells and worry; his diagnosis was depression, with insecurity resulting from husband's imminent call-up as a possible precipitating factor. She improved and, apart from a tendency to worry, has had no further trouble of a similar kind. Her main interest is her husband's business. She makes friends easily. She seemed lively and light-hearted in a rather superficial way and was very firm about small matters (e.g., was willing to travel to London to see me, but not to travel more than a few minutes distance from the railway terminus).

Millicent had no neurotic traits as a child. Though early on something of a tomboy, she grew up into a rather quieter person than Edith. When they last met Edith was impressed how much slower Millicent was in her movements. Her interests are photography, reading and rambling. When Edith's son was born Millicent experienced unexplained abdominal pains (she says she did not know he was expected), and Edith thinks she resents the fact that she has not a child of her own. However, she is not of a worrying nature and has had no nervous troubles. She has no difficulty making friends and has a fund of quiet humour. (Both twins give an amusing but not overdrawn account of the differences in early background as they saw them.) Millicent dwells more on various physical complaints she or Edith are thought to have had, although she cannot be regarded as hypochondriacal. This difference is in keeping with their upbringing as well as with the fact that Millicent had recently had much physical illness.

### *Comment*

The twins have little in common. Despite the closeness of the SRQ scores it seems reasonable to classify them as Grade IV. The difference in intelligence shows up in school

record, later career and tests. The difference in psychiatric history is quite marked, though at present Edith seems to be reasonably stable. Millicent has taken after her single, civil servant aunts, and her more settled environment has protected her from any neurotic tendencies she might have shown had she, like Edith and the other sibs, been brought up in the parental home. Besides being exposed to the mother's inconsistencies, Edith was the weaker twin from the start, had more childhood illness and is left-handed.

*CASE S f 15, AGE 40*

Separated at birth, reunited at about 5

Grade II (b)

Mother	2. JOAN . . . . .	Poorer MHR
Maternal aunt	1. DINAH	

*Separation*

At a few weeks on account of father's failure in business. Joan (who was being breast-fed) went with parents and three elder sibs to London. Dinah remained in a small country town with a maiden aunt of 46, 10 years older than mother. FATHER: timber merchant and later clerk, gentle and kind. MOTHER: soft-hearted, inclined to spoil her children, 'it was easy to get around her', died at 75 after senile psychosis. AUNT: 'very, very strict, very, very religious, impossible to get round her'. The twins were probably together at various times before school age, but the mother continued to have more to do with Joan, the aunt with Dinah. They were reunited most of the time from 5 to 15, generally with the aunt, but sometimes with mother. On leaving school Joan returned to London and lived with mother. Except for a year or two during the war they have not since lived near one another, apart from visiting each other one or two times a year.

*Later Environment and Health*

Dinah has continued to live in the same small country town in which she was brought up. For 8 years she worked in a confectioner's shop till her marriage to a bread salesman, now a bus driver, who is a quiet, undemonstrative man. She had a miscarriage at 25. She looked after three evacuated children during the war and has an adopted son of 9. She looked after her mother who, for the last 4 years of her life, suffered from failing memory, for the last 18 months did not recognize her and finally tried to wander away from home; she died in 1950. Dinah now helps to care for her aunt who has become a senile invalid. She gives hospitality to a homeless youth who works with her husband. Joan did office work in London before marriage and during the war. Her first marriage to a bank clerk occurred 7 months before Dinah's. Her husband, an energetic man who played rugby football, was killed in an air-raid in 1940. At about the same time as Dinah, Joan had a miscarriage. She remarried in 1946. Her second husband was an R.A.F. officer who later tried theatre management and engineering. They live in a popular south coast resort and have now taken over the management of an hotel. She has no children of her own, but busies herself in helping to bring up the daughter of a niece. Neither twin has had any serious marital difficulties. Joan is financially better off than Dinah. The twins correspond about once a fortnight.

Since a fall at 3 or 4 Dinah's left shoulder has been a little higher than her right. Childhood health was good, except for an eye infection which Dinah had. Menarche at 13, Dinah first by one month. Both have had much dysmenorrhoea and are inclined to be anaemic. Both first wore dentures at 22 and started to go grey at 26. Joan had an operation for peritonitis in 1935 and gynaecological operations in 1938, 1945 (ovarian cyst removed), 1948 and 1949. In 1948 she put on weight, reaching 12 stone. She now (1954) weighs 9½ stone, more than 1 stone heavier than Dinah. Dinah had an illness in 1936, which she calls appendicitis, when she was in bed for 3 weeks, but she says she was too frightened to let the doctor examine her properly. She suffers from catarrh.

*Test Results*

	<i>Joan</i>	<i>Dinah</i>
Dominoes	10	6
Mill Hill	14	14
Extraversion	16	4
Neuroticism	16	19

The Dominoes scores of both twins are surprisingly low.

*Personality*

There was some jealousy between the mother and the aunt over who should care for the children, and when either had the care of both children she favoured in small ways the one she had looked after as a baby. Dinah preferred aunt to mother. The twins quarrelled a lot as children. Joan tended to bully Dinah and even does so now. But they resented anyone else interfering with their quarrels and if one was punished the other would cry in sympathy. Both were very shy, blushed easily and suffered from frequency of micturition. They were emotional children. Dinah missed some early schooling on account of an eye infection, but after some coaching caught Joan up. They won prizes for embroidery in an Eisteddfod at the age of 8, Dinah first, Joan second. They love embroidery still, but whereas Joan always follows a pattern, Dinah makes her own design. Joan eventually overcame her shyness to the extent of taking part in a school debating society. As young women they loved dancing.

The twins are of pyknic build. Their voices and the way they smile are alike. They give the impression of being most warm-hearted and friendly persons who love to devote themselves to others. Joan wishes she did not worry so much over other people's troubles. Her doctor, in a letter to us, refers to her keen interest in her niece and her somewhat complicated affairs. Dinah's drive to help others is seen in the history, and her hospitality was experienced personally when I called on her. They must always be on the go. They smoke 20 or more cigarettes a day, Dinah calling herself a chain-smoker. They are only occasional drinkers, Joan preferring whisky, Dinah rum. Joan finds fatty foods disagree with her and is allergic to strawberries. Both say they are terrified of cats. Joan goes 'all goosey' at the sight of one and claims never to have touched a cat. Dinah says their fur, their claws and the way they swish their tails 'seems to go right through me'. However, both like spaniels. They make a great deal of their telepathic-like experiences. They have chosen the same pattern of wallpaper when living in different parts of the country. Dinah says she feels listless when Joan is unwell, especially when she has her operations. When she is tired she feels sure it is because Joan is draining energy from her.

Anxiety traits are well marked in both. Both said they had attended their doctors for their nerves and with the twins' permission the doctors have kindly furnished us with reports on them. Joan's doctor says she has been a regular caller at the surgery for the past 4 years, almost invariably with pains in the chest, sometimes accompanied by extreme introspection and agitation which specialist examinations (all negative) and much reassurance and symptomatic treatment have failed to alleviate for long; she thought she had angina. (Earlier she had a fear of cancer which after her latest operation her surgeon succeeded in dispelling.) Otherwise her present doctor finds her a reasonable, intelligent and pleasant person. In 1941 she had a nervous breakdown lasting 6 weeks. She was finding accountancy work in London too much of a strain. This was during the raids, and she was living near the house in which her first husband had been killed and her father injured the year before. She improved when she moved to easier work in North Wales.

Dinah has attended her doctor frequently for flutterings in the chest, nervousness, pressure on top of the head, headaches and giddiness, indigestion and other symptoms: 'She is always anxious about her health', he writes, but is easily reassured at least for a few months. He refers to her as a quiet, unassuming and very helpful person.

In keeping with the test results the main difference appeared to be that Joan was more extraverted. She did most of the talking and leaned forward in her chair while Dinah leaned back. She was more heavily made up and renewed her make-up in public—Dinah retired to do this. Joan says she is more high-spirited than Dinah and likes to tease people. Both her husbands were keen on dancing like herself, but Dinah has dropped this interest.



Joan likes to talk about her various operations and doctors. She was inclined to make a fuss over the finger-printing, PTC-tasting and the Dominoes, the last of which gave her a headache. She thinks Dinah has got quieter over the years. Dinah did in fact appear a sadder person though not really depressed.

### *Comment*

The degree of separation during childhood in this pair of twins is about the smallest in the series and its precise extent is uncertain. However, it was sufficient to affect the twins' feeling for their mother and hers for them, and personality differences between the mother and the aunt were very marked. As with twins brought up together the inter-twin relationship may have been an important cause of differences. The fact that Joan may have been indulged more and Dinah more rigidly brought up may have been a factor which assisted Joan in becoming the more dominant twin and more dominant personality. Later factors accentuated this development—the character of the husbands, the localities where they lived (the one in a quiet country town, the other in London or a seaside resort), Joan's frequent visits to hospitals for operation, and Dinah's nursing her invalid mother. Although Joan has become more extraverted and perhaps more hysterical, the basic similarity—the marked friendliness and tendency to anxiety—nevertheless remains.

### *CASE S f 16, AGE 41*

Separated at birth

Grade III

Adopted

1. JUNE . . . . . Poorer MHR

Adopted

2. CLARA

### *Separation*

The twins were the illegitimate children of an actress. Very soon after birth Clara was adopted (not legally) by friends of mother, whose surname she took as a child. She did not learn she was not their child until a birth certificate had to be produced when she started work at 14. (Although she had first met her twin at 8, she denies suspecting anything before 14.) Until she was 3, June was brought up by a foster-mother who was reported to the N.S.P.C.C. as being unclean and unkind by a woman who was thereupon given the care of June and looked after her for good. June was told she was a twin and an adopted child when she was 8, when her foster-mother herself first discovered by chance that June had a twin and arranged for the girls to meet. Thereafter they met for 2 or 3 weeks a year either in Clara's home in a semi-rural suburb or in June's home nearer central London, but did not get on very well. Both went to elementary school till 14, but June was given more encouragement with her lessons at home. They were both brought up as only children. After school they continued to meet at weekends three or four times a year at first and now rather less often. CLARA'S ADOPTIVE FATHER, horse and cart contractor, later bought small holding and sold vegetables; hard-working, strict but spent all his money in the pub; inclined to be suspicious. Clara is looking after him in his old age. CLARA'S ADOPTIVE MOTHER, never seemed to realize Clara grew up; used to nag, rather old-fashioned. Clara claims, however, that she had all she wished for. JUNE'S ADOPTIVE FATHER, warehouse manager, very quiet. JUNE'S ADOPTIVE MOTHER, fairly easy-going, used to entertain more than Clara's mother. June may have been spoiled as a child; she was selfish over sharing her toys with her twin. June had music and dancing lessons, but Clara was not allowed to touch June's piano. Later Clara had lessons herself.

### *Health and Later Environment*

Clara is said to have weighed only 2½ lb. at birth, while June was 6 lb. Clara had much illness up to the age of 7, including double pneumonia, but since then has kept very well except for a throat abscess. Until she was 15 June was under the care of a chest specialist but there was apparently nothing seriously wrong. Menarche occurred at 14½ or 15 in both twins, but information is inconsistent as to who was first. At 16 June had her tonsils out

and at 18 she had an operation for a vaginal cyst. At various times she has complained of fibrositis and dyspepsia. She is a little bigger than Clara.

Clara has worked for 23 years in the same laundry where she is now a charge hand. June has done clerical work and typing for various firms, both before and at various times since her marriage. Whereas Clara is single ('What will be, will be'), June has been married happily to a clerical civil servant since 26 and has a son of 11 and a daughter of 13. Her husband had tuberculosis when the children were small. After sharing a house with in-laws for 10 years they have recently moved out to a middle-class suburb.

### *Test Results*

	<i>June</i>	<i>Clara</i>
Dominoes	23	21
Mill Hill	15	11
Extraversion	15	17
Neuroticism	8	10

### *Personality*

They both look young for their years. When girls they both had ambitions to sing or go on the stage. (June as a child was a member of a dancing troupe that performed for charity. She had her voice trained and liked to sing operetta.) They are rather conventional (especially June, who, for example, expresses verbally a greater willingness to help in the investigation than one would have deduced from her behaviour) and fond of using clichés (especially Clara, who, for example, if she is unwell says she is 'off song'). They both say they are afraid of mice and any fluttering things, fears which they developed independently of one another. They also both claim to have a fiery temper.

Both are very conscious of the difference between them in social class. June, who twice refers to royalty during the interview, compares her background with Clara's 'very humble home' and feels they have little in common. Her lack of strong feeling for her twin has sometimes worried her. Clara on the other hand stresses the similarities, though she wishes she had had more education so that she could have been a typist (i.e., like June). Clara likes to be sociable and generous. She was friendly, talkative and helpful, but perhaps a little over-dressed and anxious to please. June is rather more reserved, talks about the need for privacy, the importance of minding one's own business; she is more concerned about the value of money.

June regards herself as being anxious and worrying. At 13 she developed a fear of sleeping on her own. When living with in-laws she would often feel tense; at one time she consulted her doctor, she felt so restless and fidgety; her dyspepsia she attributes to the worry of having her husband ill at home. Clara says she is not the worrying type. Whereas June spoke about her own illnesses, Clara denied any complaints herself but talked rather of sudden illness which had befallen acquaintances of hers. However she does recall feelings of tenseness when her mother nagged.

### *Comment*

Perhaps neither the similarities nor the differences in this pair go very deep. After having a worse time in the earliest years, June was brought up in a middle-class, Clara in a working-class, home. This has coloured their different attitudes. June has shown some minor symptoms under domestic stress, while Clara has remained single.

### *CASE S f 17, AGE 41*

Separated at birth

Grade II (a)

Paternal uncle

1. JACQUELINE.

. Poorer MHR

Distant cousin of mother 2. BERYL

### *Separation*

At 3 weeks on death of mother, aged 42. Since the grandparents were unable to take the twins, Jacqueline was looked after by a paternal uncle and aunt, Beryl by a distant cousin of the mother, living in different London suburbs. They were brought up to know of their

circumstances but they did not meet until 16 when they visited their father who was in hospital after an accident, and they did not get to know one another well till 18. **UNCLE:** manager of small specialized family business, a believer in everything to schedule, a worrier. **AUNT:** suffers from migraine, apt to be quick-tempered. No other children in the home; Church of England. As a child Jacqueline felt restricted by father's strictness, mother's attacks of migraine during which she was not allowed to play, and the lack of other children. **MATERNAL COUSIN:** came from an Irish background; was gay and 'made us laugh' and was not very strict, but was far from irresponsible. Beryl was brought up nominally as Roman Catholic. No father in the home, less discipline, less money. The adoptive mother's husband who ran an amusement arcade and is described as a ne'er-do-well had already left her with two sons, one of whom was killed in the First World War. Jacqueline was given piano lessons, Beryl not. Jacqueline went to an independent grammar school, Beryl to convent school, then to the elementary school and a business training college. Both left at 16½.

### *Health and Later Environment*

They were originally triplets: the third member of the set, (?) sex, miscarried at 7 months. The twins were born at full term without difficulty; but both were very tiny, Jacqueline being slightly heavier. Both were difficult to feed as babies; Beryl was 3 months in hospital on account of loss of weight soon after being taken by her foster-mother. Both were somewhat delicate as small children. Since then they have had good health. By their twenty-first birthday Beryl was already fatter and is now 1½ stone heavier. Both were given nicknames during adolescence on account of their plump build. Menarche: Jacqueline at 15, Beryl at 16. Both get headaches at the time of their periods.

Jacqueline worked as a shorthand typist, Beryl mostly as a teleprinter operator in a bank. When both working in the City at 18 they got to know each other well. They had a joint twenty-first birthday party at which they wore similar dresses. They became engaged at about the same time. Beryl married at 23 and went with her husband to the north of England. Jacqueline married 2 years later, and during part of the war, when her husband was overseas, she joined Beryl in the north where her eldest child was born. After the war Beryl's family shared Jacqueline's house in London for 18 months. Beryl's husband is a telephone engineer, Jacqueline's a bank official and a little better off. The husbands are thought to be alike in personality—both are calm, good-tempered and active in the Scout movement. Jacqueline's husband had a coronary thrombosis a few years ago. Jacqueline has two normal children. Beryl has had four pregnancies. Her second resulted in a daughter with a hare-lip which was successfully operated on (father's brother had hare-lip). Her last boy (delivered by Caesarean section) died at a few hours from a congenital malformation. The twins are too busy to meet frequently, but they have a long telephone conversation weekly, both still living on the outskirts of London.

### *Test Results*

	<i>Jacqueline</i>	<i>Beryl</i>
Dominoes	38	27
Mill Hill	25	22
Extraversion	13½	15
Neuroticism	7	8

### *Personality*

They look rather young for their years and their build is no longer in keeping with their adolescent nicknames. They were smartly dressed, Beryl being a little more heavily made up and using scent. They had very firm handshakes and were friendly and open in manner. Their voices were alike, becoming rather high-pitched when they got excited; they laughed in the same way. They have a reputation for being talkative and fidgety, though the latter trait was not particularly noted. They both made the same half-thoughtful, half-humorous face before answering questions. They share the same likes and dislikes in clothes, books, films, people and political opinions and have the same sense of humour. They are good cooks and home-makers but no good at needlework. They are efficient and practical organizers and interested in meeting people. Beryl joined the Townswoman's Guild and

after the loss of her son she threw herself actively into this, becoming treasurer of her branch and member of the social studies and rambling sections. Jacqueline heard about the organization from Beryl and became a keen member too. She is chairman of the music section and conducts the choir. Neither suffers from shyness. They have similar educational ambitions for their children, sending them to independent schools. Their greatest failing they consider to be irritability, especially with the children, but these moods are soon over. They have reacted normally to the difficult circumstances they have met with such as Jacqueline's husband's coronary thrombosis and Beryl's daughter's hare-lip. They consider they resemble one another more closely than they do their elder sister. When they first met Beryl had a momentary doubt as to whether she would like Jacqueline who came from a more well-to-do home. In fact the twins have got on excellently, even when sharing homes, and there is no tendency for one to be dominant. Both have minor counting rituals, Beryl counting the number of knives and forks when washing up. Jacqueline shares with her foster-father a step-counting ritual. When once sight-seeing with him they discovered they had both counted the number of steps to the top of a tower. Beryl is more easy-going and has perhaps a quicker wit. She was twice noticed to be singing to herself. Jacqueline is quicker off the mark with jobs and in everyday routine. As a child only Jacqueline bit her nails, until the age of 10, and she has more marked obsessional traits than Beryl. Jacqueline worries more about small things and if her husband is late home even by a few minutes thoughts of possible accidents might come into her mind; she dislikes changing the days on which she does her washing, dusting, etc., at home. Unpunctuality in others she finds most irritating. Beryl advanced the date of her marriage when her fiancé was sent to work in the north; Jacqueline says she could not have done this. Jacqueline's greater caution perhaps also showed itself in her smaller family, her more sparing use of make-up and perhaps in her greater attention to detail when doing the Dominoes. Nevertheless these differences are comparatively minor ones.

#### *Comment*

The nature of the differences in personality is in keeping with the greater rigidity of Jacqueline's early home life. In spite of the completeness of the separation throughout childhood the resemblances are, however, more distinctive than the differences and are particularly marked in gestures, tastes and social life. It would be difficult to explain the likeness solely in terms of mutual influence.

#### *CASE S f 18, AGE 42*

Separated soon after birth

Grade II (b)

Father

2. CHRISTINE . . . Poorer MHR

Paternal aunt

1. NINA

#### *Separation*

At 3 weeks, as their mother was dying. Christine remained with father in a small industrial town in the north and was brought up first by her eldest sister, then aged 20, and from the age of 4 onwards by a stepmother. There were seven other brothers and sisters and a younger half-sister. Nina was brought up by her paternal aunt in a big town about 14 miles away along with a cousin 11 years older. The twins generally spent summer holidays together in each other's homes. They knew all along they were twins, but Nina was taught to call her uncle and aunt Dad and Mum. FATHER: coal merchant and music teacher, rather strict but very jovial. STEPMOTHER: very clean and 'fed us grand', but hard and unpredictable, favoured her own child, quarrelled with most of her step-children when they married—Christine still not on speaking terms with her; congregationalist. UNCLE: loom-tuner, quiet, easily satisfied, left Nina's upbringing to his wife. AUNT: good-natured, sympathetic; Church of England. Christine had a stricter upbringing, but whilst Nina could confide in her parents Christine could not; Christine thinks Nina was spoiled. Nina did not get on well with her cousin. At elementary school Christine was in a class of about 30, Nina in one of 40-50 children.

*Later Environment and Health*

Christine worked as a mill-hand for 11 years but found it tedious. For the past 6 years she has been working in a confectioner's shop. Nina started work in a confectioner's but preferred working in a shoe shop. 3 years ago she and her husband went to work together as flock sorters, but she is not very happy there for personal reasons. The twins married within a month of one another at 22 but without Christine knowing about Nina's marriage. Their husbands have the same Christian name and are both left-handed. Christine's husband is a catering clerk in a hospital, Nina's a factory worker; they are both quiet and precise and get on well together. Nina has children of 19 and 14, but Christine is childless. They still live in the localities where they were brought up and now meet once every 2 or 3 months.

There is no information about their birth except that both were tiny and their mother, age 42, died soon after it from kidney disease. Nina was about 2 inches taller throughout childhood and is now  $1\frac{7}{8}$  in. taller and 1 st. 13 lb. heavier. Menarche occurred at 12 in both. The menopause started 4 years ago with Christine, 2 years ago with Nina. Since 13 Nina has worn spectacles for short sight. She has had good health. Christine was liable to migraine from 15 till 39. From the age of 32 until last year she suffered increasingly severely from asthma (positive reaction on six tests for allergy). A year ago she had swellings of the legs and neck and her asthma was almost continuous. Hospital investigation showed her to have thyroid trouble as well. Since taking iodine both conditions have been relieved. For the past 2 years she has had psoriasis on the left leg.

*Test Results*

	<i>Christine</i>	<i>Nina</i>
Dominoes	26	33
Mill Hill	16	14
Extraversion	18	20
Neuroticism	5	7

*Personality*

When they were children the twins fought when they met and were jealous: Nina was usually boss and remembers knocking Christine's head against the wall. They get on quite well now, though there is no unusually close attachment for sisters. However, they claim that they think alike; for example both decided to have their watches repaired before coming to London, and they have changed their hair styles at the same time and in the same way without discussing it with one another. (When seen, both were wearing their hair closely cropped at the back.)

Similarities are more outstanding than differences. Some of these were already apparent from the manner in which they completed their booklets (independently) and from their high score on extraversion. On interview, in spite of an obvious difference in appearance (Nina being bigger and stronger-looking and wearing glasses) and a tendency to criticize each other, similarities became more and more apparent. As children they were lively with plenty of friends, though Nina was perhaps more of a tomboy. They enjoyed school but were not above average at lessons; they liked needlework best. They are quick in their actions, hard working and energetic. They speak and laugh alike; they are talkative, their husbands complaining they cannot keep a secret. Nina is still a keen skater, and until her illness last year was a keen dancer; but though lacking in shyness they do not belong to any social organizations. They are frank to the point of being over-critical. They are not introspective or of a worrying nature and have a strong dislike of routine and of planning ahead. They remarked they enjoyed themselves taking part in the investigation. Neither is fond of reading.

Their differences in personality are a little difficult to evaluate, as each was more critical of her twin than of herself. Nina is perhaps a little less satisfied; people annoy her more, she is more changeable and has the reputation of being obstinate. She has higher social ambitions. Christine, on the other hand, is more irritable and jumpy—or was so during her years of chronic asthma. Worry and disappointment used to make her asthma worse.

It began soon after she and her husband heard they could not have any children. (He was thought to be infertile.) She considered adopting a child, but her husband was not keen and she dropped the idea. Her attacks of migraine were not brought on by worry. Christine, who was brought up in a musical home, continued playing the piano for longer than Nina, and it is she who likes listening to light music. Nina says she is definitely not religious: Christine would not go so far as to say that.

*Comment*

Family structure and the personality of the parents have had no obvious effect on personality traits in this case; certainly Christine is no harder and has no greater difficulty in making satisfactory personal relationships than Nina who had the more sympathetic 'mother'. However, Nina's early home and her married home were of a slightly lower social class than Christine's and this may possibly account for her thwarted social ambitions. There was a rather greater difference in physical size and health than in most monozygotic twins. It is just possible that nutritional differences during the years before father remarried might have contributed to Christine's smaller build and later poorer health. The differences in health and personality are probably closely related.

*CASE S f 19, AGE 43 (42-44)*

(Berta seen by colleague only)

Separated at 4 years (not met since)

Grade II (b)

Mother

1. HERTA. . . . Poorer MHR

Adopted

2. BERTA

*Separation*

The twins were born in South America. When they were about 4 years old, the father, a Scandinavian ship's carpenter, sold Berta, in order to settle his debts, to a doctor and his wife, the S.'s, who were Spanish speaking but of Scandinavian origin. The father tried to sell Herta too, but she was returned after 2 weeks by a French family. Berta was brought up in the Latin American city where she still lives. Herta lived with her parents at various places in South America, mostly lonely parts of the coast where she had no schooling, until at the age of 9 she returned with her mother to rural Scandinavia, where the father later joined them. Herta had to learn a new language. Berta sensed she was adopted from recurrent dreams she had and from remarks of the servants ('Who does she think she is?'), and was told when she was 11 by Mrs. S., who said, 'Your father was a drunkard and your mother was a bad woman' (the latter was untrue). She was given to understand that her family were all dead. Herta and her family were unable to find out what had happened to Berta, as Mrs. S. at first wrote evasively, hinting she had disappeared, and then returned letters unopened. When the twins were nearly 36, a letter from the father to Mrs. S. was intercepted by Berta, and the twins were soon corresponding in intimate terms. They have not yet succeeded in meeting, but continue to exchange letters and presents. Berta looks after Mrs. S. in her old age but the latter still does not acknowledge Herta's existence. FATHER: left home at 17, travelled extensively, fought in the Boer War, worked in many parts of the world. At the time of the twins' birth was ship's carpenter in a South American port, where, with his wife's help, he ran a seamen's home. Clever at making models of sailing ships in bottles, popular but boastful, given to telling tall stories, hot-tempered, aggressive, unreliable, unfaithful in marriage, alcoholic when young. Lost money in grandiose scheme to salvage sunken treasure and sold Herta on account of his debts of £5,000-6,000. Later divorced by his wife but rejoined her for a while; left her again and later married house-keeper; kept in touch with Herta. Between the ages of 53 and 56 he was four times in hospital with mental illnesses, initially depressed, but mostly hypomanic, boastful, aggressive, jealous of alleged infidelity of his mistress; attempted to escape, threatening to kill her and his wife, made dramatic attempts at suicide by swallowing broken glass, razor blades and a bottle of furniture polish. Then said to have had about three periods of depression with

hallucinations; aged 61–62 again in psychiatric hospitals on two or three occasions (diagnosed hypomania). His letter to Berta's adoptive mother was written in a spirit of self-reproach. Died at 76 of cancer. (Psychopath, manic-depressive.) MOTHER: died at 73, heart trouble; needlewomen, reserved, religious, traditional in outlook: after much indecision and prayer she accepted parting with Berta as God's will. There was a slightly older brother (died at 18 in motor accident) and a sister 18 months younger in the family, the latter reserved, stable with three children in Scandinavia. DR. S. died when Berta was 23, successful go-ahead medical practitioner, affectionate and Berta was very fond of him. MRS. S., now 80, said to look 60, formerly masseuse; active, calculating, jealous of affections of others, rather distant, religious (Lutheran).

### *Later Environment*

Herta started work delivering laundry parcels at 12 before she left school. At 14, on leaving school, she became a nursemaid, soon leaving home. Later she worked in a bakery and as a waitress in the town. At 21 she went to a large city where she eventually ran her own restaurant in which she also entertained as a singer. Her early married life was unhappy. Her first husband, whom she married at 23, was a sadist who nearly strangled her and was also a heavy drinker. She eventually obtained a divorce. At 35 she married a stable R.A.F. sergeant whom she met at the end of the war. He brought her to England where he is now a professional man. She has had no children. Berta went to high school till 16, then studied social science, languages and the piano until her marriage at 22 to a French factory owner in South America, 12 years her senior, and said to be diabetic. He is a Catholic. They have a town house and a country villa. There are no children. Berta has not had to go out to work.

### *Health*

Herta is said to have a deformity of the left foot, Berta the same kind of deformity of the right foot. In their early years Herta is said to have been the more forward and aggressive. As a child Herta came up in a rash after eating strawberries; Berta had urticaria after eating shellfish. Herta had two head injuries, the first at 18 when she was dragged along the street by a runaway horse and may have had concussion, the second at 24 when she was struck by her husband and had hospital treatment for neurotic symptoms [see below]. At 24 she had her appendix removed (no certain pathological changes, according to hospital report). At 31 she had an operation for a myoma, at 32 a subtotal hysterectomy for ovarian cysts, at 36 removal of a cyst from the right breast, at 38 an operation for a cystic mastitis on the left side and yet another local mastectomy at 42. Berta had cystitis at 18, a nasal polypus and tonsillectomy at 24, appendicectomy at 26, at 28 a right ovariectomy, and at 30 she had mastitis (left, operation not necessary; had hormone treatment for this at 42). She also has a recurrent vaginal infection and pain caused by a left ovarian cyst or by adhesions. For 10 years she says she had Ménière's vertigo, following a period of insomnia during which she took a great deal of hypnotics, and also colitis. But these troubles ceased suddenly, though liable to recur in milder form lasting 1–2 days provoked by various circumstances, physical or mental (her account). Then at 39 she had a 'vascular spasm' (low blood pressure, loss of memory and deaf for 3 hours, then aphonia 1 week, facial paralysis and change of voice) with gradual but complete recovery over a year. She also mentions hay fever, tachycardia, hyperthyroidism, neuritis, anaemia, pleurisy, and bladder complications and an injury to her foot.

### *Test Results*

	<i>Herta</i>	<i>Berta</i>
Dominoes	16	28
Mill Hill	8	14
Extraversion	16½	7
Neuroticism	16	14

Since English is the native language of neither twin, the precise significance of the vocabulary and SRQ tests must be doubtful. A score of 16 on the Dominoes seemed an

underestimate of Herta's intelligence. After an interval of almost 2 years she was retested and instructed to work carefully, but increased her score to only 19, still considerably lower than that of her twin who was tested in South America; but when Herta was tested on the Wechsler she obtained a full scale I.Q. of 111 (verbal 106, performance 115) which seemed to be a better estimate.

### *Personality*

Interviews, correspondence, hospital reports and the letters which Berta has sent to Herta give many indications of similarities. These relate to personality development and to traits which are manifest today. Only a few can be illustrated here.

When Berta was removed to the S.'s home she reacted, among other ways, with feeding disturbances. Herta reacted in a similar way when she was sent to the home of the French family, being returned by them because she screamed and took no food. Both twins refer to dim childhood memories of their lives before separation and they recount vivid dreams in childhood. As children Herta was often depressed, Berta changeable. Herta walked in her sleep as a child. Berta certainly did so on three or four occasions as an adult. After hearing she was adopted, Berta made an imaginary life for herself as a dancer and artist. She did, in fact, once appear on the stage in a theatre ballet performance, and she wrote poems for the papers before she was married. Herta, too, had ambitions to perform in public and in fact achieved these when she entertained and sang songs to the accompaniment of her guitar in the restaurant which she ran. Both twins express the wish that there was more scope for this sort of activity in their present lives.

Various similarities were noted in their sexual histories. Both refer, for instance, to ignorance of the facts of life till a late age, their ignorance or fantasies in this direction leading in both of them to unfortunate incidents. They describe similar symptoms of emotionality and headaches as especially liable to occur during the days preceding the period. Both have had a number of gynaecological troubles and neither has had children, though they would have liked them.

They both dress smartly and look young for their age, taking great care of their complexion, their clothes and their figure. One of the first things they did when they corresponded was to exchange measurements, descriptions of their lingerie, samples of cosmetics; and Berta sent some of her own clothes to Herta with the request that she should wear them. Herta has had cosmetic operations to remove moles on her nose and chest. Berta relates with pleasure how, at 38, she was pressed into entering a beach beauty competition and how photographs appeared in the papers, though her husband 'did not like his wife to be taken for a young kid'. Both appear to have traits of a mildly exhibitionist kind.

They are both generous, demonstrative and warm-hearted, with a strong need for affection, and in Berta's opinion 'we are so alike—sentimental, romantic, dreaming all the time'. Though they have never met they have developed an intense affection for one another and derive great emotional satisfaction from their correspondence, which supplies something in their lives which they sometimes feel to be lacking. 'Your letters make me feel warm inside', writes Berta, 'and my heart sings when I hear from you'. Herta replies in similar terms. When Berta sends a letter with a lipstick kiss she presses it warmly against her lips. She longs for her twin so much that it hurts. They send one another generous presents. From childhood Herta was known by the nickname Pussa or Pusser, implying someone affectionate and cuddly like a cat. Berta is sometimes known as Pussy because she purrs like a cat when she is pleased.

They both appear to be naturally gay but liable to fluctuations of mood and to various manifestations of a neurotic kind. At 17, when living away from home with no one to confide in, Herta was kissed by a man and imagined herself pregnant. She was so depressed that she made an attempt to end her life, making it look like an accident. She can laugh at it now but at the time it was very serious. Once in medical hands she was effectively reassured and the depression, which had lasted for 3 months, cleared up. At 24 she was struck on the head by her husband, causing vomiting and possibly some loss of consciousness. A month later she was admitted to hospital for 2½ months, complaining of headaches, dizziness and the feeling that her thoughts disappeared; she felt dyspnoeic, had palpitations of the heart



and said her memory was bad. On the whole she felt well in hospital, though afraid that her husband might harm her again. Diagnosis: commotio cerebri seq. neurosis. Shortly after discharge she was worse again and took an overdose of tablets in order to get some sleep. There have been subsequent attacks of depression, for instance, 7 years later, after a period of further domestic and war-time stress, when she felt miserable for several months. Since coming to England she has had further attacks, usually of short duration and precipitated by small things such as her husband having an unexpected dinner appointment. The longest, following one of her breast operations, lasted up to 3 months. Typical symptoms would be the feeling that everything was in a haze, difficulty getting off to sleep, dreams of murder, tiredness and heaviness in the limbs, difficulty starting any work. She could be distracted but would soon slip back.

Berta says she has almost always felt nervous and has received sedatives and tonics, vitamins and hormones for this tendency. She usually takes to her bed at the time of her period. Her letters make frequent reference to being in bed with some illness or another. Symptoms she has complained of include palpitation, dizziness, headaches, anaemia and many others. She has 'consulted many fine specialists, even written to France with bad luck'. Her sleep is often disturbed and at one time she took a great deal of hypnotics. Her letters indicate changes of mood. 'Felt blue and impatient and thought I was in the way of everyone.' 'I felt sad and nervous all the time, can't sleep well, lost my appetite.' 2 months after the last quotation she writes: 'My good humour and optimism are back again, I feel happy and gay'. Later, 'everything is hopeless' once again. 2 months afterwards, 'I am happy and gay again'. The following month she 'almost had a breakdown', blood examination to exclude anaemia was normal, but weight was only 58 kg. (usually 60 kg.). At other times she will describe her active participation in the entertaining that goes on when a foreign naval vessel pays a call. There are also changes in her attitude to the life she leads. At one time she describes a peaceful, contented, almost idyllic existence. 'I have very little friends—just two or three—and we are happy together . . . I have my dogs and my birds, take my sun-bath every day, so you see a very lazy life. . . . Few parties, thank God.' She looks after husband 'like a little child' and is thankful for all her old adoptive mother has done for her. At other times there are angry outbursts against the dullness of her life—'everyone around her is so calm and calculating, so selfish, so tedious, nothing ever changes, they don't like noise or parties.'

The twins are both of average intelligence and have a fluency in more than one language (they correspond in English which Berta says she does not have an opportunity to speak). Socially they have attractive personalities and lead successful lives; Herta has by her own efforts risen considerably in social level. They have high moral standards. Herta's life in Denmark before and during the Second World War was full of difficulties and temptations, and she came out of it well. It is largely feelings of loyalty to her adoptive family that have held Berta back from meeting her twin.

From the history the following differences emerge. Herta has led a much more eventful life and her psychiatric history, as related above, has probably been more disturbed (severer attacks of depression). She has shown more energy of character. She prides herself on her recuperative powers, while Berta takes more to her bed and appears more concerned about her health generally. Whereas Herta likes hospitals and encourages surgeons to operate, Berta is more afraid. Herta feels that if she were in Berta's position she would have 'blown it' and come to Europe to meet her twin or invited her to South America in spite of the feelings of her relatives there.

#### *Comment*

The case is remarkable for its human interest, the extremity of the geographical and cultural separation of the twins and the very great temperamental similarity between them. In their cyclothymic traits they resemble their father, though neither is psychopathic as he was. Herta and Berta are apparently much more alike than Herta and her slightly younger sister who was brought up with her. Berta's better performance on the intelligence tests could be a reflection of her longer education. Though said to have been the less aggressive twin in their earliest years, Berta's relatively quieter personality and her different reaction to

minor illness can probably be attributed to the more protected life she has led as both child and adult.

### *Postscript*

At the age of 49, on the occasion of Berta's visit to Europe, the twins met for the first time since early childhood. Each says that the image she had of her twin conforms to actuality. Having met, Herta says she now feels more relaxed, Berta says that meeting has made up for years of unhappiness. In general the findings of the above case history were confirmed.

### *CASE S f 20, AGE 45*

Separated at birth

Grade II (b)

Maternal grandmother	2. CHARLOTTE	.	.	Poorer MHR
Mother	1. LAURA			

### *Separation*

At 3 weeks the maternal grandmother, a dominant woman, decided she would look after Charlotte, the younger and weaker twin, as she considered the mother needed help. When other children, four in all, were born to the mother, and the grandmother's youngest son who was 10 years older than Charlotte was killed in the war, the originally temporary arrangement became a permanent one. Laura, who remained with her parents, was breast-fed, Charlotte not. Until they were 6 Charlotte lived in a town in southern England where grandfather was a building contractor; Laura in a village 3 miles away where father was a chauffeur on an estate. For nearly 3 years after this they lived in different towns about 100 miles apart on account of war circumstances. Laura received her early schooling with a few other children from a governess on the estate; Charlotte had ordinary elementary schooling. From just before their ninth birthday they lived as close neighbours in a coastal town, attending the same school until they were 15. They were closely attached and went about a lot together, but they always regarded themselves as belonging to different homes. The GRANDFATHER who had lost money during the war was a building clerk at the docks. FATHER ran a taxi service against strong competition from the bus company. GRANDMOTHER was very strict and somewhat anxious and would not let Charlotte play outside the garden before she was 9. Charlotte came in for earlier training and more severe discipline than Laura. MOTHER was very easy going and there was less emphasis on regular habits in her home, but Laura was encouraged to develop a sense of responsibility and she helped to bring up the younger children.

### *Later Environment and Health*

Laura did office work for 11 years. Charlotte looked after the invalid mother of a friend for 3 years after leaving school; when the invalid died, she joined Laura in her office. 4 years later, on her grandfather's death, instead of going to live with her mother, she decided to be independent and took up mental nursing. Here she met her husband, a Welshman, now a charge nurse at the same hospital, and she married him at 25. Laura had married, 2 years earlier, an Irishman who was a sick berth attendant in the Navy. Since leaving the Navy in 1948 he has been a radiographer. Until then he had been apart from Laura on service overseas for periods totalling  $7\frac{1}{2}$  years. Laura's husband is livelier and has a less serious outlook on life than Charlotte's, and is more interested in his work. He has a car. Charlotte has two sons, Laura no children. The twins live about 10 miles apart and visit each other frequently.

Menarche occurred at about 14 in both, Laura 3 months before Charlotte. Both have a retroverted uterus and have had treatment for subfertility. Their first pregnancies both miscarried. Charlotte had a miscarriage at 5 months in 1939 after kidney trouble. She had toxæmia and pyelitis at the time of her second pregnancy. Both children were born in the transverse position. She was advised to have no further children. In 1943 Laura had kidney trouble and toxæmia during pregnancy and at 5 months developed eclampsia. The pregnancy was terminated and she was able to have no more children. In 1949 she had a total

hysterectomy for a uterine growth and in 1955 she had a lipoma removed from under the arm. Both twins have been treated for anaemia. Charlotte is more prone to rheumatism. Laura is a little bigger.

### *Test Results*

	<i>Charlotte</i>	<i>Laura</i>
Dominoes	25	27
Mill Hill	17	20
Extraversion	12	12
Neuroticism	11	10

### *Personality*

Test results and personal impression agree in suggesting a strong resemblance. They are friendly people, liking to crack a joke, and determined not to give in in spite of getting tired rather easily. Charlotte quotes with approval her grandmother's maxim that there is no such word as can't in her dictionary and she admires Laura's plucky reaction to her recent ill health. Laura says her mother said that if she could not leave her any money she would leave her a sense of responsibility. She says, 'Experience has been a teacher'; over the years it has taught her not to give up and that there is always a way round difficulties. Both refer more than once to their growing older. They both pass remarks to the effect that mothers give in to their children too easily these days, though Charlotte herself finds it difficult not to be too soft-hearted. They are home-loving and take an active part in painting and decorating the house. They have a particular love of nature and flowers. Charlotte has been able to gather sixty different varieties of wild flowers for a show and knows where to find white heather. She has won first prize for flower arranging and helps at the local hospital by decorating the wards with flowers. Laura is knowledgeable about the names of trees and plants and her husband thinks she is mad the way she will wade through muddy water to inspect an interesting specimen. Charlotte likes to go cycling and swimming with her children. Laura used to be fond of dancing and swimming and as a child would go for long walks. Recently she has had to lead a less active life, but was soon out working in the garden again after her last operation. The twins have a strong mutual sympathy for one another.

In their relations in childhood and to a lesser extent since then, Laura has tended to take the lead. Charlotte was a more timid child and 'just had not that extra push'. She used to vomit whenever there was an air raid in the First World War. At the sound of the first air raid siren in 1939 she did so again, but not after that. At school Laura used to be top of the class, and was in a higher class for arithmetic—Charlotte came fourth because, she thinks, she was more nervous. Laura is still the more placid. Charlotte was more talkative. She liked to bring the conversation round to her children—their health, their interest, their intelligence; 'They make you life', she says. On account of the children and her husband's irregular hours and quieter nature she has fewer interests outside the home; but Laura prefers a quiet holiday, while Charlotte likes a rowdier one with the children. Laura would very much have liked children of her own. Since knowing she could not have them has been less interested in the sexual side of marriage. She is fond of Charlotte's boys (as a baby one of them mistook Laura for Charlotte and plucked at her blouse to be fed). When her husband was abroad she felt she was in danger of becoming too introspective, so she took up welfare work 'to take me out of myself' and enjoyed doing voluntary work at a local infant welfare clinic. She still does this 2 days a week. She liked it particularly when she used to visit a squatters' camp where she says many of the children were unwanted. She tried to make the clinic a home from home for them, bringing toys, arranging flowers and organizing parties. Since her operation she has complained of a lack of energy and has had to adjust her life accordingly. She looked tired. Unlike Charlotte, Laura is a non-smoker and does not take sugar in her tea.

### *Comment*

Laura's lack of children and her recent ill health would seem to account adequately for some of the differences. It is possible, however, that Charlotte's more rigid upbringing by a

rather dominant and anxious grandmother has made her a little more anxious than her twin. Charlotte was the weaker twin at birth.

*CASE S f 21, AGE 47*

Separated from birth to 12 years

Grade I

Maternal grandmother	? Birth	} MARY . . . Poorer MHR
Mother	order	

*Separation*

Mother 'had never been strong' and for this reason the twins were parted within a week of birth. Mary, the stronger and heavier, remained in the country village with the maternal grandparents. The parents went, taking Nancy with them, to the home of the paternal grandparents in a distant coastal town. They first met again, aged about 8, when their father was called up: he wanted a photograph of the twins together. From then on they met in the coastal town for 1 week each August. Neither has any recollection of these early meetings. At 12, for reasons which are not clear, Mary joined Nancy in the town where they attended the same school. Until then Mary had attended the village school, while Nancy went to a private school. 9 months later the maternal grandparents decided that mother should bring both children home and they have lived in the same country village ever since. MATERNAL GRANDFATHER: paper mill worker; for most of twins' childhood lived on compensation for factory accident and became very deaf; Mary was the apple of his eye; very quiet. MATERNAL GRANDMOTHER: described as a hard type but would comfort the children when they needed it; everything had to be just so; believed in going to chapel three times on Sundays. FATHER: gardener; very good, practical and placid; had recurrent malaria. MOTHER: uncertain whether she had mental illness in early life, but for as long as the twins can remember would do very little housework, was difficult to get on with, never kept any friends because she would abuse them. At 65 was first admitted to mental hospital following a confusional episode which was regarded as part of a dementia with some organic impairment (? presenile dementia); history of selfishness and destructiveness which had gone on since the twins were children; has remained in hospital or after-care homes for past 5 years. When in the coastal town the twins lived with their mother in the home of their paternal grandparents: grandfather kept a general store, very strong chapel man; grandmother, a 'lovely' person. This home was a little better off financially than the country home. The twins have a sister 13 years younger, unlike them and 'very go-ahead'.

*Later Environment and Health*

After working as tambour beaders the twins married a pair of friends in the village at the age of 25. Whereas Mary's husband is a go-ahead fruit grower, Nancy's is content to work as a chair polisher and a week-end groundsman; at one time he was employed by Mary's husband. Mary has two daughters and a son, Nancy has one daughter. Both have happy domestic lives. Menarche occurred within a few months of one another at 14, Mary first. Mary was once off work for 6 months with rheumatism. Nancy had a premature menopause at 36. Otherwise they had fairly good health until they both developed slight hypertension 2 or 3 years ago. 9 months ago Nancy had carcinoma of the breast, followed by mastectomy and radiation treatment. Mary is left-handed.

*Test Results*

	<i>Mary</i>	<i>Nancy</i>
Dominoes	32	28
Mill Hill	13	17
Extraversion*	3 (2)	3 (2)
Neuroticism*	13 (12)	14 (11)

\* In brackets, scores on retest after interval of 29 months. (Collusion suspected on first attempt, 37/38 identical responses.)

*Personality*

When they were first reunited at 12 they were 'strangers to one another' and a cousin with whom Mary had been close friends may have resented Nancy's arrival. Soon the twins became very close. At school they would tie for first or second place in the class. Before marriage they went to work together in a small factory. They live a stone's throw from one another now. On account of their quiet disposition, their close relationship to one another and their dislike of sex relations, their husbands jokingly say they have married 'only one good one between them'. If one does not collect the other to do their shopping together at 9.0 a.m. there must be something wrong. (The husbands see they get the same amount of spending money each.) They are mutually dependent. Neither twin dominates the other, though at first Nancy used to handle the money; she was more used to it. They have strong chapel interests and like knitting and watching television. In spite of their background neither has taken any interest in gardening. They say they have the same taste in clothes and have bought the same kind of hat from different counters of the same shop. When filling in the questionnaire it was noticed that they hesitated over the same items and both laughed at the question about saying 'no' to a salesman (they can't). They describe their personalities in very similar terms and prefer to talk about 'we' rather than 'I'. They probably underestimate their abilities, like to keep in the background, enjoy a 'simple way of life . . . anything so long as it is peaceful'. They are sensitive to criticism ('remarks cut deep') but say they never show—or even feel—anger and are too placid to worry unduly.

Differences were minimal. Mary was perhaps a trifle more forthcoming. When Nancy was in hospital 9 months ago for a breast operation, Mary was very upset, lost 1½ stone in weight (since regained), cried all the time, 'thought the end of the world was coming', could not sleep without sedatives. She wondered how she could manage if Nancy did not get better. She was her usual self again as soon as Nancy's treatment was finished within 2 months. She has not worried about her own health. Nancy has not regained her weight since her operation, has some sleeping difficulties and tires easily, but does not appear to have been so distressed. Only Mary says she has ever wondered whether her relationship with her twin was too close.

*Comment*

Mary and Nancy seem to be by nature extremely placid and introverted personalities, lacking in drive. This has encouraged their remarkably close relationship which has made their later lives almost indistinguishable. The only real difference is the very understandable reactive depression which Mary had when Nancy was ill. The quite different circumstances of their lives up till the age of 12 and the occupational and other differences between their respective husbands do not appear in this case to have had any effect on the personalities of the twins.

*CASE S f 22, AGE 48*

Separated at about 2½ years

Grade I

Adopted

1. OLWEN

Adopted

2. GWLADYS . . . Poorer MHR

*Separation*

They are illegitimate children with no certain knowledge of their parentage. They were adopted by unrelated quarrymen with the same surname and of about the same age from the same county in North Wales. Gwladys was taken first, probably not long before Olwen who was adopted at 3. OLWEN'S 'FATHER': very kind and quiet. OLWEN'S 'MOTHER': not very strong, when well jolly, when ill very worrying; quite strict. 2 years older than Gwladys's 'mother'. Olwen's parents adopted a niece 7 years younger than Olwen. GWLADYS' 'FATHER': 'very, very strict, he kept you down'. GWLADYS' 'MOTHER': also strict, but not excessively so. They had two sons of their own, 8 and 16 years younger than Gwladys. In both cases the twins were jealous of their younger foster sibs. At 4 or 5 Gwladys' family moved to Lancashire and at 13 from there to South Wales. Olwen's family perhaps set

greater store by education, sending her to grammar school, where she had 2 years more schooling than Gwladys but she couldn't keep up with the work. Gwladys left school at 13. On leaving school both had to work in domestic service. Olwen had wanted to be a nurse, Gwladys a ship's stewardess. Olwen was told she was adopted and had a twin when she married at 21. From her early teens she knew she had a 'cousin' who looked just like her. Gwladys returned to North Wales at 23 and was here sometimes mistaken for Olwen. She denies knowing she was a twin until a year after this when their first meeting was arranged, but it is likely that she had some idea, especially when working in a chip shop belonging to an aunt, who knew the whole story. When in this shop she was seen by a small cousin of Olwen's who mistook her for Olwen, and it was this that led to the twins' meeting at Olwen's home when they were 24.

### *Later Environment and Health*

Within 6 months of meeting they were living together in the small village where Olwen lived. Here Gwladys met her husband, marrying him 2 months after going there. The twins and their husbands successfully shared a house for 5 years. Then Olwen and her husband left to look after her parents in England. During the Second World War, Olwen returned to her county town and became caretaker of a youth club, while Gwladys was in England with her foster-mother. After the war, at the age of 40, they were again living fairly near one another, Olwen in the county town, Gwladys in the village 14 miles away. They meet regularly, often spending weekends together. Olwen married at 21, Gwladys at 25. Olwen's husband is a supervisor in a factory, Gwladys' a charge hand in a mill and probably a duller man than Olwen's husband. Olwen had a healthy daughter 28 years ago, followed by a miscarriage 2 years later. Gwladys had a miscarriage 21 years ago and 12 years ago she successfully adopted a baby girl. Neither complains of family difficulties. Gwladys works on the domestic staff of a holiday camp during the summer season. Olwen does not now go out to work, having had a major operation 2 years ago.

Olwen is known to have been backward in early development. There is no information on this point about Gwladys. Both twins had fits, stated to be epileptic. It is known that Gwladys had fits at 3 and Olwen had convulsions at 10, a spell of unconsciousness attributed to sunstroke at 15 and a nocturnal fit in which she bit her tongue at 16. Both are very restless sleepers, and both complain of headaches and biliousness on account of which they are unable to travel long distances. These attacks, which she calls migraine, were severe in Gwladys until 10 years ago. Menarche: Olwen at 12, Gwladys not until 15 or 16. Gwladys has recently reached the menopause; Olwen has had no periods since her operation at 46 on her appendix, colon and cyst on womb. Gwladys had her appendix removed aged 24. Both have had treatment for anaemia; Gwladys' haemoglobin is at present 73 per cent., Olwen's 100 per cent. Both have had attacks of rheumatism which have invalidated them for 3 months. Olwen is a little bigger.

### *Test Results*

	<i>Olwen</i>	<i>Gwladys</i>
Dominoes	4	2
Mill Hill	13	7
Extraversion*	10 (12)	10 (8½)
Neuroticism*	12 (14)	12 (13½)
Sutton booklet	85	76

\* Scores on retest in brackets: collusion suspected on original completion of test (identical responses).

Both twins are naturally Welsh speaking, but this does not explain their low score on the Dominoes which is in keeping with the impression on interview of low intelligence. Olwen's higher vocabulary score is in keeping with her longer full-time education and with her more stimulating adult environment: her husband is quite intelligent and she dealt with

correspondence in English when working at the youth club. On the Sutton booklet test of neuroticism both have quite a neurotic score, Gwladys the slightly more so.

### *Personality*

'They are too much alike', says Olwen's husband. 'They think and say the same things'. When seen, they were very similar in expression and gesture. Their eyes had an almost wild or scared look about them, darting from place to place. From time to time they catch each other's eyes and start giggling. They say they do this because they know the same idea is striking them both. Their hands frequently went to their mouths in a tense, finger-biting gesture. In movements they were inclined to be awkward and held their fingers very stiffly for finger-printing. At times they seemed to lose interest and appeared tired or bored, Gwladys sighing more than once; then they livened up again.

The twins were friendly and hospitable. After giving instructions by letter how to reach her cottage, Olwen wrote, 'Let us know if you prefer us to meet you, we can do that too you know'. On arrival I was treated to a high tea after my journey. After the interview and subsequent correspondence arranging blood grouping, etc., I had a letter from Olwen inquiring if I was tired after my journey to Wales and asking if my visit would mean the twins would appear on television. 'I suppose you do not mind my asking these things? Since I have met you I seem more homely to inquire about things', she remarks. Gwladys wrote asking after my health and thanking me for my 'utmost Attention towards us Both'. In spite of this friendliness I do not feel that I got to know the twins well. Efforts to get them to describe their personality or even their everyday life met with little response. Their answers were sometimes beside the point, or they lost spontaneity or burst out giggling. This may have been partly due to dull intelligence and suspicion of the stranger (I expect there was a great flow of language between the twins as soon as I left). However, they did describe themselves as not making friends easily with others (or not straight away) and say they do not mix much socially. Olwen's husband says they are normally rather quiet but can get excited, for example, at a party. He says the twins seemed just as like one another in character when they first met as they do now, and does not think their characters have changed with the years or with their influence on one another. In the Normal Personality Traits section of the booklet both double-underline: reserved, sensitive, impulsive. Other shared traits that emerge from the general picture are: poor eaters and sleepers, quiet, serious but not gloomy; apt to be excited; few interests.

Linked with these similarities is the close relationship which exists between the twins, together with their claims of the following three instances of telepathic-like experience. These all date from the period between Gwladys' return to North Wales and the twins' setting up house together. During this time the twins might have seen one another without realizing it. Olwen's husband had seen Gwladys in Woolworths and his 14-month old daughter had mistaken her for her mother.

About a year before the twins met, Olwen said she dreamed she had a twin working in an hotel in a nearby town. Her husband said 'Don't believe dreams'; but it transpired that Gwladys was in fact working there at the time (the possibility that an acquaintance had told Olwen that she had seen her double cannot be excluded). 4 months before they met, Gwladys had her appendix out. When coming round after the anaesthetic she 'saw' her twin standing by her bed. 3 months after they met, Gwladys was going on a joyride with a boy friend when the car skidded and overturned on a bridge throwing her out into a field. All that night Olwen says she was restless, 'I can't sleep, something is happening'. The next day she read the news of Gwladys' accident in the paper.

No other similar experiences are reported. However, on completing their booklets the twins were found, apart from other similarities, to have given identical answers to all thirty-eight items of the Self-Rating Questionnaire and to forty-six out of fifty pairs of words under Normal Personality Traits. They strongly denied collusion and Olwen's husband is of the opinion that they completed the booklets in their own homes although they were posted by one of the twins at the same time. After the interview they were sent by post slightly differently typed versions of the Sutton booklet with the various sections rearranged, and the Self-Rating Questionnaire inserted at different places in the two books. They were

asked to complete this on their own and there is no reason to suspect collusion. This time twenty-nine out of thirty-eight Self-Rating responses were identical. In the Sutton booklet they marked 289 out of 381 items the same (76 per cent.), being consistently similar in all eight sections.

Olwen relates how, after hearing at marriage she had a twin, she used to look at every girl she passed in case she should be her longed-for twin sister. The suspense between hearing that Gwladys had been located and her first meeting a month later was more than she would like to endure again. The twins claim always to have agreed perfectly. At first Olwen regarded herself as superior because she had been married longer, but Gwladys denies she lets her dominate her. However, during the interview in Olwen's house Gwladys sometimes deferred to her if she did not grasp the meaning or was not sure of the answer to her question, and she let Olwen do most of the talking. They take particular pleasure in being together and at 48 they dress alike when going out together. In each other's company they become absorbed in their secrets and they giggle a lot which they do not do otherwise. Some weekends Olwen's husband stays with friends, leaving his home to the twins. Gwladys hopes shortly to move to the town to be nearer to Olwen and also because it is livelier than in the village.

Differences in personality are probably minimal. 'Gwladys can be livelier', says Olwen's husband. She herself admits she is hastier in speaking her mind than Olwen but does not wish to enlarge on this. She talks of the great number of different jobs she has had. In keeping with this greater impulsiveness Gwladys was quicker and less accurate than Olwen in doing her Dominoes test. Olwen is more literate—she reads more and there are more books in her home; their handwriting is alike with unevenly formed letters, but Gwladys' is less tidy and she is more haphazard in the use of capital letters and punctuation.

#### *Comment*

This pair is one of the latest to have been reunited—not till the age of 24; the resemblance is among the most striking. Their common Welsh culture may play a part in this and, no doubt, there is an understandable hysterical exaggeration in the closeness of their relationship and claims of telepathy. Physical causes may also contribute to the likeness—note the history of backwardness and fits and their liability to headaches, travel sickness, rheumatism and anaemia. Underlying it all is their genetical identity.

#### *CASE S f 23, AGE 48*

Separated at 6 weeks

Grade IV

Paternal grandmother

1. ANNIE

Mother

2. TRIXIE

. . . Poorer MHR

#### *Separation*

At 6 weeks, when the mother had a minor illness, the paternal grandmother looked after the twins. The mother was soon better but the grandmother returned only Trixie, the smaller baby, to her, keeping Annie herself. The separation, intended at first to be temporary, proved permanent, as the father did not like to ask for Annie back. The grandmother lived with three spinster aunts and a bachelor uncle who felt Annie gave grandmother something to do. The grandmother, then 73, wanted to keep Annie until she died. That was not till 13 years later when Annie herself decided to remain with her aunts rather than return to her mother who had always wanted her back but, according to Trixie, had had her face slapped by the aunts for suggesting such a thing. The twins were brought up a mile apart in a north-country village where the grandmother lived on a farm and the father ran a smallholding owned by his mother. Trixie was brought up along with two older sisters, Annie as an only child. They went to the same school. On leaving school at 14, Annie worked in the village, Trixie in the nearby town; they might not meet for weeks. FATHER: smallholder, later provisions roundsman, working in a shop owned by his mother and managed by his sister; said to be pleasant, over-dependent on his mother but master in his own home. MOTHER: 'too soft and would rather give than take'. GRANDMOTHER: selfish but devoted to



Annie. The uncle was well disposed towards Annie and very jovial. The aunts were unexceptional personalities and interested in village affairs, the parents being more interested in the town. Annie's upbringing is said to have been more old-fashioned—she was checked for giggling and made to sit still.

#### *Later Environment and Health*

After working at dressmaking, Annie in the village, Trixie in the town where she eventually lived, Annie married a paper-hanger at 23 (he is asthmatic) and Trixie a garage labourer at 26. Trixie's husband is 'deadly quiet' and mean with his money and they are not very happy; they have arguments over their only son. Annie's husband is livelier—'it was a true love-match and therefore a happy married life', says Annie; they have a son and a daughter. The twins' doctor, however, is of the opinion that they married similar husbands, asthenic and rather immature characters. For the past 4 years Trixie has been working in an ordnance factory. 4 years ago Annie left the district in the interests of her husband's health, and misses old friends. Until then she had been living in the house in which she was brought up, looking after her elderly and latterly rather difficult aunts until they died.

At birth Trixie was so small 'you could put her in a pint pot'. Annie was always the bigger and at present she is an inch taller and over 3 stone heavier. As a child only Trixie had scarlet fever and an operation for swollen glands in the neck. At 21 Annie had tonsillitis followed by some heart trouble and at 31 a bad attack of influenza which left her weak and liable to feelings of anxiety for a while. Both twins complain of over-acidity. At 25 Trixie had an illness in which she had double vision and loss of power in the arms. For the past year she has complained of jumpy feelings in the legs. On interview her speech was indistinct. A report from her doctor stated that she had disseminated sclerosis and subsequent correspondence indicated that it was getting worse. Menarche at 13, Annie first by 2 or 3 months. Trixie is at present passing through the menopause; Annie's periods are still regular.

#### *Test Results*

	<i>Annie</i>	<i>Trixie</i>
Dominoes	19	9
Mill Hill	12	6
Extraversion	12½	11
Neuroticism	12	14½

Retested on SRQ after 28 months (to observe possible change in Trixie):

Extraversion	12	7½
Neuroticism	9	14½
Sutton booklet	91	76 (i.e., Trixie more neurotic)
(test of neuroticism)		

#### *Personality*

Annie is a warm-hearted, sociable, rather sentimental person. She is very devoted to her family and sets great store on anniversaries, funerals, etc. She calls everyone 'Love'. She is proud of herself for the way she has looked after her old people, her husband, her children. 'I don't think there is anyone else who has done it so successfully. We have come through happy and I would choose the same life over again if need be.' Interests include gardening, dancing, dramatics, clothes, animals. She tells how the twins once met, each carrying a cat in her arms. They have also bought the same presents for each other independently. At school she was bigger than Trixie, a little higher up the class and used to fight her battles for her. As a small child she can just remember being frightened at having to wear an eye-shade and being afraid of going out of the house or meeting people. Apart from vague feelings of anxiety when recuperating from influenza she can recall no other nervous troubles.

There was probably a basic similarity in traits of an extraverted and sentimental kind and in interests such as clothes, dancing and animals. However, Trixie has always (according to Annie) been jealous, excitable and difficult—'it gets on my nerves'. She thinks it is because she (Annie) always had a better home. It is more likely that these differences date from the

onset of Trixie's disseminated sclerosis; in the opinion of the doctor who knows them both they were very much alike temperamentally before Trixie's illness. The difference in behaviour is very marked now. (A limp handshake was one of the few similarities noted.) Trixie left much of her booklet uncompleted. Asked what her husband's occupation was she said: 'What's that to do with it? He's not a twin.' Her failure to answer most questions in the booklet to do with sociability she explained by saying 'There is a time and a place for everything' (interview indicated difficulties in social relations). At one moment reserved and suspicious ('What's it all in aid of?' repeated after many explanations), the next moment she is talkative, sentimental and 'familiar' (criticizing the cut of my suit, saying 'naughty' when I drop a key she hands me), offering to pray for me, hinting that other men have been interested in her. She objects to most of the tests, but does them, making many excuses for herself. Refusing morning coffee because she 'hadn't time', she stayed to lunch. She argued openly with Annie over old family scores and other matters. Annie wrote apologizing for Trixie's behaviour; she says she is always contradicting herself.

### *Comment*

The big qualitative difference (Grade IV) is almost certainly due principally to Trixie's disseminated sclerosis. On purely psychogenic grounds one might have expected Annie, brought up as a play-thing to keep the grandmother happy when her mother wanted her back, might have turned out the more disturbed personality. However, she has had the advantage of a robuster physical constitution and a happier domestic life.

### *CASE S f 24, AGE 50*

(Both twins sent their names in independently)

Separated from birth to 5 years		Grade II (b)
Paternal grandmother	1. JOANNA	Poorer MHR
Mother	2. ISOBEL	

### *Separation*

From a few weeks until 5 years and again at 17. Isobel remained with mother in an industrial town where the father was Baptist minister. Joanna, the bigger and stronger twin, was taken by the paternal grandmother and her second husband, a wool merchant in the country, the mother's health and her duties as minister's wife making it difficult for her to bring up both twins. The grandfather is described as a poet and dreamer. Both homes were strict (particularly that of the grandparents) and highly religious and in neither were there other children. After reunion in the parental home the twins went to private schools together until at 17 Joanna took an arts course at a provincial university, Isobel a domestic science training in London.

### *Later Environment and Health*

They both married non-conformist ministers, Isobel at 23, Joanna at 24, since when they have met on an average two or three times a year. Joanna married a steady practical husband while Isobel married a more imaginative man. Isobel's husband was injured in the First World War, has heart disease and is unable to work full-time. They have two children; Joanna has one. Isobel has had to keep on a full-time job, while Joanna has been freer to devote herself to outside activities [see under Personality]. On account of their husbands' careers both have lived in many different parts of the country. A year ago Isobel and husband volunteered to live in one of the New Towns.

Neither twin has had serious illness. Both have suffered from urticaria, possibly connected with emotional disturbance. Joanna's symptoms first occurred after her engagement which she felt had pushed her twin into the arms of the first man who came along—her father's curate—whom she married rather suddenly and against family opposition. Isobel had urticaria during the Second World War when her husband was in hospital 70 miles away and she was running a home and doing a responsible job as well as visiting him twice a week. She suffers

from it more frequently than does Joanna. 2 years ago Isobel felt tired and had to give up her job—a strenuous one. Her doctor put her on a 2-year course of amylobarbitone and dextro-amphetamine. Joanna has been over-weight and is now taking (?) dextroamphetamine.

### Test Results

	<i>Joanna</i>	<i>Isobel</i>
Dominoes	41	40
Mill Hill	27	28
Extraversion	13	18½
Neuroticism	10	1
Rated by twin		
Extraversion	15½	18
Neuroticism	6½	4½

### Personality

Both twins are of superior intelligence. They are devoted to teaching, fond of writing and organizing ('We both find it hard not to organize whatever society we find ourselves in.'—Joanna), quick workers and women of decided views who do not always see eye to eye. Both have maintained their strong family religious traditions. Their liability to urticaria under emotional stress has already been mentioned.

While Joanna has been senior English mistress in girls' public schools, Isobel has returned to domestic science teaching since giving up more responsible posts of an organizing kind in the county education offices or for a government department. These posts involved the writing of pamphlets publicizing new services. Joanna has been in demand as a public speaker in bodies such as the League of Nations Union, the Townswomen's Guild and a women's church council of which she says she was offered the national chairmanship. She has done free-lance journalism, much of it for religious publications. The twins exchange long letters with one another weekly, and Isobel writes a regular account of her doings to her children, one of whom receives a carbon copy. They both saw the television programme on twins and, living in different parts of the country at the time, both at once wrote, quite independently, long and informative accounts of themselves to the B.B.C. instead of merely answering the questionnaire in the *Radio Times*. They were surprised to be reminded at the interview of the details they had given in their letters and the booklets. They were glad of the opportunity which the investigation gave them of meeting once again, but when together they usually contradicted one another. While Isobel's extraversion score is very high, Joanna impresses one as being almost equally extraverted and perhaps more managing. Both make remarks such as, 'I am very shy but never show it'.

Isobel has tended to be the more practical, Joanna the more idealistic. Isobel usually took the lead in childhood and she showed more interest in the Girl Guides. As already noted, Isobel studied domestic science, Joanna arts. More of Joanna's energies go into religious work. She has written instructional articles for teachers in Sunday School journals and has had published a biography of a religious leader which she wrote for children. She speaks enthusiastically about her activities but in rather a down-to-earth manner—'Religious stuff, uplift, you know'.

In contrast to her husband ('a sane Englishman') Joanna regards herself as 'a temperamental Celt'. She seemed less composed than her sister and is apt to get more excited in an emergency. She made an appointment for a joint interview without consulting Isobel and later tried to cancel it. She was critical of others in a way not observed in Isobel, referring, for instance, to a maidservant's tactless remark, a doctor's inefficient tonsils operation and the poor construction of the Synonyms test. She thinks her parents subconsciously favoured her twin whom they had always looked after and whom, she says, they regarded as delicate. (This was denied by Isobel who, on the other hand, remarked that whenever they visited their grandparents she noticed that THEY always favoured Joanna.) Joanna lays more stress on their twinship. She claims to have had severe abdominal pains at night a few hours after Isobel had had an emergency operation for appendicitis in another town. Isobel is sceptical of this and has had no such experiences herself. Joanna's writings sometimes add a touch of

imagination to fact. She once wrote an article entitled *When You're a Twin* in which she claimed that they both had telepathic-like experiences. She also wrote that when her twin was ill with scarlet fever she failed to catch the germ; in fact, as Isobel points out, it was Joanna who had scarlet fever and Isobel who escaped. Isobel is of the opinion that for Joanna any possessions or even experiences of her twin belong equally to her. Joanna took it for granted that it was in order for her to sign for Isobel's travelling expenses in connection with the research. A much more striking example occurred a year ago when Isobel moved house and Joanna, who lived in another part of the country, paid her a visit. Soon afterwards Isobel was surprised to read an article in a local paper entitled, *We Moved to a New Town*. This was illustrated by a photograph of her house and contained opinions which her friends recognized as hers. She took the matter up with the editor and threatened legal action, only to discover that the article had been by Joanna. When the editor had queried the manuscript (sent from town Y) as a *bona fide* description, Joanna replied, 'My sister and I have moved to X (the New Town). I have only returned to Y to settle my affairs. Shall rejoin her.' The incident has blown over but for a time it caused acute embarrassment.

### Comment

Marked though the basic similarity is, there are important and interesting differences. It is possible to argue that the return of Joanna at the age of 5 from the grandparents' home to that of the parents and twin sister was an experience of critical importance for her. Any real or imagined tendency of the parents to favour Isobel, whom they understood better, could well have encouraged paranoid traits and, in a personality like hers, have led to a compensating tendency in Joanna for her to regard her twin's experiences as her own. Their differing university trainings and domestic lives must also be given weight in explaining Isobel's more practical and realistic attitudes.

### CASE S f 25, AGE 51

Separated from birth to 12 years

Grade II (a)

Maternal grandmother 2. ODETTE

Mother 1. FANNY . . . . . Poorer MHR

### Separation

At 6 weeks the maternal grandmother took Odette, who was a little stronger, to the country. The mother, being asthmatic, could not manage both twins, but kept Fanny with her in the London area. At 2½ Fanny sustained severe burns and on return from hospital at 3 she went to the grandparents in the country for the winter months in the interests of her health, Odette returning to the parents. Every 6 months the twins changed homes in this way, but spent summer holidays together in the country, until they were 8. From that age until 12 Odette was once again permanently with the grandparents. At 12 the father decided the twins should now be together and that Odette would be able to help her mother at home. They remained in the same home until after they left school. No parental favouritism is reported, but Fanny was protected and restricted more because of her burns. GRANDFATHER: schoolmaster, chairman of local council in the west country, choirmaster, freemason; got on well with Odette whom he liked to coach in mental arithmetic during walks in the country; inclined to be impatient and particular. GRANDMOTHER was already totally blind from cataract when she took Odette, but was well aware of all that went on and liked to go out to social functions with her husband. Odette was cared for by a housekeeper when a baby. There were no other children in the home. There was a strong religious background (Methodist); pictures and theatres not allowed, but otherwise Odette was 'absolutely spoilt by doting grandparents. . . . I had everything I desired'. Financially the grandparents were better off than the parents. FATHER: carpenter, later master builder, very strict, 'his word was law', lived for chapel and his work; at 47 had depressive illness lasting for 2 years, not in hospital. MOTHER: chronic asthmatic, rather better after moving to another town, also in the London area; sociable, musical, rather dependent on husband. There is a sister 2 years younger than the twins and a brother 9 years younger whom Fanny

and later Odette helped to bring up. The parents' home was equally religious, but 'we had a strict upbringing', says Fanny, 'in a working-class home where money was precious'. On account of father's work and mother's health, the parents moved house seventeen times during the first 10 years of the twins' life.

#### *Health and Later Environment*

Both were very tiny at birth. At 2½ Fanny was badly burned on the face and left arm and while in hospital for this had scarlet fever. Later she had any childhood illness that was going, while Odette had almost none until she was 17. On account of her burns Fanny was not allowed to play games or go swimming. Both have had very good health in adult life. Menarche: Odette at 12, Fanny at 13. Menopause: Odette at 45, Fanny at 46.

On leaving school they took a training for the clerical branch of the Civil Service. Odette just passed, Fanny barely failed the examination. Odette started as a Civil Service telegraphist but could not stand the pace, especially when recuperating from scarlet fever at 17. She left the Civil Service and 4 years later started her general nursing and midwifery training. She had decided to take up nursing when in hospital herself with scarlet fever. Till her marriage at 29 she worked as a district nurse in the county in which she was brought up, travelling around by motor cycle; she knew and was known in many homes. Since marriage she has devoted herself to voluntary Red Cross work. Fanny went in for office work. For the past 28 years she has been with the same large firm of electrical instrument makers where she is senior wages clerk in charge of a department of sixteen. It is routine work but she does not mind that; it brings her in contact with many people which she likes.

Both twins have married widowers. Odette's husband is 20 years her senior, headmaster of a secondary school, now retired and a local magistrate. Odette's step-children were a medical student of 19 and a schoolgirl of 14 when she married. She has a daughter of her own who is now at a teachers' training college. Fanny did not marry till 43. Her husband is 11 years older. The younger of two stepsons was then 21. Fanny has no children of her own though she would have liked a girl. Her husband was for years a poultry salesman in a large meat market, but now works as stores clerk with Fanny's firm. The twins' husbands, although so different in background, get on well together—'They both enjoy a bit of fun', and they are both freemasons. Fanny continues to work, as her husband does not get a pension when he retires. Odette and Fanny correspond four or five times a year and meet once or twice a year.

#### *Test Results*

	<i>Odette</i>	<i>Fanny</i>
Dominoes	38	40
Mill Hill	21	17
Extraversion	13½	15
Neuroticism	4	8

#### *Personality*

As a child and young woman Fanny was sensitive but not unduly so, about the disfigurement caused by her burns. It is not known how the twins reacted to their changes of home before the age of 8. They did not miss one another when parted after holidays together. When reunited at 12 they did not get on well at first. Fanny was probably jealous, while Odette had some difficulty fitting into the larger family where more was expected of her; she used to retire to her room if visitors arrived. From the age of 15 they got on much better. Neither took the lead. They did well at elementary school. It was regarded as a disgrace if either of them came as low as fourth. Both were good at arithmetic. In spite of being brought up apart they consider themselves temperamentally more like each other than like their sister or brother—more free and easy and more independent; 'We make our own way'. They feel closer to one another and 'our conversation mingles better'. Odette's husband, who was seen briefly, thinks they are alike in being not easily upset; 'they know their own minds and their own way about, and they are very methodical'. Their history shows them to be very able in their own spheres, and to have had an active social life. Odette among other things has been local commandant of the Red Cross and president of the

Women's Institute. She used to enjoy tennis and village dances. 2 years ago she found her voluntary activities getting too much for her—after an attack of influenza she found herself getting easily 'het-up'—so she has cut them down now, continuing with part-time ambulance duties only. Fanny has risen to a responsible position in her firm and used to be secretary of the social club, secretary of the tennis club and a regular attender at the firm's dances. Since marriage Fanny has lived a quieter life. Both enjoy working with their husbands in the garden. Among other activities both have been members of a choral society. Fanny plays the piano. Odette used to play the violin in an amateur orchestral society. Both have been Sunday School superintendents. Fanny has not had the same sense of vocation for any of her activities as Odette has had for her nursing, but during the Second World War she did St. John's Ambulance work. As already mentioned, both married widowers and they appear to have taken this in their stride; they report good relations with their step-children. Though neither can be regarded as being markedly neurotic both have minor obsessional traits. Odette has counting habits; Fanny has gone home and then returned to work to make sure whether she has locked the safe up properly. Both have a fear of fire and water and in cinemas or hotels will look round for the emergency exit. The fear of fire is understandable not only in the case of Fanny but also in Odette who was always hearing about Fanny's accident: 'I was supposed to have rescued her', she says. There is no ready explanation for the fear of floods.

There were differences in voice and in dress. Their accents betray their origin, Odette from the west country, Fanny from London. Fanny wore a fur coat and has her hair permed. Odette was more plainly dressed and wears her hair short and straight; this in keeping with her rather more down-to-earth, independent manner. Odette is more reserved and more placid, Fanny says she is not ashamed to show her feelings. Fanny thinks she lives a gayer life and has more young friends than Odette, though she thinks Odette's activities have given her social contacts of a wider kind. Odette prefers the country to the hectic life of London. Odette plans things out in advance more than Fanny; she does not make the clock an enemy. Both are methodical, but Fanny is fussier, with the result that she sometimes finds she is having to work against time. The tea things must be washed up before she can go and do anything else. Odette reads more, and will often read light fiction and autobiography in bed till 1 or 2 a.m., but she does not care for serious reading.

#### *Comment*

A great part of their difference in career and interests must be attributed to the fact that Odette was brought up by a country schoolmaster, Fanny by a London carpenter and builder. Odette later married a schoolmaster, while Fanny married a poultry-salesman. Odette is more reserved, plans more carefully and has rather different interests. The smaller community and the family tradition of social service perhaps gave Odette greater scope for showing her initiative. It is possible that Fanny's relatively greater anxiety is attributable to her stricter upbringing and her having been severely burned. Nevertheless their basic similarities in intelligence and personality show up clearly in spite of their different environments.

#### *CASE S f 26, AGE 55*

Separated at 6 months

Grade II (b)

Maternal uncle

1. AMY . . . . . Poorer MHR

Mother

2. TERESA

#### *Separation*

At about 6 months, it is said on account of Teresa being in poor health (? nature). Teresa remained with her parents while Amy was brought up by and took the surname of a maternal uncle and his wife, living in another large town in the Midlands, some 16 miles away. The first meeting they recall was when both were bridesmaids at their elder sister's wedding when they were 17. They think they were told they had a twin when they were 5 or 6. Teresa missed much schooling on account of illness and left school when she was 12. Amy stayed on till 14. Social conditions in both homes were poor. Both FATHER and UNCLE drank heavily and kept their families short of money. Both worked in iron foundries, father's

work perhaps being the more skilled; however, it is Amy who refers to her home as middle class and Teresa as working class, though Amy's home was more crowded. Teresa says her father nagged her a lot; Amy thinks her uncle was not so strict and she got on all right with him. MOTHER and AUNT appear to have been very easy-going. However, Teresa, from an early age, 'had to do everything' at home—her 6-years-older sister left home to become a nurse on leaving school. Amy did not have to do household chores so young and she relied on her five elder half-brothers and sisters, children of her uncle by a previous marriage. The aunt had been previously married, but her three children by this marriage did not live with her. The twins' mother died at an advanced age from what may have been a long-standing progressive organic brain disease (hospital record not traced).

#### *Later Environment and Health*

Soon after they first met Amy often visited Teresa's town to court the brother of her elder sister's husband whom she married a year later. Teresa was jealous of her twin at first: 'I was a spitfire', she says. Since about 24 they have lived in different districts of the same town and get on fairly well when they meet, which is not often ('She is always out'—Teresa). Amy married at 18—husband railway labourer, died suddenly 5 years ago, jolly and liked company but nearly broke up the home when, in the early years of their marriage, he heard that Amy (in fact it was Teresa) had been seen out with another man. Amy had seven children, three of whom died at an early age within 4 years of each other, from chest trouble. She lives with her youngest daughter of 17 who is a professional acrobat. Amy has always gone out to work in factories, shops, canteens, as a post office sorter during the war, and at present as assistant in a butcher's, part time.

Teresa says she can never remember when she got married—it was probably about 23. Her husband is a boiler-maker, a quiet man, attached to his home and garden, who never goes out ('Might as well be dead as married to him'—Amy). Teresa says he is a good husband, but she seems a little afraid of him. She gave birth to twins, a boy and a girl who both died, and later to two sons, both now married. Teresa used to do factory work which she left to help with her husband's greenhouse. At present she is a daily cleaner in a hairdressing establishment. She lives on the outskirts of the town on an estate. Amy lives in the centre of the town, next-door to where she was brought up.

#### *Health*

Teresa had St. Vitus' dance badly as a child. She says it came on after a fright she had when she was 6. She had hospital treatment and missed much schooling because of it, but it got better when she left school. When she went to school she would as likely as not faint and have to be taken home. (No suggestion of epilepsy.) She occasionally gets cramp in her fingers now. She has also been in hospital for loss of weight and chest trouble. She has had two operations for mastitis and one she does not know what for, in which she was sterilized. Amy did not have chorea as a child but for several years—she cannot say just how long—she has been excessively fidgety, particularly when excited. This was most noticeable on interview when squirming movements of the hands and arms were observed: she often put her fingers in her mouth or plucked at her neck. Her gait was also odd, but this was apparently explained by her bad varicose veins and the fact that she was wearing high-heeled slippers that were hurting her feet. Brief examinations by Dr. da Fonseca did not suggest any neurological condition. Arm and patellar reflexes were normal. Both twins are scared of doctors and were very tremulous when the blood samples were taken. Each says she has been told she should wear glasses, but it is too much trouble. They are both a little hard of hearing. Amy is 1 stone heavier.

#### *Test Results*

	<i>Amy</i>	<i>Teresa</i>
Dominoes	12	9
Mill Hill	9	7
Extraversion	14	15
Neuroticism	9½	14

Both twins did poorly at school. Their performance on the intelligence tests was even better than expected, judging by the impressions they gave on interview. They were slow in grasping the point, wandered from the point and were inconsistent in the information they gave. Both claimed to have a bad memory. The slight difference on their tests favours Amy who had more schooling. The SRQ results may be unreliable, as both admitted not understanding many of the words.

### *Personality*

As already indicated the twins were remarkably alike in the impression they gave of low intelligence and anxiety. Teresa's memory for dates was just as poor as Amy's. Though it was only in Amy that movements suggestive of some form of chorea were observed, they were both tremulous when the blood was taken and Teresa jumped in her chair when the telephone bell sounded and at the flash of the camera. Both put their hands to their mouths in similar ways and their nails were severely bitten.

When seen separately, each started the interview by complaining of her nervous symptoms. Teresa says 'my nerves just get worse and worse'. She cannot keep still, has difficulty getting to sleep because of a tight feeling behind her eyes, she feels so tense she could scream, her husband 'chews' at her for being so restless. She had a breakdown when her boys were in the Army during the war (one of them was in Palestine and she feared for his safety)—'it was cry, cry all the time'. Her doctor wanted her to go voluntarily to a mental hospital, but she refused; she felt better when the boys came home again. Amy began the interview by saying her doctor wanted her to go to hospital for her nerves, but she went to her brother's instead; she was always crying, hated being spoken to even by her daughter, felt fed up at work which she usually loves, and was away for 9 weeks. This was a year ago when her son got married. Her nerves were also very bad when her children died. Like Teresa, Amy also complained spontaneously of difficulty in going to sleep because of thoughts going round and round in her head—her eyes will be shut but will feel tight, she cannot rest. Neither twin will sleep on her own. Amy has her daughter with her. Teresa, who does not like travelling, let her husband go on holiday but had her twin come to stay with her so that she would not be on her own.

Other similarities, suggested by the booklets and confirmed by interview or observation, relate to a marked lack of social shyness and a quickness in actions and in expressing emotion. Teresa, who was the quieter of the two, at one time playfully hit her twin over the head with the test booklet when having a discussion on whether Amy was stubborn or not. They also consider they are alike in having a smile for everyone and in doing anyone a good turn. Amy in particular says she will gladly and light-heartedly take the blame for other people.

The chief difference is that Teresa's anxiety keeps her at home, while Amy's drives her out. Teresa is excessively house-proud, smokes thirty cigarettes a day, gets depressed if she has a drink, lives for her greenhouse. Amy is 'come-day, go-day' about her housework, loves a jaunt, enjoys herself when she is out, gets depressed and restless if she stays at home. However, when asked quite generally what kind of things she liked doing best, she replied 'scrubbing, mopping and dusting'; but she had neither the time nor the opportunity to be house-proud like Teresa. She has many friends at the pubs where she is often stood a drink and is merry and good company. She made many references to drink during the interview, arriving an hour late because she had stopped to have one. In the booklet she said she drank 'as much as I can afford'. She says she smokes about ten cigarettes a day. In keeping with the above differences Amy has dyed her greying hair black for the past 5 years. She was dressed in bright blue with a feather in her cap and high heels while Teresa, whose hair was not dyed, wore a brown and grey costume and flat heels and spoke in a softer voice. She wanted frequent reassurance that she would not be asked to come to London more than once: 'It was a job to get me down here at all, I can tell you'. She had not told her husband she was coming.

### *Comment*

Though Teresa is much quieter, they are both persons of dull intelligence who are tense and affectively labile. Both had predominantly affective illnesses in middle life. There is



also a suggestion of an organic factor, possibly of a familial kind—Teresa apparently had choreic movements as a child, Amy has them now. Further investigation was, unfortunately, not possible.

Teresa's greater interest in her home may be partly due to the early training in domesticity which Amy did not receive. It was almost certainly intensified by the differing personalities of their husbands. In their most outstanding features the twins are strikingly alike. Though information on background factors is rather inadequate, the influence of the twins on each other during their formative years can be ruled out as a cause of their resemblance.

*CASE S f 27, AGE 56*

Separated from 9 months to 12 years

Grade II (b)

Maternal grandmother	1. DORA	
Mother	2. BRENDA	. . . Poorer MHR

*Separation*

At 9 months on account of Dora's poor health. Brenda remained with the parents in London, while Dora, the smaller and more delicate, went to the maternal grandmother in the country. They were reunited at 12 in the interests of Dora's schooling. Special point was made of seeing that the twins had the same clothes, the same presents and the same pocket-money. They met twice a year. Dora was happy with her grandmother and pleased when she came to live with the parents a year after the twins were reunited. **MATERNAL GRANDMOTHER:** widow of farm worker, tailoress, very placid and contented, lived a quiet life; no other children in the home. **FATHER:** engraver; had marked obsessional traits, would not allow a pack of cards in the house, had unreasonable fears over the children's health, was afraid to punish them in case he did them serious physical harm; 3 years before his death from asthma at 59 when the twins were 16 he had to give up work on account of shaky hands, and was thereafter depressed. **MOTHER:** lively, easily roused, fond of musical entertainments at home. Two elder and one younger siblings brought up with Brenda; close-knit, reserved family; two of the other sisters are very lively and the brother 'somewhat emotional for a man'.

*Later Environment and Health*

Dora left school at 14. Brenda had broken her leg at 13 and did not return to school after that. For 2 years they worked in separate firms, Dora as corsettière, Brenda as dressmaker, then on outbreak of war till marriage they did clerical work in a ministry. Brenda married a watchmaker from the north of England at 20 and has no children. Dora married a local government finance clerk in the London area when she was 24 and they have two children. While Dora lives in a pleasant dormitory town outside London, Brenda has for 35 years lived in a small industrial town in the north which she says is dark and dismal. Her husband is very quiet and is unable to get about on account of 'bad legs'. The twins meet twice a year still.

Menarche occurred in both twins at 14 within a month of one another. Dora is supposed to have had poorer health than Brenda as a child (nothing definite). At 16 she severed a thumb tendon. At 30 she injured her spine and dates her subsequent ill health from then. At 34 she says she was told at a hospital that she would always have poor health. At 35 she had an appendicectomy and an ovarian cyst removed. At 42 she had osteo-arthritis. At 49 she had an operation for adhesions and volvulus. She has subsequently suffered from colitis and various menopausal symptoms. At 56 she had an operation for gallstones and umbilical hernia and since then has suffered from 'blood pressure'. When seen at 58 she had just fractured a rib in a fall. At 13 Brenda had a compound fracture of the left femur, resulting in shortening of the leg. At first the father would not send her to hospital, but later he transferred her from one hospital to another because he was not satisfied with her treatment. For 2 years she wore a surgical boot and later made-up heels. She has always had a slight limp, though like Dora she used to enjoy dancing in her teens. She has had some

trouble which her doctor told her was 'gall bladder'. From about 30 she has had attacks of rheumatism and from about 52 has been handicapped by a very painful knee and hip (? arthritis). At 56 she had had two recent falls in the street and when seen had her arm in a sling (fractured tip of radius).

### *Test Results*

	<i>Dora</i>	<i>Brenda</i>
Dominoes	13	22
Mill Hill	12	10
Extraversion	9½	6½
Neuroticism	8½	19

Dora's Dominoes score seems to underestimate her intelligence, but she may have deteriorated slightly during the 2 years which elapsed between the testing of the twins at 56 (Brenda) and 58 (Dora).

### *Personality*

The younger sister, who accompanied Brenda to the hospital and who finally persuaded Dora to be seen, considers that, even when the twins first came to live together at the age of 12, they were more alike in temperament than any of the other sibs, being much quieter. Now they are alike in a number of respects, including their rather high-pitched, monotonous, slow voices; and both are very talkative, particularly on the subjects of their ailments. Both have had much ill health and there was some anxious hypochondriasis about their attitudes. Dora asked to be recommended a good neurologist. She thought some damage had been done to her by traction for her arthritic spine. Brenda is afraid of hospitals and has refused treatment for her leg, but she is very concerned about it and probably lets herself be unnecessarily restricted by it. Her doctor has said her inability to tie her shoe laces is 'just nerves'. Both twins complain much of sleeplessness, especially Brenda who says she has not slept right through the night since her 20's. Both, too, mention a fear of falling—Dora on account of her high blood pressure and dizzy turns, Brenda on account of her bad leg—as a reason for their not liking to go out much. They keep very much to their own homes—'It is difficult to get either of them to go anywhere', says the younger sister. Although she lives well within an hour's journey from the hospital and professed a willingness to co-operate, it was only on the ninth attempt that Dora was finally seen (visited at home); her health was the reason she usually gave for being unable to make the journey. When they go out together it is like the blind leading the blind, according to the sister; they seem so unable to find their way about. They have few interests and little energy to carry them out. In the booklet Dora gives as hers 'reading, and resting when I can', Brenda, 'not any'. Dora says she has lately been feeling stupid. Brenda complains that she will pick up a book, read three pages and have no idea what it has been about. When doing the intelligence test, both were indecisive and asked repeatedly for help. Dora's daughter (also seen) has been impressed by the love of both twins for detail. Dora is said to be superstitious, e.g., about crossed knives and wearing green. Brenda denies being superstitious, but she gets the feeling that something dreadful is sure to happen if ever she goes on holiday.

Within the framework of these similarities, Brenda has a more depressive attitude—'She is jolly, I am serious', as she puts it herself. While Dora enjoys entertaining in her own home, makes friends easily, likes a drink of stout occasionally, and says she manages to keep happy and determined even when she is ill, Brenda is different in all these respects. She and her husband do not entertain and they go out to the cinema only about twice a year. Friends have left the neighbourhood and she has made no new ones. Though she has traces of a north-country accent now, Brenda does not feel she 'is one of them'. Dora is interested in the doings of her children and grandchildren and in her garden. Brenda has neither family nor garden to be interested in. Brenda admires Dora's pluck. Breaking her leg at 13 has, she feels, put a damper on herself and given her an inferiority complex. She always looks on the morbid side of things. Dora likes hospitals, Brenda fears them. Whereas Dora is fond of turning out the house from time to time, Brenda cannot bring herself to do this. Brenda is also liable to headaches, heaviness in the head and, when excited, trouble with 'the nerves

of my stomach'. Though worse in the past 3 years, Brenda's neurotic symptoms seem to have been chronic for many years. Dora feels that since her marriage Brenda has become harder.

### *Comment*

Dora's quieter country upbringing does not appear to have brought about the differences. Brenda's accidental injury to her leg (together with her father's attitude to it) and her childless married life with an exceedingly quiet husband in another part of the country from the rest of her family are seemingly the decisive factors.

### *CASE S f 28, AGE 59 (on completion of booklets)*

Vera seen briefly by colleague only. Maisie not interviewed but supplied much information by correspondence

Separated from a few months to 12 years and again at 17 Grade III (?)

Father

2. MAISIE

Paternal uncle

1. VERA . . . . . Poorer MHR

### *Separation*

On the death of the mother, Maisie remained with the father and three elder sibs, Vera being taken a few months after birth by a paternal uncle and his wife who had five children of comparable age; both lived in the same town in northern England. The twins met for tea most Sundays. Vera did not know till 11 that she was (unofficially) adopted, but Maisie always knew Vera was her twin. When they were 12 the uncle and aunt emigrated to Canada and Vera at father's request came to live in his home. Vera was homesick for her uncle and aunt. She resented references to the close resemblance between the twins. At 17, she joined her foster-parents in Canada where she has lived ever since. Maisie visited her there 8 years ago and very recently Maisie visited the Old Country. FATHER, turner, badly off, too proud to accept financial help, devoted to family but very strict; Maisie not allowed to play with children in the street as this would waste her shoe leather. Theatres and dancing not allowed. Father did not remarry. Maisie was brought up by a wet-nurse, then for 2 years by an elderly housekeeper who was said to have loved her but was severe with the other children, then by a widowed aunt whom the family adored, and then, when the aunt remarried, by an elder sister. The UNCLE who brought up Vera was a signalman, better off than father, 'rather liked his drink' but was very affectionate. The AUNT took in lodgers. There was much more freedom in the home. They could read comics and go to an occasional dance or theatre but it was nevertheless 'a good Christian family, working class, proud and dignified', according to Vera herself. The aunt accused the father of wanting Vera back for her earning capacity, but this was not true as the twins signed on as dressmaker's apprentices for 2 years unpaid, and the father paid for Vera's passage to Canada; he was very distressed that he had 'failed to win the love and trust of his own child'.

### *Later Environment and Health*

Maisie worked as dressmaker, clerk, card writer and time-keeper till her marriage to a schools inquiry officer at 23; they have one son and one daughter. She still lives in her home town. She suffered a great deal of ear-ache as a child, has had operations for the 'usual women's complaints', and has had high blood pressure for the past 2 years.

In Canada, Vera worked as a clerk till her marriage to a mechanic at 21. According to Maisie she was not as happy with her foster-parents in Canada as she had expected to be. Her husband is said to be an incurable drinker but holds down quite a good job. They have had two daughters and one son. The younger daughter, age 23, is blind and mentally retarded, had a brain operation at 16 and is looked after at home by Vera. Vera wears glasses and had a complaint of the right ear. There is no other information about her health.

### *Test Results (SRQ only)*

	<i>Maisie</i>	<i>Vera</i>
Extraversion	13	8½
Neuroticism	13½	13

*Personality*

At school both twins were best at reading and composition, weakest at arithmetic. Both have been very active in church and welfare work, taking up voluntary part-time work of this kind since marriage. There may also be an obsessional quality about their personalities—Maisie answers 11 SRQ questions with a question mark and after posting her booklets writes again to correct a minor point about the duration of one of her jobs; Vera also comments on her difficulty in making up her mind about her answers and there was a rigidity about her refusal to co-operate on some points. Of twenty-eight items in the Normal Personality Traits section of the booklet which were answered by both twins, twenty-three were answered in the same way. On Vera's latest visit relatives were much impressed by their identical mannerisms and their tendency to do or say the same things. Nevertheless when Maisie visited Vera in Canada she considered they were unlike in temperament. Another sister who visited more recently reported that Vera now dyed her hair and gave her age as 8 years younger than she really was. Vera's own account is that she had changed in her general attitude. As a child, and even up to the age of 27 (the year in which her invalid daughter was born) she was painfully shy. 'Then all of a sudden', she writes, 'I began to get confidence in myself. I became a leader in church work and worked hard and enjoyed it, and everything I made up my mind to do I became a success at. . . . My greatest ambition is to travel, to own my own business, take an active part in a good club.' When seen briefly by a colleague, she appeared to be 'a fine, gentle, old lady'. She was willing to talk, but her mind was made up: she would not answer any silly questions or play around when there were more important things to be done (she was referring to the care of her daughter). But she felt ashamed to take this attitude when she knew her twin sister had co-operated so well. She did complete the booklet but left blank the sections on family history, physical data and income. A year later she visited England, and for her state of mind then we have Maisie's account. She opines that 'all the emotional upset of the years past made my sister—now I don't know what word to use, but sometimes I think her mind is warped, she does and says such unaccountable things'. Unfortunately few details are given, but by her refusal to write to Maisie, though she apparently enjoyed her holiday and Maisie's hospitality and she writes to other members of the family, suggests that she has taken offence at something. But this was 'just one episode to try and show you the difference that backgrounds and emotional upsets can create in people' says Maisie.

In contrast to Vera's increase in activity, Maisie writes: 'It has been somewhat difficult to give a true analysis of my character due to the fact that I have considerably slowed down in every way during the last 2 years', i.e., since the age of 57. She complained in particular of sleeplessness. (In a later letter written when she was 60, there is the suggestion of over-activity: 'I have not been well for the past 3 or 4 weeks and my doctor is trying to slow me down in my activities'.)

*Comment*

This pair has been less thoroughly investigated than the others. Monozygosity seems likely in view of the striking likeness that was commented upon when the twins met as adults (photograph taken then confirms this). The extent of the personality resemblance must remain uncertain. It is possible that the twins have in common a cyclothymic tendency which has shown itself in Vera by a swing into overactivity and in Maisie mainly in retardation. The disturbed family relationships, which were in evidence during childhood and made their 5 years together in the father's home unhappy ones for Vera, seem to have coloured relations between the twins.

*CASE S f 29, AGE 59*

(Both twins sent in their names)

Separated at 9 years

Grade III

Father

1. ADELINE

Maternal aunt

2. GWENDOLEN . . . Poorer MHR

*Separation*

They were brought up together in a country village until their mother's death, when they were 9½. The mother is described as having been of a sunny disposition. The brothers and sisters were taken by different relatives. For a few weeks the twins were both with a MATERNAL AUNT at the other end of the village but, being noisy children, they proved too much for her. She was a stern woman of 50 who believed in a place for everything and everything in its place. Adeline who had always been 'Dad's girl' was allowed to return home. The aunt kept Gwendolen. The paternal grandmother (easy-going, not fussy), helped to look after Adeline until father remarried 2 years later. The STEPMOTHER was very strict and had little affection for Adeline. FATHER, agricultural labourer, then gardener, later smallholder; generally happy. UNCLE, master baker. The uncle and aunt were about 10 years older than the parents and they regarded themselves as socially superior. The aunt was rather restrictive and would not let Gwendolen go out to play after school with other children or with her twin. There was no particularly close relationship between the twins in childhood. Gwendolen was in a higher class at the village school which they both left at 13. Gwendolen has never gone out to work, but has sometimes helped with book-keeping in the family business. Adeline went into domestic service in the nearest big town. She had three posts, one of them for 3½ years, and at 21 went north to marry a soldier she had met when he was in the local hospital. For the following 38 years she lived in a large industrial town in the north, while Gwendolen continued to live in the same or a neighbouring village in the Midlands. A year ago Adeline returned to the village to help look after an aged invalid aunt.

*Health and Later Environment*

As a child Adeline was shorter and paler than Gwendolen. Both had ear abscesses when aged 12 months. Since a child Adeline has been hard of hearing. She is now totally deaf in the right ear and partially deaf in the left. No other illnesses of note in either twin. Menarche reported as: Gwendolen at 11, Adeline at 13. Menopause, both at 50, since when Adeline but not Gwendolen has grown stouter, Gwendolen being 1 stone lighter and 1 inch taller.

Adeline's husband was a slaughterer who had a good deal of unemployment. He drank more beer than he could afford and was sometimes hasty tempered. Gwendolen refers to him as a ne'er-do-well. Adeline says he was 'not what you would call a good man but was well-liked and well-known locally'. He died 8 years ago having been an invalid for 2 years. Adeline then worked as housekeeper to a doctor. She has three sons, the youngest now aged 22, and had a daughter who died in infancy. Gwendolen married 5 years after Adeline. Her husband kept the village grocery shop and post office store; he died 4 years ago. She has a daughter of 22, a school teacher.

*Test Results*

	<i>Adeline</i>	<i>Gwendolen</i>
Dominoes	29	30
Mill Hill	23	23
Extraversion	7	5
Neuroticism	13½	18

*Personality*

Similarities are present but not very marked or easy to describe. They have the same soft, rather high-pitched voices, but a regional difference in accent. They appear to have a kindly, gentle nature and were disposed to speak well of people. In a few years time they will be 'nice old things'. They have similar reading tastes (e.g., family romances), they like knitting and needlework and gardening, though Adeline did not have much opportunity to do the latter in her industrial town. They have kept up their connection with the Methodist Church and are non-smokers and alcoholic abstainers. Both are modest in describing their capabilities.

Differences are more pronounced. Gwendolen joins in the activities of the Women's Institute (jam bottling, jumble sales, etc.) and enjoys a whist drive. She is organist at

the local Methodist Church. Adeline is shy of partaking of social activities, probably on account of her poor hearing and lack of opportunity when younger. However, she is an efficient lip-reader, has a quiet sense of humour and will laugh at jokes arising from her own mis-hearing. While Gwendolen considers herself reserved and worrying, Adeline is more lively and happy-go-lucky. Gwendolen remarks that Adeline's harder life has made her so that she does not care. Adeline is freer with her money. Adeline is slower, Gwendolen more bustling. Gwendolen is very methodical. She can tell the time of day by when the trains pass. She cannot sleep some nights on account of thoughts about what she ought to do the next day going round and round in her head. She continued looking for an old photograph for some time after being told not to bother. At 11 or 12 Gwendolen had attacks of fainting and profuse sweating. She is nervous of thunderstorms. It was unfortunately not possible to see Adeline on her own. It was thought she was a little ill at ease and could not be pressed to stay to tea in her sister's house. From Gwendolen's daughter who came in later it was gathered that Gwendolen's family regard themselves as somewhat superior to Adeline whom they consider as apt to make a fool of herself—'I can't imagine Aunt Adeline on the London escalators', says the daughter.

### *Comment*

These are the oldest monozygotic twins in the series. Although they were the latest to be separated, their different environments after the age of 9 seem both directly and indirectly to have made for personality differences. Gwendolen seems to have taken over her aunt's social standards and slight fussiness. Only Adeline entered domestic service and this led her to the town and eventually, through marriage, to a very different social environment. This and the effects of Adeline's deafness have resulted in differences more marked than those shown by the majority of twins parted at birth.

## ANECDOTAL INFORMATION ON TWO PAIRS, NOT IN THE SERIES, WHICH IT WAS NOT POSSIBLE TO INVESTIGATE FURTHER

### *SUPPL. CASE 1, FEMALE, AGE 21*

Information by letter from twin A and her 'mother', following the television programme ('I wish it could have been longer'). A wrote up to say they were 'mirror twins . . . identical bodies and voices'. They were separated at 9 months on death of parents. B was adopted at 13 months into the family of a Roman Catholic policeman, A at about 16 months by a Church of England publican. B went to a convent, A to a high school in the different north of England towns where they were brought up. They first met and were told of their relationship when they were 14 and since then have met weekly. A is a receptionist in a large store, B a telephonist. Sometimes they will try to telephone one another at the same time. They have the same bad teeth, the same appendix twinges, and 'our emotional entanglements even seem to run on the same lines.' In February 1954 the twins expressed full willingness to co-operate, but in December A's 'mother' wrote to say that A 'was married in May and is now living in America, also her sister. . . . It would I am sure have been a most interesting case, as they were so much alike in every way.' In 1956 no reply was received to a letter asking for the twins' present addresses.

### *SUPPL. CASE 2, MALE, AGE 33*

Information by letter from wife of twin A. Frequently mistaken, occasionally by wife and children. Separated at 3 months (mother had tuberculosis). A taken by elderly relations, later returned to parents. B taken by uncle after whom he had been named; his wife was childless and would not hand B back to mother. MOTHER said to be weak-willed, self-pitying, preferred elder son to A; now schizophrenic; AUNT, jealous, domineering, built

her world round B. Twins brought up in same town and now work for same firm as joiner (A) and engineer (B). A has two, B three children. They are said to think alike, e.g., buying identical presents for one another, but to be different in character—'A is shy and diffident, while his brother has all the confidence A lacks. These are facts which you would not be able to get out of the boys', A's wife adds. When the wife's suggestion that we might visit was taken up, no reply was received, and it was thought that the twins themselves did not look on the investigation with favour. The family lives in the north of England.

Though lacking objective confirmation, these interesting accounts are consistent with the reports of some of the more adequately investigated pairs.

# SHORT CASE SUMMARIES OF DIZYGOTIC TWINS BROUGHT UP APART

(For tests and ratings see TABLE 42)

## *CASE Ds 1, MALE, AGE 62*

Separated at 18 months on account of size of mother's family. A with own parents and other sibs (father, farm labourer; mother 'a dear', easy-going), B with childless maternal aunt in another part of the country (uncle, horse driver, heavy drinker; aunt, strict, bad-tempered). A, asthenic build, left-handed, married, no children, has worked in gentleman's service as chauffeur, club steward. B, pyknic build; married, three children; emigrated to Canada at 18, still there (seen by colleagues), government clerk; chest wound in First World War, nephrectomy, moderate degree of deafness. In personality both are friendly and very talkative, but B is more intelligent, more active in community affairs, is sanguine, shrewd, contented, self-reliant; A more practical with hands but (in spite of 'better' parents) is moodier, was easily frightened as a child, shows much anxiety in relation to persons in authority, became agitated when doing the tests, has consulted doctor for tenseness and sleeplessness at time of added responsibility at work.

## *CASE Ds 2, FEMALE, AGE 12*

Separated at 2 years. Maternal aunt (single, teacher), who had helped all along (B was a 'blue baby', mother in poor health), took A permanently at that age when she did not settle in day nursery. B remained with parents in neighbouring town. Both at grammar schools. A heavy sleeper, B light sleeper. A (like mother and aunt) has had migrainous headaches from age of 3, liable to occur when excited; also a dry skin condition (familial), left-handed. B had rheumatism at 9 and recently developed an arthritic condition of the hip, for which she is now in hospital. B is of a managing disposition and when they are together 'drains the vitality out of A'. B is boyish, restless, inquisitive, gets herself dirtier; A is shy and retiring, rather sensitive, more affectionate. They have little in common.

## *CASE Ds 3, FEMALE, AGE 13*

Separated from 5 months, when B went to hospital for congenital dislocation of hip, till 5½ years, and again from 8½ since when B has been at residential school for physically handicapped, paying only occasional visits to mother. A at home with mother and sibs; parents separated. At 5, B was untrained in toilet habits, took 2 hours over meals, is now regarded as 'a packet of nerves', self-conscious, jumpy, moody at school, achievement below I.Q., grim, determined expression. A is a healthy-looking girl with a happy smile, lively, rather restless, no serious problems.

## *CASE Ds 4, FEMALE, AGE 19*

Separated at 17 months, when mother died of tuberculosis. A taken by paternal grandparents; no financial hardship, but paternal grandmother resented having her, was an aggressive domineering woman who continually threatened A that 'if you don't do what I say you'll end up just like your mother'; liable to hysterical nervous breakdowns. B was taken by maternal grandparents in the same large city; some financial hardship; maternal grandmother quiet and gentle, but worried by paternal grandmother who 'terrorized' her, gave B emotional security. Twins went to same school; have got on quite well together. A was class ahead after B had pleurisy at 13. In keeping with their respective homes A is rowdy, out-going, determined, B much quieter, less worried about her health, expresses more concern about the interfamily tension. Some similarities in mannerisms reported. B has recently married, A is engaged. At 18 they were referred independently to a chest clinic where pulmonary tuberculosis was diagnosed in both twins. This was active in the case of A; after 11 months in hospital her condition was thought to be quiescent. In B there was



no indication of present activity, but rest at home was advised for 8 months and she too was treated with chemotherapy. (Pair notified by colleague who had heard of their concordance for tuberculosis and investigated them for us.)

*CASE Ds 5, FEMALE, AGE 26*

Separated at 9 months. After hospitalization for diphtheria B was taken by paternal grandmother, A remaining with parents in the same London borough. Mother's family grew to thirteen in number, including another pair of dizygotic twins. Father, dock labourer, intelligent, difficult. Mother, dull, deaf. A had *petit mal* at 7, *grand mal* at 9, fits controlled for 4 years until recent recurrence; typically epileptic E.E.G. Missed much schooling, but holds good secretarial job; is egocentric, has quarrelled with father, married 5 years ('we are getting adjusted now'), has complained to her Member of Parliament about her housing, is thinking of changing her religion. B had convulsions in infancy, but has no other epileptic manifestations and a normal E.E.G. Also somewhat impulsive, but more reserved, 'not so enthusiastic about things', gets on with father, married life suits her, fonder of open-air life, various unskilled jobs.

*CASE Ds 6, FEMALE, AGE 39*

Illegitimate. Separated soon after birth and have not met since. After 2 years in a private Home, B came to live with some distant relatives, kind, elderly people. Did well at school. A went to a large orphanage where she had a number of different housemothers, left the orphanage school at 14, leaving from class VIB (prize for trying hard). She remained in the care of the orphanage till 21, thereafter having many posts as children's nanny. A has weakness of the left leg (? from early polio) and has had asthma since 23 (now much better). She is thin, undersized, talkative and almost impossible to keep to the point, seemed quite cheerful, but afterwards wrote us long letters about her troubles, addressed to Dear Madam, though she was seen only by male members of the staff. B had some spinal trouble as a child and from age of 10 has had asthma, hay fever and migraine (the last still severe), rheumatism at 12. From age of 20 she has been an invalid with a disorder of the thyroid and pituitary glands. She is confined to bed in the house of her adoptive parents; fat, sullen, depressed, irritable, quite intelligent (estimate I.Q.: A, 85; B, 115), looks to hypnotism for a cure.

*CASE Ds 7, FEMALE, AGE 39*

Separated at 9 years on account of overcrowding, A going to childless paternal aunt while B remained with own parents and five other sibs. Attended same school. A more restrictive upbringing. Reunited at 15. A smaller and more illness, including rickets; more pyknic. Mutual telepathic feelings claimed; A the leader. A had three miscarriages, B two live-born children. A has recurrent neurodermatitis. Very different in personality; A cheerful, overtalkative, emotionally labile, loves excitement, exaggerates, dominates her husband, B shy, sad-looking, worrying, liable to recurrent attacks of anxiety, dizziness, nausea, sleeplessness. Both have had psychiatric treatment: A at 34 for mild depression after second miscarriage (previous attack after first miscarriage at 29—Maudsley diagnosis, reactive depression); B during second pregnancy (age 37) feared child would have hare-lip like her first child, 4 weeks after delivery had panic attacks, choking sensations, fears about the child, phobia of travelling, feeling she was being forced to the left when walking, crying spells, depressed feelings, stayed at home for about a year (Maudsley diagnosis, phobias). (Case reported by da Fonseca (1959) as cases 34 and 35.)

*CASE Ds 8, FEMALE, AGE 39*

Separated at 3-6 months after death of mother. A with foster parents in southern England, at one time in various Homes, B with uncle and aunt in northern England. First met at 16, last met at 28. B led sheltered life. A says, 'I was pushed around till I married'; at one time suffered from malnutrition. B, a retiring type, A more broad-minded, more aggressive. (B unwilling to co-operate; information from sister who knows both twins and by letter from A. Booklets not done.)

*CASE Ds 9, FEMALE, AGE 50*

Separated at birth because mother (working midwife) had five older children to look after. Childless maternal aunt took A to the large town, while B remained with parents in the mining village as baby in large family. Aunt had hysterical traits, and A did not get on with her second husband (from age of 13 onwards); A had to conform more to adult ways. After a broken engagement A married present husband, school caretaker, very quiet, cannot cope with emergencies, five children; A resigned but happy, does voluntary club work, escorts foreign children on tours of London; slow, dreamy temperament, worries easily, goes off her food, things play on her mind; developed eczema when daughter married outside her religion. B's husband has skilled industrial job, sociable, three children (two surviving); B 'leads a happy cabbage life . . . content to sit and chatter', enjoys sex (A not).

*CASE Ds 10, FEMALE, AGE 51*

Separated at 1 month because of illness of mother, A going to paternal uncle and aunt, B remaining with parents in same large city; met as cousins, twinship not discovered till 25; A less happy as a child as 'mother' impressed on her what sacrifices she was making. A left school at 16, B at 14. Till marriage A mental nurse; B in warehouse. A unhappily married, separated, unsuccessful divorce proceedings. B helps husband in tobacconist's shop. Both have had nervous breakdowns, A's attributed to her domestic troubles, no details of B's. A has had three abdominal operations, migraine, arthritis; B headaches, rheumatism, high blood pressure. A more intelligent (?). Fairly alike on questionnaire. B initially not keen on investigation, but A thanks me 'for bringing my family to me'. (Booklets only.)

*CASE Ds 11, FEMALE, AGE 53*

Separated at 1 month on father's death, A remaining with mother, B going to aunt in same small town (better off). Same school. Live in different parts of country, meet only 'once in years' now. Both had gynaecological operations, B at 32, A (hysterectomy) at 52 followed by nervous trouble. A apparently more shy and reserved, poor sleeper, 'inclined to drift'. (Booklets only.)

# TEST RESULTS AND BASIC DATA RELATING TO OTHER PAIRS

TABLE 41. AUTHOR'S RATINGS, INDIVIDUAL INTELLIGENCE AND  
PERSONALITY TEST SCORES AND DIFFERENCES

CONTROL MALES (MZ)

Case Number	Initial	Age	Author's Rating	Dominoes		Mill Hill Vocabulary * = Junior Scale		Extraversion		Neuroticism	
				Scores	Difference	Scores	Difference	Scores	Difference	Scores	Difference
C m 1	N	13	I	29	1	27*	4	15.5	0.5	6.5	1.0
	K			28		23*		16.0		7.5	
C m 2	I	17	II (a)	31	1	22	2	14.0	0.0	8.0	0.0
	S			32		20		14.0		8.0	
C m 3	Ch	20	I	38	3	17	0	18.0	0.5	6.0	1.0
	Ce			41		17		17.5		7.0	
C m 4	D	23	III	—	—	—	—	12.0	1.5	9.0	2.0
	C			—		—		10.5		7.0	
C m 5	D	30	II (a)	29	3	21	0	9.0	4.5	8.0	4.0
	T			26		21		13.5		4.0	
C m 6	G	33	IV	19	0	20	5	16.0	2.0	13.0	10.0
	B			19		15		14.0		3.0	
C m 7	E	35	II (b)	45	4	21	1	12.0	1.0	10.0	0.0
	P			41		22		13.0		10.0	
C m 8	C	39	II (b)	34	1	19	1	12.0	3.5	6.0	5.5
	M			35		20		8.5		11.5	
C m 9	B	39	II (b)	—	—	—	—	19.0	1.0	9.0	1.5
	E			—		—		20.0		7.5	
C m 10	Ed	40	II (a)	33	3	23	2	11.5	1.0	7.0	0.5
	Er			36		21		12.5		7.5	
C m 11	A	45	III	42	7	17	4	11.0	7.5	4.5	3.5
	N			35		13		3.5		8.0	
C m 12	A	50	IV	(25)	—	15	1	(18.0)	—	(12.0)	—
	J			(?)		16		(?)		(?)	
C m 13	A	51	II (a)	33	2	20	2	18.5	5.0	11.5	3.5
	I			31		22		13.5		15.0	
C m 14	E	51	III	26	3	18	1	16.0	6.0	8.0	6.0
	B			29		19		10.0		14.0	
C m 15	F	53	III	—	—	—	—	19.0	5.0	8.0	2.0
	W			—		—		14.0		6.0	

TABLE 41—*contd.*  
CONTROL FEMALES (MZ)

Case Number	Initial	Age	Author's Rating	Dominoes		Mill Hill Vocabulary * = Junior Scale		Extraversion		Neuroticism	
				Scores	Difference	Scores	Difference	Scores	Difference	Scores	Difference
Cf 1	J	9	II (a)	28	0	13*	3	19.0	3.0	9.0	2.5
	H			28		16*		16.0		11.5	
Cf 2	J	28	II (b)	32	4	19	1	14.0	2.0	8.0	6.0
	C			28		20		12.0		14.0	
Cf 3	J	29	II (a)	20	12	11	5	16.0	0.5	12.0	0.5
	K			32		16		15.5		11.5	
Cf 4	E	30	I	7	8	8	1	16.0	0.0	2.0	3.0
	H			15		9		16.0		5.0	
Cf 5	P	32	II (a)	24	2	18	2	18.5	5.5	8.5	3.5
	C			22		20		13.0		12.0	
Cf 6	D	34	II (b)	—	—	—	—	15.5	1.5	13.0	6.0
	E			—		—		14.0		7.0	
Cf 7	E	34	III	42	11	25	1	14.0	3.0	13.0	5.0
	L			31		24		11.0		8.0	
Cf 8	R	35	I	31	2	16	1	12.0	0.5	4.5	2.0
	I			33		17		11.5		6.5	
Cf 9	G	35	II (a)	21	15	21	0	10.0	5.0	14.0	2.0
	B			6		21		15.0		12.0	
Cf 10	K	36	—	—	—	—	—	16.0	3.5	8.0	2.5
	C			—		—		19.5		10.5	
Cf 11	Sy	36	II (b)	35	10	19	2	18.0	6.5	3.0	14.0
	Su			25		21		11.5		17.0	
Cf 12	H	37	II (a)	23	4	16	6	17.0	0.0	10.0	2.0
	K			19		22		17.0		8.0	
Cf 13	F	38	II (a)	28	7	17	3	15.0	1.5	14.0	4.5
	D			21		14		13.5		9.5	
Cf 14	Em	40	I	22	1	17	1	17.0	0.0	9.0	0.0
	El			21		18		17.0		9.0	
Cf 15	B	41	II (b)	—	—	—	—	12.0	0.0	11.5	3.5
	C			—		—		12.0		15.0	
Cf 16	J	41	II (a)	41	3	26	1	16.5	4.5	3.0	0.0
	N			44		27		12.0		3.0	

TABLE 41—*contd.*  
CONTROL FEMALES—*contd.*

Case Number	Initial	Age	Author's Rating	Dominoes		Mill Hill Vocabulary * = Junior Scale		Extraversion		Neuroticism	
				Scores	Difference	Scores	Difference	Scores	Difference	Scores	Difference
C f 17	H	41	II (b)	31	5	21	3	17.0	1.0	7.0	3.5
	G			26		18		18.0		10.5	
C f 18	P	41	I	34	12	17	1	12.0	0.0	12.0	1.5
	C			22		18		12.0		10.5	
C f 19	A	43	III	14	6	17	4	17.0	1.5	13.5	2.5
	F			8		13		18.5		11.0	
C f 20	I	44	I	27	7	23	0	17.0	3.0	10.5	3.5
	M			34		23		14.0		14.0	
C f 21	L	45	II (b)	—	—	—	—	14.0	0.5	11.5	3.5
	D			—		—		14.5		15.0	
C f 22	I	48	—	—	—	—	—	10.5	0.5	15.5	0.5
	S			—		—		11.0		16.0	
C f 23	J	48	II (a)	26	1	21	0	14.5	4.0	4.5	4.5
	F			27		21		10.5		9.0	
C f 24	I	51	II (a)	38	7	18	3	15.0	8.0	11.5	5.0
	W			31		15		7.0		16.5	
C f 25	M	52	II (a)	30	6	21	1	11.0	2.0	7.0	1.5
	U			24		22		9.0		8.5	
C f 26	A	53	III	29	7	20	8	3.5	8.0	10.0	1.5
	J			22		12		11.5		11.5	
C f 27	D	54	IV	(10)	—	15	5	8.5	6.0	5.5	0.5
	I			(1)		20		14.5		6.0	
C f 28	J	58	II (a)	25	0	28	2	11.0	4.5	1.0	2.0
	Y			25		26		15.5		3.0	
C f 29	V	59	I	19	1	18	0	11.0	1.5	10.5	0.0
	R			18		18		9.5		10.5	

TABLE 42. DIZYGOTIC PAIRS: MAIN FINDINGS

Case Number, Sex	Age	Author's Rating	Self-Rating Questionnaire						Intelligence (see below)
			Extraversion			Neuroticism			
			Scores		Difference	Scores		Difference	
			A	B		A	B		
Ds 1 m	62	IV	11.0	6.0	5.0	7.0	8.0	1.0	*
Ds 2 f	12	IV	—	—	—	—	—	—	
Ds 3 f	13	IV	—	—	—	—	—	—	*
Ds 4 f	19	II (a)	11.5	7.5	4.0	13.0	8.0	5.0	*
Ds 5 f	26	III	13.0	14.0	1.0	11.0	11.0	0.0	*
Ds 6 f	39	IV	12.0	12.5	0.5	13.5	7.5	6.0	
Ds 7 f	39	III	8.0	18.0	10.0	18.0	5.0	13.0	*
Ds 8 f	39	IV	—	—	—	—	—	—	
Ds 9 f	50	IV	11.0	17.5	6.5	13.0	7.5	5.5	
Ds 10 f	51	II (a)	8.0	10.0	2.0	16.0	13.0	3.0	
Ds 11 f	53	II (b)	10.5	13.0	2.5	12.5	9.0	3.5	
Dc 1 m	46	II (b)	19.0	19.0	0.0	5.5	4.0	1.5	*
Dc 2 f	30	III	12.5	18.0	5.5	9.0	10.0	1.0	
Dc 3 f	32	III	8.0	13.5	5.5	10.0	5.5	4.5	
Dc 4 f	35	IV	5.0	16.0	11.0	9.0	10.0	1.0	
Dc 5 f	36	III	3.0	21.5	18.5	13.0	5.0	8.0	
Dc 6 f	37	II (a)	12.0	10.5	1.5	10.0	9.5	0.5	
Dc 7 f	40	III	8.0	12.0	4.0	20.0	14.0	6.0	
Dc 8 f	41	IV	10.5	20.0	9.5	9.5	9.0	0.5	
Dc 9 f	42	III	17.0	17.0	0.0	16.0	5.0	11.0	
Dc 10 f	42	IV	9.0	10.0	1.0	15.5	16.5	1.0	
Dc 11 f	45	IV	17.0	11.5	5.5	14.5	5.5	9.0	
Dc 12 f	45	III	16.0	8.0	8.0	3.0	10.0	7.0	*
Dc 13 f	50	II (b)	15.0	17.0	2.0	9.0	11.0	2.0	
Dc 14 f	51	IV	11.0	9.0	2.0	13.0	10.0	3.0	
Dc 15 f	52	II (b)	12.0	12.0	0.0	4.5	2.0	2.5	*
Dc 16 f	55	IV	5.5	16.0	10.5	14.5	14.0	0.5	
Dc 17 f	55	IV	7.0	9.0	2.0	14.0	9.0	5.0	

DZ Controls with booklets from one twin only: Dc 18 m 38 IV; Dc 19 f 33 II (b); Dc 20 f 39 II (b);  
Dc 21 f 42 IV.

## INTELLIGENCE TEST FINDINGS

Case Number	Dominoes			Mill Hill Vocabulary * = Junior Scale		
	Scores		Difference	Scores		Difference
	A	B		A	B	
Ds 1	17	25	8	16	24	8
Ds 3	31	30	1	17*	19*	2
Ds 4	32	12	20	12	14	2
Ds 5	17	29	12	21	9	12
Ds 7	21	13	8	—	—	—
Dc 1	24	28	4	21	22	1
Dc 12	33	13	20	17	19	2
Dc 15	31	44	13	26	28	2

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