

Juel-Nielsen

Individual and Environment

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Monozygotic Twins Reared Apart

Niels Juel-Nielsen

INDIVIDUAL
AND

ENVIRONMENT

Monozygotic Twins Reared Apart

NIELS JUEL-NIELSEN

The controversy over the role of nature versus nurture in development continues to this day. More than 100 years ago, Sir Francis Galton initiated the study of twins as a means of elucidating the interaction of heredity and environment. He remarked: "There is no escape from the conclusion that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly found among persons of the same rank of society and in the same country." This statement has remained a challenge, to be refuted or confirmed by further research.

Identical twins reared apart are very rare. Yet their value for investigations of the origins of both normal and abnormal characteristics is inestimable.

In this book, Dr. Juel-Nielsen reports on a longitudinal study of 12 pairs of monozygotic twins, aged 12 to 77 years, who grew up in different environments in Denmark. After describing the collection and selection of material for investigation, Dr. Juel-Nielsen explains the methods of research, which included extensive interviews, medical examinations, and psychometric assessments. He then presents the results in terms of similarities and differences in general health, intelligence, personality traits, and physical and mental disorders. These results are considered in the light of the differing environmental influences.

Dr. Juel-Nielsen's original study was carried out over the period 1954-1959. This new volume includes for the first time the results of a 20-year follow-up study, completed in 1979. Additional information is provided about the subsequent life course of the twins, their mental and physical health, and the causes of death.

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As Dr. Peter B. Neubauer writes in his Foreword, this "is a book that deserves to be read many times, for it is a vital resource for all those who study the complex interrelationship between environment and development, between norm and pathology during the life cycle."



Niels Juel Nielsen, M.D., is Professor of Psychiatry at the University of Odense and Superintendent of the Department of Psychiatry at the Odense University Hospital, Denmark. He has represented the field of psychiatry on the Danish Medical Research Council since 1973.

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INDIVIDUAL AND ENVIRONMENT

Monozygotic Twins Reared Apart

by

NIELS JUEL-NIELSEN

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CONTENTS

<i>Foreword</i>	
Peter B. Neubauer	5

<i>Introduction</i>	
I. I. Gottesman	7

PART I

<i>Chapter 1</i>	<i>Heredity and Environment</i>	11
<i>Chapter 2</i>	<i>Aims of the Investigation</i>	14
<i>Chapter 3</i>	<i>Psychiatric-Psychological Twin Research</i>	19
	The twin method	19
	Use in psychiatric-psychological research	23
	The "classical" twin method and the concordance-discordance concept	23
	Special twin methods	25
	Social and psychological aspects of being a monozygotic twin	26
<i>Chapter 4</i>	<i>Previous Investigations of Monozygotic Twins Reared Apart</i>	30
	Newman, Freeman & Holzinger	31
	Shields	33

MATERIAL

<i>Chapter 5</i>	<i>Collection and Selection of Material</i>	37
	Brief account of the history of the investigation	37
	Criteria of selection	38
	Material from the twin register	38
	Material from other sources	40
	Discussion of the collection and the selection of material	40
<i>Chapter 6</i>	<i>The Investigation Material</i>	43
	Sex	44
	Age distribution	44
	The separation	44
	Time of separation	44
	Reasons for separation	45
	Age, marital status and occupation of the biological parents	45
	Direct or subsidiary causes of separation	46

METHODS

<i>Chapter 7</i>	<i>Investigation Methods</i>	49
	Medical-psychiatric interviews	50
	Collection of supplementary information	51
	Medical-psychiatric examinations	52
	Psychometric methods	53
	General methods of testing	53
	The Wechsler-Bellevue Test	54
	Raven's Progressive Matrices	55
	Rorschach's Test	55
	Rapaport's Word Association Test	56
	Discussion of the psychiatric-psychological methods	56
<i>Chapter 8</i>	<i>Determination of Zygosity</i>	60
	Criteria of zygosity	61

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✓ Results of the zygoty determination	61
✓ Discussion of zygoty determination	63

RESULTS

<i>Chapter 9 Intra-pair Differences and Similarities</i>	65
General Health	66
Height and weight	66
Cardiological examination	68
Neurological examination	68
Electroencephalographic examination	68
Ophthalmological examination	69
Other examinations and conditions	69
Somatic diseases	70
Intelligence and personality	72
Intelligence	73
Personality	73
Psychiatric Disorders	78
<i>Chapter 10 Environmental Differences and Similarities</i>	90
✓ Circumstances before separation	90
✓ The birth	90
✓ Breast feeding	92
Early psychological circumstances	92
Social, psychological and inter-personal conditions during upbringing	95
<i>Chapter 11 Psychometric Investigations</i>	104
Intelligence testing	104
Wechsler-Bellevue Intelligence Scale, Form 1	104
Inter-individual differences	104
Intra-individual differences (Test-retest)	106
Intra-class differences	107
✓ Raven's Progressive Matrices	111
Inter-individual differences	111
Intra-pair differences	113
Comparison of W-B and Raven-test results	113
✓ Personality testing	115
✓ Rorschach's Test	115
Word Association Test (a.m. <i>Rapaport</i>)	115
Summary of the results and conclusions of the psychometric investigations	121

GENERAL DISCUSSION AND CONCLUSIONS

<i>Chapter 12 Influence of Material and Methods on the Results</i>	123
✓ Results and general conclusions	128
Some general and final comments	137
Summary	141
Elementary tables A, B and C	145
Twin Pair Index	149
References	150

PART II

<i>Case Material</i>	1-292
----------------------------	-------

PART III

<i>Chapter 13 Follow-up: Twenty-five Years Later</i>	1-16
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FOREWORD

The first edition of this book, which did not include the follow-up study, has for a long time been an important source of clinical information and a model of research methodology. Juel-Nielsen's study of monozygotic twins reared apart addresses itself to basic clinical and developmental questions. It recognizes the interplay between nature and nurture in a specific way by differentiating those aspects of development which are more stable from those which are more adaptive to environmental influences. Moreover, the study provides us with information that gives us clues about the consistency of psychiatric disorders through life, and the distribution of psychiatric disorders as to concordance and discordance. The data also reflect the individual lifestyle of each pair of twins, and reveal individual variations. Thus, we are able to see explicitly the different dimensions of maturation, development, and pathology in a framework emphasizing areas of clinical assessment that usually remain relatively obscure.

Juel-Nielsen conveys to us the drama of the meetings between the twins. In the process, he gives us valuable information about the body and self-image and the narcissistic endowments of the twins. These topics are of increasing interest today, and Juel-Nielsen's work underscores the importance of studies in obtaining data relevant to them.

The research methodology employed in this study is characterized by the clear and complete statement of all the observable data. Professor Nielsen is modest in his conclusions, for he prefers to see his work as a springboard for further study, hypothesis formation, and as a basis for control and comparison.

It is a book that deserves to be read many times, for it is a vital resource for all those who study the complex interrelationship between environment and development, between norm and pathology during the life cycle.

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INTRODUCTION

It is ironic that the recent scandal-exposé about the probable frauds perpetrated on the scientific community by the late British psychologist Sir Cyril Burt has reawakened interest in the use of identical twins reared apart to illuminate basic questions about Nature and Nurture in the development of human characteristics. Amidst the furor created (*Hearnshaw, 1979*) by the fabrication of data, co-workers, and pairs of twins (Burt allegedly collected data for 53 pairs of monozygotic, MZ, twins reared apart), three genuinely classic studies of such rare pairs comprising much more than mere disembodied test scores for IQ have been ignored. The three classics, complete with extensive case histories and other detailed documentation, are by *Newman, Freeman, and Holzinger* from the United States (1937) with 19 pairs, by *James Shields* from the United Kingdom (1962) with 44 pairs, and in the case of the present volume, by *Niels Juel-Nielsen* from Denmark (1965, 1980) with 12 pairs. Each of the three works has been seminal to the thinking and theorizing of behavioral and medical scientists throughout the world. Regrettably, however, few readers have actually read the original versions of these monographs, and have had to content themselves with condensations or reports of conclusions found in secondary sources. The American study may be found in some first-class libraries, the Shields' monograph has been out of print for more than a decade, and the first version of the present volume was only available to subscribers of the Supplements to the Scandinavian psychiatric journal, *Acta Psychiatrica Scandinavica*. (I consider myself to be blessed by the good fortune of receiving an autographed copy, having first met the author in Risskov, Denmark, when he was finishing the manuscript in 1964.)

In its present reprinting *Juel-Nielsen's* already invaluable work has been enriched by incorporating for the first time the results of a 25-year follow-up study of his 12 pairs completed in 1979. Of the 24 individuals originally investigated, 11 are dead and the remaining range in age from 45 to 93 years. His longitudinal observations of adult MZ twins discordant (one affected, the other not) for a trait of medical or psychological interest permit the detection in a compelling manner of the causes of so-called environmental diseases and the triggers of so-called genetically conditioned disorders that are manifested if the healthy twin should become sick in the course of the study. *Juel-Nielsen* offers the reader a proverbial goldmine of information unburdened by excessive speculations or theoretical biases. Given present

day sensitivities to issues such as the invasion of privacy and the confidentiality of medical records (legitimate as they may be for the layman and troublesome as they may be for the behavioral researcher), we are unlikely to see such rich case reports of nonpatients very often in the future. In contrast to other histories in the literature on identical twins reared apart, *Juel-Nielsen* presents us with crucial details on the course of the pregnancy, descriptions of the deliveries, results of neonatal physical examination, information regarding breastfeeding, birthweights, and so forth. Moreover, the availability of the adoption papers permits the reporting of accurate information about biological and adoptive families; it is quite easy to construct pedigrees for the twins and their relatives for three generations. The information in the histories comes not only from intensive interviews initially conducted over a two- to four-year period, but also from the extensive information available to qualified researchers from various Danish registers (National Police Register, National Psychiatric Register, National Twin Register, Death Certificates, etc.). Tantalizing observations with heuristic potential are given with respect to cancer of various sites, angina, hypertension, alcoholism, periodic depression, sexual frigidity, and orthopedic problems. Summaries of each twin's EEG and EKG are provided along with the results of special ophthalmological examinations.

Behavioral scientists cannot but help be impressed by the availability of the subtest scores on the Wechsler-Bellevue Intelligence Scale (I), not only on initial testing but also after an interval of eight months. Raven's Progressive Matrices were also administered and reported. The formal scoring on a Rorschach for each twin accompanies each case history, and the author presents the result of a pioneering blindfolded study to match the protocols of members of a pair. The author gives his clinical impressions of personality similarities and notes that the observed similarities are all the more remarkable because of the frequent large differences in circumstances such as marital status, occupation, age at marriage, and number of children. *Juel-Nielsen*, like P. E. Meehl, takes pains to point out that the apparent conditioning of a trait by genetic factors cannot be equated with therapeutic nihilism.

It may seem paradoxical that this Danish study with its appropriate emphasis on genetic contributions to human variability should be informed by a quotation from *Sigmund Freud* (1938): "The determining causes of the varying forms of human mental life are to be looked for in the interplay between inherited dispositions and accidental experiences. . . . What the constitution of one person can deal with may prove an unmanageable task for another. These quantitative differences will determine the differences of the result." *Juel-Nielsen* is atypical, however, in that his enthusiasm for human genetics is tempered by a keen interest in personology, psycho-

dynamics, psychotherapy, and the phenomenology of the neuroses. In presenting his findings he emphasizes problems and avoids making facile promises: “. . . These investigations show . . . that an intensive qualitative, clinical investigation and analysis, in contrast to investigation methods aiming at a quantitative statistical analysis, led to results and conclusions that, apart from their more uncertain scientific value, have greater meaning.” By opting for a humanized idiographic approach to the study of identical twins reared apart, *Juel-Nielsen* is following in the footsteps of such renowned personologists and clinical investigators as *S. Freud*, *G. Allport*, *D. Burlingham*, *H. A. Murray*, *R. White*, and *J. Shields*. They all shared a willingness to forsake some of the scientism of science in order to do justice to the uniqueness of human personality.

Identical twins brought up apart are scarce, indeed, and their potential for stimulating research ideas about the origins of normal and abnormal characteristics is great. MZ intrapair differences (whether reared apart or not) of a trait or a disease can only reflect nongenetic factors so that the magnitude of such differences permits an estimate of environmental influences. Correspondingly, similarities between MZ twins reared in different (ideally, random) environments, as measured by a correlation, can provide a direct estimate of the contribution of genes to the characteristic at issue. Pronounced discordances imply different environmental exposures *or* protective forces. Unexpected concordances, despite different cultural-ecological commonalities, suggest that something genetic in these identical genotypes is being expressed and thereby open the door to biogenetic lines of investigation into etiology.

Beyond my words of praise for this landmark contribution to the biomedical and biosocial sciences, I feel compelled to end this Introduction with a cautionary quotation that I know would be endorsed by *Juel-Nielsen*. It emanates from the pen of our late and beloved colleague, *James Shields* (1978): “I doubt if MZAs will ever be more numerous and representative enough to provide the main evidence about environment, or about genetics, but they furnish critical examples of persons of identical genotype reared in different homes. They can give unique real-life illustrations of some of the many possible pathways from genes to human behavior—and so will always be of human and scientific interest.”

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Conclusion

HEREDITY AND ENVIRONMENT

The development of the human individual, from conception to death, is determined by an infinitely complicated interplay of those dynamic factors that are implanted in the zygote and those that are found in its surroundings.

This interaction of heredity and environment—its possibilities and limitations in general and in each particular case—is of vital importance to those disciplines which are devoted to the relations of human beings to society, and which are employed on the assumption that the individual may, at least to some extent, be modified by environmental influences. In this connection psychiatry holds a prominent position. In fact, every psychiatric patient represents a heredity-environment problem.

The problems of heredity and environment have been the subject of lively and, very often, passionate debates, which at times have also been characterized by exceeding vagueness with regard to approach and definitions. Heredity and environment are concepts that can be used in widely different meanings, and exact definitions are therefore called for.

The simplest terminology is undoubtedly the one formulated by *Wilhelm Johannsen* (1903), the Danish geneticist, who introduced the terms: *genotype*, by which is understood the total sum of genes in the organism, and *phenotype*, which is its external appearance, and which represents the result of the interplay of the genotype and its surroundings.

This clear distinction was founded on experimental analyses of “pure lines”, in plant- and primitive animal-life. Experiments on, for instance, clones, e. g. a group of organisms reproduced asexually from a single sexually-produced individual and, hence, genotypically identical, prove that the variation within the clone is exclusively due to differences in the surroundings. External conditions may induce the appearance of certain quantitative differences, but the essential and qualitative character remains unchanged, whatever the surroundings.

Quantitative differences are, as a rule, determined by additive gene-systems and, in principle, present varying degrees of environmental lability, whereas qualitative differences are generally determined by single pairs of

genes governed by the Mendelian laws of heredity, and these qualities are entirely, or predominantly, characterized by environmental stability.

The genotype is an abstraction and cannot be observed directly. It represents the genetic material that, by means of the chromosomes and via the gene loci, is transmitted from generation to generation. It must, however, be considered not only structurally but also functionally as a set of dynamic factors or principles.

The phenotype can be directly observed from the appearance of the total characteristics of each individual and, from the phenotypical variations, the influence of external factors can, under certain experimental conditions, be analysed.

The idea of *heredity*, that which is inherited, therefore comprises certain possibilities or limitations of development. The phenotypical realization may vary and the variation is determined, on one hand by the possibilities or the limitations set by the surroundings, on the other hand by the factors implanted in the particular genotype.

The experiments mentioned above demonstrate, furthermore, that different genotypes may react differently to identical changes in surroundings, some standing a change better than others, and, finally, they show that there is a close association between genotype and surroundings, in that an organism seems to attain its "optimal" development under conditions that do not deviate substantially from its "normal" ones.

These observations, and the defining principles dependent upon them, must be presumed to have general validity and to be applicable to the heredity-environment problems of the human individual.

The expression *environment* covers a wide range of meanings, some all-embracing, others very limited, and is, hence, considerably more difficult to define. Taken in its broadest sense, the outside world as a whole, environment embraces every external impulse that can be thought to influence any given individual. This wide concept may be divided on different planes of which a division into a pre-natal and a post-natal environment is the simplest and most pregnant.

In psychiatric-psychological terminology it is natural to divide the post-natal world into an "objective" world, or a "common" human environment, and into an environment or "milieu" that can be termed "individual", "subjective", "experienced" or "relevant". An absolute and sharp psychiatric-psychological distinction between the individual and his environment is of course not possible; it is a case of an inseparable interplay, in the truest sense of the word of complementary phenomena. The individual is of course not only influenced by his environment but he also forms his environment in as far as his possibilities to respond to, or to choose among, different environmental stimuli permit him.

An investigation of the interaction of the human individual and his environment is an attempt to analyse the variability that can be observed among human beings. This phenotypical variation is determined in part by the various genotypes and in part derives from the various environmental influences. Experimentally, the problem can be tackled by a fixation of one of the two variables, either the genotype or the environment.

The *twin method* is commonly considered to be the best method for an investigation of the interplay of heredity and environment, and, in principle, an investigation of monozygotic twins is the most suitable method for a scientific assessment of the importance of environmental factors. This method is based on a theoretical assumption of the existence of two kinds of twins: monozygotic twins, originating with the fertilization of a single egg which has then divided and developed into two independent individuals that are genotypically identical, and dizygotic twins originating from two separate eggs and therefore in genetic respects just as different or as similar as any other siblings.

In ordinary psychiatric-psychological research it is in practice difficult to eliminate, or to bring under complete control, all variations due to environmental factors, but by means of the study of monozygotic twins, it is possible to keep the genotype "constant" whereby an analysis of the influence of the variable environmental factors on the psychological and psychiatric phenotype of the individual should be possible.

Chapter 2

AIMS OF THE INVESTIGATION

The aim of the present work is *to add to our knowledge of the interaction of the individual and his environment by means of an intensive psychiatric-psychological investigation and analysis of the differences and the similarities between monozygotic twins who have been reared apart from early life.*

As monozygotic twins can be assumed to be genotypically identical, all phenotypical differences that can be demonstrated between the twin partners must derive from differences in their total surroundings.

Similarities between monozygotic twins do not, however, necessarily lend themselves to unambiguous interpretation. Twins, in common with other siblings, are generally brought up together; therefore, phenotypical similarities may theoretically derive both from the genotype and from their common environment.

Methodologically, an investigation of separated, monozygotic twins has the advantage of excluding those errors and difficulties that may occur in an assessment of phenotypical differences and similarities, which, in both cases, may be traced back to social and psychological aspects of the twin situation itself.

To be a monozygotic twin and to grow up as such is, undoubtedly, a special social and psychological experience that differs in essential points from all other conditions of upbringing.

The environmental influences, to which monozygotic twins are subjected during their common upbringing, present similarities as well as dissimilarities.

Merely on account of their strong, physical resemblance, it is obvious that monozygotic twins exercise an influence on, and are, at the same time, influenced by persons in their environment in a far more uniform fashion than is the case for those individuals not possessing corresponding outer points of resemblance.

Conversely, at a very early stage in their development, the twins may be treated differently by those around them, primarily perhaps because of slight differences between the twin partners; differences in, for instance, birth weight, size or vigour. As time goes on, this differential treatment may well

develop further, until the relationships of the twins to their surroundings are essentially different, and a diversity of experience the result.

Even though monozygotic twins thus, usually, live under environmental conditions that, on a number of points, are, undoubtedly, more uniform than those under which dizygotic twins, sibs or unrelated persons in the same home are brought up, they do not grow up in absolutely identical environments; were it such a simple matter, then monozygotic twins would, invariably, develop identically. The experiences of everyday life alone prove that this is not the case.

Concomitant with the presence of these similarities and dissimilarities in the environment, the psychological interaction of monozygotic twin partners is usually an extremely complicated process.

In consequence of the continual confrontation with their own reflected image, the twins may develop towards a certain psychological equality, and this special interpersonal relationship will further tend to develop and emphasize points of similarity.

On the other hand, consciously or unconsciously, their personalities will tend to diverge, each being assigned a special "role" and each developing a different relationship to persons in his surroundings. Such a differentiation of personality can be presumed to become, ultimately, so extreme that on some points the twins will present qualities, which are directly opposed, and which have been termed "polar".

When brought up together, an apparently harmonious balance between these opposing tendencies in the twins' development is, usually, achieved, but, psychologically, these conditions are presumably peculiar to monozygotic twins.

From these special social and psychological conditions of the twin situation, it follows, that neither the similarities nor the dissimilarities between monozygotic twins lend themselves to univocal interpretation, since the similarities can be attributed to their common environment and the dissimilarities to the differentiation of personality due to the twin relationship. One cannot even dismiss the idea out of hand that monozygotic twins reared together are likely to present a greater differentiation, particularly with regard to their personalities, than would have been the case, if they had been reared apart.

In an investigation on monozygotic twins brought up apart from early life, completely ignorant of their mutual relationship, or without having had the opportunity to experience themselves as a twin in the psychological sense, the investigator has, first and foremost, the advantage that the psychological aspects of being a monozygotic twin are no longer present, and consequently the risk of misapprehending similarities and dissimilarities between the twin partners can be obviated. Expressed in another way, a study of monozygotic twins reared apart renders possible an investigation and analysis of the de-

velopment, which has taken place, when genotypically identically equipped individuals—respectively the same individual—have been brought up under different environmental constellations.

Such conditions of observation make possible an evaluation, not only of the differences, but also of the similarities between twins.

However, even though monozygotic twins are reared apart, a series of general cultural, social and psychological factors may well be common in their environments, but with respect to conditions that are presumed to be more relevant to the normal and to the psychopathological development of personality, such as for instance the interpersonal relationships in the environment, the opportunity for establishing attachments to objects, as well as the whole psychological structure of the home, it can be expected, beforehand, that the environments in question will show a certain variation, and it is reasonable to assume that this variation will correspond to those differences in environmental factors which can be found between one home and another.

These considerations probably represent the nearest possible fulfilment of the theoretically desirable premise of a psychiatric-psychological research in which the investigator is enabled to control the conditions of investigation in such a way that a series of variables of circumstance—with the exception of certain variables, the influence of which it is especially desired to examine and analyse—can be kept, practically speaking, constant.

However, this, theoretically ideal, method of investigation presents many problems in practice. The prime difficulty in investigating monozygotic twins reared apart lies in their rarity, and the other methodological difficulties are connected with this simple fact.

When the present study was instigated, it would have been desirable, that the approach to the heredity-environment problem had been further defined or specified. This would have meant that we should have been able, simultaneously, to survey the possibilities for collecting and investigating a sufficiently large Danish material of monozygotic twins reared apart, and to ascertain to what extent such a material would comprise sufficient data for the testing of well defined hypotheses or theories. Finally, it would have meant that we, there and then, could have established and handled methods of investigation directed at special aspects of the heredity-environment problem.

Apart from the fact, that, when our investigation of the first pair of twins began in 1954, it could be presumed with fair probability that the number of separated monozygotic twins that could be registered in Denmark and made the object of an investigation would be modest, none of the above mentioned premises existed. The registration and collection of the material was bound to cover at least several years, and, therefore, there was no pos-

sibility of predicting either the nature of the final material or the best way of analysing and presenting it, until its collection had been completed.

The methods of investigation immediately at hand were more or less the same as those employed in ordinary clinical psychiatry and psychology, e. g. psychiatric interviews, medical-psychiatric examinations and clinical evaluation, together with traditional psychometric methods, designed to assess, partly the functions of intelligence, and partly the normal and abnormal development of personality.

When all these conditions concerning the material and the methods of investigation are considered, it is, beforehand, easy to enumerate a number of weighty reasons, why such an investigation of monozygotic twins reared apart could not be expected to produce results leading to explicit, general conclusions on the interplay of heredity and environment and on its significance for the development of normal and pathological traits.

It was obvious from the beginning that the investigation should primarily be directed at an intensive, clinical analysis of each pair of twins over as long an observation period as was practically possible, while a more comprehensive statistical treatment of the data had to be disregarded.

On the other hand, the material procured through the present investigation should not be undervalued. In the case histories and through the accounts of the psychometric examinations we have aimed at a presentation of the results of the investigation in such detail as to enable others to make their own, independent analysis and evaluation of the whole material. At any rate, the collected data furnish a basis for discussion, partly of each, concrete approach, as presented in the description of the interplay of heredity and environment in each case, partly of the heredity-environment problem in its general, psychiatric-psychological aspects. Finally, the material illustrates a series of fundamental problems concerning the conditions of psychiatric-psychological observation, the current methods of investigation and the formation of theories.

The theoretical basis of the investigation and its primary working hypothesis is, hereafter, that differences between monozygotic twins reared apart from early life must be conditioned by differences in their surroundings, and similarities must be taken as an expression of the common genotype.

The first step in the investigation must be to demonstrate differences between the twin partners and, as far as possible, to specify, define, measure and quantify these differences, while paying every heed to the possibilities of error in the evaluation, that are due to defects in the mode of investigation.

The next step must be directed towards an endeavour to explain the demonstrated or presumed differences between the twins in the light of such differences in their environment, as the information concerning their upbringing indicates.

The third and final step concerns the similarities, or lack of dissimilarities, which, unless they permit of another explanation, must be considered to be genotypically determined and to be expressions of a stability against different environmental factors.

As has already been stressed, the results that can be produced by such an investigation and analysis are primarily conditioned by the material of investigation and by the methodology employed.

As is the case with any other scientific method, the twin method is encumbered with several possible sources of error, partly those errors connected with the twin method itself, and partly those that are especially relevant to its use in psychiatric-psychological research.

These methodological problems will be considered in the following chapter.

Chapter 3

PSYCHIATRIC-PSYCHOLOGICAL TWIN RESEARCH

THE TWIN METHOD

Francis Galton (1876) was the first to study life and disease histories of twins with the aim of elucidating the interplay of heredity and environment.

In those days, there was no means, in theory or in practice, of distinguishing between monozygotic and dizygotic twins, but *Galton* divided his material into two groups, one, containing those twins that were "similar" and continued to be so throughout their lives despite differences in their environments, and the other comprising those that were "dissimilar" and continued so. There is every reason to assume that, by this intuitive method of approach, he arrived at a classification closely corresponding to that which has formed the basis of subsequent twin research.

Through his studies of "the history of twins as a criterion of the relative powers of nature and nurture", *Galton* (1883), as well as calling attention to many of the methodological problems that have since been discussed in connection with twin research, arrived at a conclusion, which, as so often happens in the literature, has later been considerably simplified. It is usually contracted into the axiom: "Nature prevails enormously over nurture", and, in this form, it has more or less remained as a challenge to be refuted or to be confirmed by all twin researchers. As pointed out by *Blacker* (1952), the original formulation of *Galton's* conclusion runs as follows: "There is no escape from the conclusion that nature prevails enormously over nurture, when the differences of nurture do not exceed what is commonly found among persons of the same rank of society and in the same country." The conclusion thus contains a significant reservation without which its original import is lost.

Although the observations made by *Galton* have largely historical value today, it is worth mentioning that the development of the twin method was delayed primarily because his publications on this subject—as was also the case with the fundamental observations on the laws of heredity published by *Gregor Mendel* (1865)—lay unheeded for many years.

With the turn of the century, scattered reports of twin studies appeared in the literature, some casuistic, others investigations of a more systematic order. The conclusions of neither category, however, were based on a distinction between monozygotic and dizygotic twins.

The twin method was, in reality, not resumed until the 'twenties. Among its pioneers, *Newman* (1923), *Siemens* (1924), *Dahlberg* (1926), and *Verschuer* (1927) should be mentioned.

Siemens' name stands out among the many who have endeavoured to procure a satisfactory basis for the differentiation between the two types of twins. The advent of the "polysymptomatic similarity test" established the first, practicable method for the solution of this problem, but it must also be admitted that some of the criteria, on which a decision on the zygosity problem originally rested, have lead research into the vicious circle, so disastrous for the twin method, *viz.* that monozygotic twins are monozygotic because they are "similar", while, differences between twins, in principle, indicate that they are probably dizygotic.

The work of *Essen-Möller* (1941 b) produced an entirely lucid and logical basis that satisfies, both in theory and in practice, the question of the zygosity diagnosis of any pair of twins. Owing to the recent, rapid development in serology, so many objective criteria of zygosity are obtained today, that zygosity can now be determined with the 99.9 per cent certainty, to which every scientific method of investigation aspires.

For the use of the twin method, and for the evaluation of its results, it is naturally of fundamental importance, that the zygosity diagnosis rests upon a foundation of extreme exactness; even more must this apply to the present investigation, in which the material is, numerically, so modest. This important question will be dealt with in a later chapter.

Meanwhile, some more general and theoretical objections to the twin method will be considered. The most important have been discussed in a previous publication (*Juel-Nielsen, Nielsen & Hauge, 1958*).

For man there is no direct, cytological proof of the prime requirement of the twin method, that only two types of twins exist, but, in the course of time, comprehensive, empirical material, completely supporting this theoretical assumption, has been produced both in general, and in human genetic research.

Various theories of the occurrence of twins in man have been put forward. One of the theories is based on the assumption of oöcytic twins, a third type, developed from a single egg, which, after dividing, has been fertilized by two sperms. On this assumption the two individuals thus forthcoming must be equipped with identical genes on the maternal side, while the paternal genes are different, and, genotypically, such twins are intermediate to monozygotic and dizygotic twins. So far, however, no absolute evidence of the existence of such a type of twins has been presented, and, at all events, its occurrence must be extremely rare, and for that reason alone, this theoretical contingency may be disregarded in an ordinary twin investigation.

Neither has cytoplasmatic heredity been proved in man; in theory, primary

dissimilarities, not conditioned by genes, may be assumed in monozygotic twins, and these differences may primarily manifest themselves as the so-called "reversed asymmetry-phenomenon" or "mirror imaging", which corresponds to the asymmetry of the two body halves of the same individual. In Scandinavia, *Dahlberg* (1926, 1930), has used the concept: "genotypical asymmetry" without, however, wishing to affirm that monozygotic twins are really genotypically dissimilar. *Bouterweek* (1934) finds in his reflections on this phenomenon, "Rechts-Links-Abwandlung", the explanation of why it is possible to observe differences, including psychical, between monozygotic twins, whereas he does not seem to attach much significance to the postnatal environment, in this respect. *Newman, Freeman & Holzinger* (1937) take asymmetry to be a "third factor", which is connected with the biological phenomenon of twinning, and, therefore, independent of the factors of heredity and environment.

In this connection, the many investigations on the frequent occurrence of left-handedness in twins should be mentioned; most investigators have discovered an increased frequency in twins, not only in monozygotic, but also in dizygotic twins. In a survey of the question of asymmetry and lateral inversion in monozygotic twins, *Verschuier* (1959) has summed up the discussion to the effect that, in a comparison between the homologous body halves of monozygotic twins, there is a greater similarity between them, than between the right and left body halves of the same individual, and the frequency of genuine asymmetries, i. e. organ-asymmetries, is the same as for other persons, and, finally, accidental disturbances of the symmetry phenomenon are scattered quite by chance in monozygotic twins.

All these hypotheses have, particularly in the past, been the objects of investigation and discussion. The majority of the many investigations on these problems have been unable to establish with any certainty that these hypotheses have critical significance. In any case, they do not shake the prime theoretical requirement of the twin method: that monozygotic twins are equipped with an identical genotype.

Another series of theoretical objections to the twin method has been put forward by *Price* (1950), who made a thorough survey of the sources of error that, conceivably, could be set in relation to the natal and prenatal conditions of twins, particularly of monozygotic twins. He especially emphasizes that, when accounting for the frequent dissimilarities between monozygotic twins, it is possible that the significance of the postnatal environmental factors are exaggerated, and he draws attention to possible prenatal factors, for instance, an unequal share of the maternal circulation in embryo that may cause dissimilarities in twins.

No matter how important these "primary biases" may be in evaluating the results produced by the twin method, they are, nevertheless, exclusively

theoretical and cannot yet be said to be sufficiently documented. They serve chiefly to emphasize the fact that the concept of environment also embraces prenatal conditions, and that our knowledge on this point is still incomplete; however, they do not affect the prime, theoretical assumption of the twin method.

Finally, a last group of objections must be considered. They deal with the suggestion that twins deviate, biologically, from other people to such an extent that it is open to discussion, whether results obtained by the twin method are generally applicable. Investigators, i. a. *Brander* (1935) have pointed out that twins, monozygotic more so than dizygotic, are often characterized by prematurity and a tendency to birth lesions; others have observed a delayed speech development, greater frequency of intelligence defects, or a correlation of twin births and the appearance of mental disorders such as mental deficiency and epilepsy.

Most of these studies are concentrated upon conditions in twin pregnancies and the natal period, and upon conditions to which not only similarities but also dissimilarities between the twins can be attributed. Twin investigations made late in childhood or in adulthood have not, however, with any certainty, proved that twins in general deviate, biologically or mentally, from other persons. That twins, and in particular monozygotic twins, are, during their upbringing, in a special social and psychological situation, differing in many ways from the usual environmental conditions of other persons, has already been touched upon, and will later be further discussed.

All in all, the above mentioned objections to the twin method do not furnish sufficient reasons for rejecting the theoretical basis of the twin method.

On the other hand the twin phenomenon is biologically characterized by a series of special conditions, possibly conducive to errors of judgement, both with regard to differences and similarities between the twin partners.

Theoretically it is conceivable that certain intrauterine environmental factors may play a considerable role in the appearance of certain phenotypical similarities or dissimilarities, and, possibly, the prenatal factors are more varied for monozygotic than for dizygotic twins.

These possible sources of error cannot, however, be avoided. As no proof of their general significance exists, the importance to be attached to them must vary from one investigation to another; attention must be directed to conditions that are presumably relevant, and their significance for the evaluation of the results, in each case as well as in the total investigation, must be estimated.

In this connection, one should, however, realize that the more similarities and differences can be attributed to factors in the prenatal environment, the less they can derive from factors in the postnatal environment. Theoretically,

the significance of postnatal environmental factors may well be reduced to an elaboration of some congenital, primary, fundamental dissimilarities or similarities between the twins, due to prenatal factors. Owing to our present lack of knowledge regarding the prenatal and the natal conditions, or by simply ignoring these theroretically possible sources of error, the significance of postnatal environmental factors in relation to the appearance of phenotypical similarities and dissimilarities can be overrated.

This risk, of course, applies equally to psychiatric-psychological investigations of twins, although it is here, beforehand, perhaps especially difficult to evaluate and to accept the significance of such prenatal factors.

USE IN PSYCHIATRIC-PSYCHOLOGICAL RESEARCH

The twin method has been widely used in psychiatric-psychological research. The comprehensive literature extant in 1951 has been compiled for both fields in *Gedda's* monumental work.

In psychiatry, the twin method has contributed towards the elucidation of the importance of heredity in schizophrenia, manic-depressive psychosis, epilepsy, mental deficiency, certain psychopathic and criminal states and other behaviour disorders or mentally abnormal conditions. Recent surveys of twin research in psychiatry are to be found in the publications of *Kallmann* (1959) and *Shields & Slater* (1960). Scandinavian accounts have been given by *Essen-Möller* (1963) and *Strömngren* (1964).

In psychology, a long series of twin investigations has been made on intelligence functions, normal personality structure and on more special mental characteristics and abilities. An excellent survey has been published by *Woodworth* (1941); more recent accounts are to be found in the works of *Eysenck* (1956) and *Fuller & Thompson* (1960). Scandinavian compilations have been made by *Lunde* (1937), *Lehtovaara* (1938), *Østlyngen* (1949), *Smith* (1949), and *Husén* (1953).

THE "CLASSICAL" TWIN METHOD AND THE CONCORDANCE-DISCORDANCE CONCEPT

Most psychiatric-psychological twin investigations have been made by means of the twin method which traditionally comprises a comparison between monozygotic and dizygotic twins, with the employment of the concordance-discordance concept, and which is used under the assumption that the environmental conditions of monozygotic twins do not differ from those of dizygotic twins.

An agreement between the twin partners with regard to a certain disease or quality is termed "concordance", and a difference, "discordance". When employed for diseases or characteristics showing a distinct qualitative variation of the either-or type, these concepts are satisfactory in theory and in practice.

In psychiatric-psychological research, the concordance-discordance concept has no little uncertainty, which may result in an over- as well as an under-rating of similarities and differences between twin partners.

These problems arise partly from the difficulties in defining the limits between psychiatric disease entities and normal-psychological characteristics, and partly from the various uncertainties and possible sources of error of psychiatric and psychometric methods of investigation.

Any comparison of psychiatric and psychological characteristics between twin partners is determined by the "plane" on which the comparison is made and by the reference system employed. With the methods of investigation available, the reliability and the errors in measurement will very often be equal to the differences required to be registered.

Furthermore, there is an association between the intensity of the investigation on the one hand, and, on the other, the use of a concordance concept, which in some cases may be narrower and more superficial, in other cases more comprehensive and differentiated.

The usual employment of the concordance concept carries with it the implication of an agreement between the twins with regard to the presence of some more or less well defined disease or quality. In most twin investigations in which the presence of such concordance has been made probable, the time of manifestation, the symptomatology and the course in the monozygotic twins have usually been markedly different, which imply that non-genetic factors must have played a significant role in the development of the disease or quality in question.

A "discordance" for, for instance, psychosis may simply be due to a more or less intensive investigation resulting in the designation of a "mentally normal" or a "non-psychotic but psychiatrically remarkable" twin partner. In cases of other psychiatric diseases such as, for instance, the neuroses, where a clear distinction from the normal variation can be even further blurred, the concordance-discordance concept is naturally even more difficult to employ, but also in such cases a postulated discordance, or "incomplete" concordance, indicates that non-genetic factors have promoted or hindered the manifestation of the disorder in question.

Accordingly, in psychiatric-psychological research, it is not only in the cases of remarkably high, but also in low concordance frequencies that the diagnostic concepts of the investigator, the intensity of his methods of investigation, and, finally, his subjective interpretation of the assembled data, are important.

SPECIAL TWIN METHODS

As stated previously, the twin method is a valuable method of research for elucidating the influence of environmental factors. In consequence, the "classical" use of the twin method is in some investigations substituted by special methods, designed to examine series comprising primarily monozygotic twins, and with special reference to an analysis of the causes of the relationships or the pathogenic links in an incomplete manifestation or discordance.

Luxenburger (1928) and *Essen-Möller* (1941 a) have pointed out that studies of monozygotic twins with psychiatric disorders can serve to elucidate the degree to which an attachment of various psychic symptoms to certain psychiatric syndromes may be warranted. *Essen-Möller* (1963) has termed this method the "nosological" twin method.

Another twin method, the so-called "historical" method is likewise primarily directed at a discordance analysis. As put forward by *Essen-Möller* (1963), this method corresponds to the procedure in ordinary clinical-diagnostic routine, except that, besides the patient, the investigation also covers a genetically identical control. Instructive examples of such analyses of discordance have been presented especially by *Slater* (1953).

A third method, the "experimental", approaches the problems from a direction opposite to the two already mentioned, in that it attempts to examine the possibilities of various environmental influences to produce differences in the development of monozygotic twin partners. This method was originally introduced by *Gesell & Thompson* (1929). Monozygotic twins were placed under different pedagogic influences, for instance, one twin was trained in some special accomplishment with the co-twin as control.

The experimental method has also been employed in psychiatric and psychometric research. *Dencker* (1958), at the instigation of *Essen-Möller*, studied the neuro-psychiatric and psychological conditions resulting from closed head injuries, on a basis of a material consisting of twins, only one of whom had been subjected to head injury. Correspondingly, *Kaij* (1962) investigated twin partners, one of whom had suffered from alcoholic abuse. Casuistical reports have appeared of experimental studies of monozygotic twins, concordant for schizophrenia but treated differently, for instance, one twin with insulin and the other with cardiazol, *Murphy & Luidens* (1939), one with lobotomy, *Weatherly & Deabler* (1954, 1958), or both, simultaneously, with reserpine, *Benaim* (1960).

Investigations of twins reared apart must be placed in connection with these special methods since they are primarily based on investigations of monozygotic twins with an emphasis on an analysis of differences between the twin partners.

As has been stated above, the traditional use of the twin method entails

the assumption that the environmental factors are, on an average, just as alike, or just as unlike, for monozygotic as for dizygotic twins. This assumption, especially in the case of psychiatric-psychological conditions, may, as mentioned previously, be queried and will be considered in detail in the following.

SOCIAL AND PSYCHOLOGICAL ASPECTS OF BEING A MONOZYGOTIC TWIN

As already pointed out by *Galton*, the personalities of monozygotic twins often develop in apparently diametrically opposed directions: "The one was the more vigorous, fearless, energetic; the other was gentle, clinging, and timid; or the one was the more ardent, the other more calm, and placid; or again, the one was the more independent, original, and self-contained; the other the more generous, hasty, and vivacious. In short the difference was that of intensity or energy in one or other of this protean forms; it did not extend more deeply into the structure of the character. The difference was in the keynote, not in the melody".

Schulte (1929) and *Poll* (1930) seem, however, to have been the first to have drawn attention to the finding that the relations between twins and the twins' relations to persons in their surroundings are considerably more similar for monozygotic than for dizygotic twins.

Since then a number of authors: *Hartmann & Stumpf* (1930), *Stocks* (1930), *von Bracken* (1934), *Lunde* (1937), *Newman, Freeman & Holzinger* (1937), *Lehtovaara* (1938), *Woodworth* (1941), *Østlyngen* (1949) and *Zasso* (1960) have discussed this question and have found the assumption confirmed that the environment in which twins are brought up is generally much more alike for monozygotic than for dizygotic twins. By reason of their striking outward resemblance, monozygotic twins will from a very early stage influence those in their surroundings and also each other in a very uniform fashion, while nothing equivalent should be characteristic for dizygotic twins. This similarity in the environment of monozygotic twins must naturally ultimately be due to their identical genotype and their special possibilities for interaction upon their surroundings. Furthermore, monozygotic twins, in contrast to dizygotic, are linked during childhood, by a special interpersonal relationship and a strong sense of affinity, and a mutual identification process may explain a number of psychic similarities presented by the twins later on.

Other writers have assumed yet more complicated psychological relations between twins. *Köhn* (1931) is of the opinion that environmental factors are actually more different for monozygotic than for dizygotic twins, because their special psychological situation impels monozygotics to individual self-assertation, and their developments take diverging courses with psychological

differences as a result. The differences in personality development in dizygotics, on the other hand, are primarily based upon their genotypical differences and are not conditioned by special psychological factors attached to the twin situation itself.

More recently, *Bluekercken* (1932), *Lohmeyer* (1935), *Kerr* (1936), *von Bracken* (1936), *Schiller* (1937), *Woodworth* (1941), and *Østlyngen* (1949) have also indicated that the development of monozygotic twins differ on account of their "complementary" roles. *Kerr* (1936) thinks that "a protest", conscious or unconscious, against their psychological situation is the reason for the tendency of monozygotic twins to develop different temperaments, *von Bracken* (1936) finds both "uniforming" and "differentiating" tendencies in monozygotic twins, a differentiation towards a more extroverted and a more introverted partner being characteristic.

Slater (1953) has stressed the finding that one twin becomes more active, leading, and dominating, while the twin partner becomes the reticent, passive, and submissive, but, *Slater* raises the question whether the concepts "dominance" and "submissiveness" are really contrasts, in that he refers to the experience of clinical psychiatry in which persons, who demonstrate dominance in one environment and submissiveness in another, are often met with, and who are, moreover, perfectly capable of switching from one to the other.

Most recently *Dencker* (1963) has studied the "dominance-submissiveness" relation. Like *Shields* (1954), he finds that there is, among twins, a significant association between higher birth weight and dominance, but none between higher birth weight and weight later on. He does not, however, think that this association is significant in itself for the later development of the personality, but he points out that the "dominance-submissiveness" relationship, once established, seldom changes between twins. According to *Dencker*, his investigations demonstrate that psychological factors are of greater significance than factors of an organic nature for the promotion of a differentiation in monozygotic twins.

These special psychological conditions of twins have also attracted the attention of psychoanalysts; particularly, the identification process and the overlapping in the structure of the ego and the superego which can be assumed in twins. However, as some of these studies have been made on dizygotic twins, apparently with preference for opposite-sexed twins, the point is rather weakened.

Others, for instance *Burlingham* (1952), who, for a considerable length of time, made minute observations of three pairs of monozygotic twins from birth, noticed that the larger, and physically more robust twin, usually, but not invariably, became the more active, while the physically weaker partner became the more passive. She emphasizes the great significance in the twin environment of the defence mechanism of identification, and, particular-

ly, that this finding makes an evaluation of differences and similarities in twins difficult. With respect to the parent-child relationship and its possible significance for the development of similarities and dissimilarities, the mother's or the father's acceptance of and attitude to each individual twin can never be absolutely identical, a factor that, together with the whole, psychologically complicated, twin situation, may contribute to the finding that the social and psychological environment is experienced differently by the twins; hence, it would be an error to affirm that the environment of monozygotic twins reared together is the same.

For all the above mentioned conditions concerning the special psychological conditions of monozygotic twins it must be realized that they are hypotheses, which are difficult of proof, either one way or the other, but, methodologically, they make a theoretically adequate evaluation of psychological similarities and differences between the twins very difficult, because both can be said to have evolved from the twin situation. As pointed out previously, an investigation of twins reared apart from early life is in practice the best methodological short-cut available. The ideal material would be one in which monozygotic twins were separated at birth, put into foster or adoptive homes and brought up without knowledge of each other's existence, as they would then not be twins in the psychological sense but merely individuals with identical genotypes living in separate environments.

Bleuler (1952) has doubted the value of twin studies because monozygotic twins, even when they are reared apart, yet present considerable similarities, and this may well be because the twins procure for themselves environments that are alike.

This theoretical objection has been discussed in a previous Danish publication, *Juel-Nielsen & Linnemann* (1958).

The objection must be said to be a far too narrow and dogmatic apprehension of the possibilities of the interplay of a given genotype and the various factors that must be included in the concept of environment.

That an association exists between genotype and environment is obvious, and that monozygotic twins reared apart present similarities is, as pointed out by *Schulz* (1956), at any rate with regard to outward characteristics, a result which ultimately derives from their identical genotype. But, as emphasized by *Kaij* (1962), an individual's choice of childhood environment, is certainly restricted by a number of social, psychological and cultural factors; twins, as little as others, can freely choose their own home and childhood environment, with its characteristic methods of upbringing, its schooling, etc., to say nothing of the psychological factors linked to interpersonal relationships, which last, particularly, vary from home to home.

It is an over-simplification of the problems to state that monozygotic twins become "similar"; it would be a truer generalization to state that they always

become “different”, although it may be difficult to define just how great the actual difference is.

That which investigations of monozygotic twins reared apart aim to elucidate is *the interplay of a given genotype and two given environments* with their special limitations and possibilities, both in cases where this interplay runs a parallel and harmonious course and also in such cases where the interplay, by the very reason of the given genotype-environment constellation, produces a deviation in the twins with regard to definite mental characteristics or psychiatric disorders.

Bleuler's objection represent a total rejection of the use of the twin method in psychiatric-psychological research and *Kaij's* statement, that *Bleuler* “throws away the egg with the shell”, seems justifiable. Even though, at first sight, the objections may seem logical enough, a closer consideration of them reveals that they are invalid in theory, and they are, moreover, inconsistent with the mass of experience obtained from investigations of monozygotic twins reared apart.

Chapter 4

PREVIOUS INVESTIGATIONS OF MONOZYGOTIC TWINS REARED APART

As the occurrence of twins who have been separated in childhood is extremely rare, it is relatively easy to survey the international literature relating to it.

It consists, chiefly, of two considerable and systematic investigations, an American by *Newman, Freeman & Holzinger*, published in 1937, in which 19 pairs of separated monozygotic twins were studied, and a recent English investigation by *Shields* (1962), comprising the largest material of separated, monozygotic twins to date, 44 pairs in all.

Beyond these two studies, the literature contains only scattered reports of isolated cases of separated, monozygotic twins.

Popenoe (1922) was the first to publish a short report of a pair of separated, monozygotic twins. This pair was studied exhaustively by *Muller* (1925), whose formulation of the problems, the methods of investigation and analysis of the results have remained as a model for all subsequent twin studies of this kind. Further American studies of single pairs of separated, monozygotic twins have been published by the following: *Rosanoff, Handy & Plesset* (1935, 1937), *Kallmann* (1938), *Gardner & Newman* (1940), *Burks* (1942), *Stephens & Thompson* (1943), and *Kallmann & Roth* (1956). *Burks & Roe* (1949) studied four pairs of separated twins, but, as pointed out by *Shields* (1962), one of the pairs was presumably dizygotic. *Schwesinger* (1952) investigated a Mexican pair.

English studies have been made by *Saudek* (1934), *Yates & Brash* (1941), *Burt* (1943), *Craike & Slater* (1945), and *Slater* (1961), who have each investigated a single pair; the last mentioned pair is also included in the large material investigated by *Shields* (1962).

In Germany, *Lange* (1931) has investigated one pair, *Bouterweek* (1943) investigated two pairs in Austria, and, finally, there are two Japanese studies published by *Fukuoka* (1937) and by *Yoshimasu* (1941), each including a single pair of separated twins.

In Scandinavia, there are no previous accounts of systematic investigations on separated twins, but in some of the recent psychiatric twin investigations

based on a systematical collection of twins, accounts have been given of a few pairs of monozygotic twins brought up apart. In Sweden, *Stenstedt* (1952) and *Dencker* (1958) each observed a single pair in their series, and *Kaij* (1962) has described two pairs of separated twins. In Finland, *Tienari* (1963) found two pairs and, in Norway, *Kringlen* (1964) had one pair of separated, monozygotic twins in their relatively small twin series.

Together with the present Danish material, the total number of separated, monozygotic twins in the international literature amounts to at least 103 pairs.

The greater number of these twins have been classified as either mentally normal or as presenting only slight, neurotic or characterological, disorders.

Those few cases where either one or both of the twins presented severe psychiatric illnesses, particularly psychotic states, are of special interest. Four pairs, published respectively by *Kallmann* (1938), *Craike & Slater* (1945), *Kallmann & Roth* (1956), and *Slater* (1961), were convincingly concordant for *schizophrenia*. These cases lend themselves to the traditional objection, originally offered by *Luxenburger* (1928), that the cases were chosen and published just because they presented concordance. In the above mentioned systematically collected twin materials of *Tienari* (1963) and *Kringlen* (1964) containing, respectively, two pairs and one pair of separated, monozygotic twins, the cases were classified as being discordant for schizophrenia.

Rosanoff et. al (1935), who also selected his material systematically, found a pair of separated twins, who both presented a temporary, very similar psychotic state, which, from the description, seems to have been a *psychogenic psychosis*. *Stenstedt* (1952) in his material had one pair of separated twins who were concordant for *manic-depressive psychosis*. In the twin series of *Lange* (1931) and *Yoshimasu* (1941), dealing with *criminality*, there were, in the former, a concordant, and in the latter, a discordant pair of separated twins. Finally, *Kaij* (1962) in his study of alcoholism had two pairs of separated twins, both of whom were concordant.

Critical surveys of these investigations on single pairs of separated twins have been made by *Newman, Freeman & Holzinger* (1937) and by *Shields* (1962). In the following, it is these two large investigations alone that will be considered.

Newman, Freeman & Holzinger (1937).

They collected their twin material over a ten year period. The majority of the 19 pairs of separated twins were studied in connection with a large exhibition held in Chicago; a few pairs of twins, presumably monozygotic, refused to take part in the investigation.

The material comprises 12 female and 7 male pairs, of ages varying from 11–59 years with a considerable accumulation in the younger age groups.

Most of the pairs had been separated in early childhood, nine in the course of the 1st, six in the 2nd, and two in the 3rd years of life; further, there were one pair separated in the 6th and two pairs in their 8th years of life.

The diagnosis of zygosity, resting on the methods of classification existing at that time, must be termed well established.

Besides various anthropological measurements, the twins were subjected to a comprehensive psychological test battery, both for intelligence and for personality: The Stanford Revision of the Binet-Simon Test of Intelligence, the Otis Self-Administering Test of Mental Ability, the Thurstone Psychological Examination (American Council Test), the International Test (devised by Stuart C. Dodd), the Stanford Achievement Test, the Downey Will-Temperament Test, the Individual Form (Complete) and the Woodworth-Mathews Personal Data Sheet, the Pressey Test of the Emotions, the Kent-Rosanoff Free Association Test, and also an analysis of handwriting.

The results of the investigation are presented in great detail, great attention being paid to the statistical analysis. As basis for comparison, corresponding investigations were made on 50 pairs of monozygotic, and 50 pairs of dizygotic, same-sexed twins reared together.

A brief summary of the results and the main conclusions cannot give due justice to this remarkable investigation.

In the intelligence tests, it was found that monozygotic twins reared apart were less similar than monozygotic twins reared together, but more similar than dizygotic twins reared together. The difference between the monozygotic twins was chiefly derived from four pairs whose schooling and education had been very different. An analysis of the environments of the total material revealed that slight deviations in the environment had but little influence on the results obtained from the intelligence testing.

In the personality tests, the similarities in the test results achieved by the monozygotic twins reared apart were less apparent, and an analysis of the environments showed no certain relations between differences in personality and social and educational differences.

In one particular personality test (the Woodworth-Mathews), a difference was found between monozygotic and dizygotic twins, in that the separated twins were actually slightly more similar than those reared together. Without further proof this finding can naturally not be accepted as evidence that twins reared together are, with regard to personality, more different than those reared apart. As *Shields* has remarked in this connection, the metrical difficulties are so very much greater in personality tests than in intelligence tests.

As has been pointed out by *Woodworth* (1941) and by *Shields* (1962), the opinions of the three authors on the value of the conclusions to be drawn from their investigation vary a good deal: *Freeman*, the psychologist, finds that the investigation reveals that "human nature may be improved or de-

based to a degree that many have thought impossible”, *Holzinger*, the statistician, point out that “relatively great environmental differences must be present to produce a noticeable effect”, and, finally, *Newman*, the biologist, admits to have been “much more impressed with the very great intrapair similarities after the twins had been exposed to all sorts of environmental differences”.

This impressive pioneer work has been widely quoted. Some have criticized the statistical analysis, others have taken the numerical results out of their original contexts and, ignoring the careful reservations of the authors, have utilized them to prove or to disprove various hypotheses. Few seem to have taken the trouble to read the book in its entirety, the instructive case material least of all.

Shields (1962).

He started the collection of his impressive material in 1953 in connection with a B. B. C. Television programme on the subject of twin research, in which a special appeal was made to monozygotic twins brought up apart to fill in a questionnaire and come forward in the interests of scientific research.

From this questionnaire 41 pairs of separated twins were derived, the remaining three pairs were procured from other sources, two pairs in connection with the admission of one of the twins to a psychiatric department. A small number of, presumably monozygotic, twin pairs refused to co-operate.

The material comprised 29 female and 15 male pairs of twins of ages varying from 8–59 years. The majority, 30 pairs altogether, had been separated in the first year of life, and, of these, most at birth, or within the first few months. Six pairs were separated in their 2nd and three pairs in their 3rd years, two pairs in their 4th and one pair in their 5th years. Finally, there were three pairs who had been separated when seven, eight and nine years old respectively.

The diagnosis of zygosity was for the most part established by blood group testing.

The author succeeded in obtaining personal interviews with practically every pair of twins. The investigation was carried out by means of interviews conducted after the twins had each been sent a detailed booklet for completion. The twins were given intelligence tests consisting of the non-verbal Dominoes Intelligence Test and the verbal Synonyms Section (Set A) of the Mill Hill Vocabulary (Form B, 1948). Personality was tested by the Self-Rating Questionnaire (devised by Eysenck) to disclose the personality dimensions “extraversion” and “neuroticism”. On the basis of his interviews, the author made a rating of similarities and differences between the twins with regard to their personalities, and, in connection with this, an analysis of the differences in their environments.

Control groups of 44 monozygotic and 32 dizygotic pairs of twins, matched for sex and reared together, were obtained from the same source.

In the arrangement of his material, *Shields* has attached equal importance to a statistical analysis and an analysis of the material obtained through the interviews.

In the intelligence tests, it was found that separated, monozygotic twins were less alike than the controls. The differences were less marked than the corresponding observations made by *Newman et al.*, but they did, however, show a co-relation with slight differences in the childhood environments.

In the personality tests, no certain differences were found between separated and controls, although there was a tendency for separated to show greater similarities for "extroversion" and "neuroticism" than was the case for twins brought up together.

The analysis of the presumed causes for differences in personality showed that the difference in personality between monozygotic twins brought up together may possibly be due to the twinship, and that the association between leadership and extroversion in monozygotic twins was a possible explanation of why twins brought up together had personalities that were more dissimilar, particularly with regard to extroversion, than was the case for the separated twins.

On the other hand, an analysis of the author's rating of similarities in personality showed that separated twins were less similar than those brought up together, but the difference was not statistically significant, and its direction was not confirmed by all the psychological tests. In a few cases, and by a systematic analysis of the case material, a co-relation of the early environment to the findings with regard to personality was disclosed, although *Shields* does not find, that the differences in upbringing stand as the all important cause of the differences in the later personality.

The author, who is a sociologist with wide experience in psychiatric-genetical research, emphasizes that the investigation has clearly demonstrated the significance of genetic factors for the development of both intelligence and personality. He concludes by making two general propositions which, despite their mutual contradiction, are supported by the results of the investigation:

- 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".

In spite of the differences of material and method in the investigations of *Newman, Freeman & Holzinger* and *Shields*, the results produced must, on the whole, be said to show close agreement.

The investigations have both entailed enormous labour. Both have been accomplished with the exercise of meticulous care, and with a critical treatment and interpretation of the collected data. Some points, seemingly weak from a critical angle, can be mentioned, but there can be no doubt that these twin investigations have been carried out with as great precision as is practically possible for this kind of research.

The greatest care has been taken in both investigations to counter any possible theoretical objections with which the collected material might be encumbered; the assembling of comprehensive twin materials to act as control on selection, is an example of this.

In attempting to place the present investigation against this background, it is, to begin with, reasonable to point out that, as there are only two systematic investigations on monozygotic twins reared apart, one American and one English, any possibility for carrying out a corresponding Scandinavian investigation should be utilized.

Next, it must be considered to what extent the present investigation may serve as an object of comparison with its predecessors, especially whether such an investigation can produce a further contribution towards the elucidation of the methodological problems and the results of such investigations.

As outlined in the introductory chapter, the Danish investigation was curbed from the start in its possibilities of producing a twin material that was numerically comprehensive. With the exception of certain test results, a detailed statistical analysis of the results was out of the question, and, emphasis was chiefly laid upon an investigation directed at an analysis of the casuistic material.

The necessity for, and the desirability of, supplementing the Danish investigation of separated twins with an investigation of a "control material" has been considered carefully.

In favour of the production of such a material, it might, to begin with, be maintained, that the psychometric methods of investigation employed have not been standardized upon a Danish population, but this disadvantage would not be satisfactorily remedied by an investigation of a control material which would of necessity be numerically very modest.

The present twin material owes its origin to a nation wide registration of twin births (cf. the following chapter). Even though the final material cannot fully claim to represent a completely unselected series of twins, yet the inclusion of a control material has seemed less imperative than was the case in the American and English investigations in which the probands were twin pairs who had come forward voluntarily.

Finally it must be pointed out that, quite early on in the investigation, it was considered doubtful whether a control material, consisting of either

monozygotic or dizygotic twins reared together, would, from the point of view of the methods of investigation employed, provide a control group that was logically and theoretically ideal. This opinion can be supported by reference to the difficulties, considered in a previous chapter, that are met with in evaluating the hypotheses that have been put forward concerning the special psychological conditions of monozygotic twins brought up together. Also the differences that may appear in personality testing, between separated twins and twins brought up together, point in the same direction; at any rate, our opinion is justified by the fact that, in an investigation of monozygotic twins reared together, there would be a theoretical possibility that the forthcoming results might produce difficulties of interpretation, which could not clearly be outweighed by the advantage of such a control investigation.

A control material comprising unrelated persons matched for sex and age and brought up together, or perhaps, as is the case with separated twins and with other persons, brought up in different environments, would, theoretically, be logical, but such an investigation is hardly practicable; after all, investigations of twins present certain advantages, because twins usually accept that a special interest is connected with them, and they thus provide a "neutral" basis for an investigation of "normal" persons.

In the light of all these considerations, our investigation had not got very far before it was decided, instead of collecting a control material, to utilize the special possibilities of a country of the size of Denmark for a follow-up study in which a series of examinations over a period of years could be carried out. By means of interviews given at suitable intervals a longitudinal observation and comparison of the twins could be made. At the same time such a long term study provides an opportunity for retesting the twins and for collecting material which could be used for an evaluation of the reliability of the tests employed.

On the other hand, an intensive study of twins carries, undoubtedly, a certain risk of producing a "contrast effect", e. g. the less marked or the less accessible differences between twins who, on the whole, present many points of similarity, may become more outstanding, and, perhaps, especially so on the clinical examination and evaluation. This risk should be counteracted by the longitudinal observation which creates especially favourable possibilities for evaluating whether such differences, or presumed differences, are more or less conditioned by temporary circumstances or whether they are of a more permanent character.

In short, the present work must be regarded as an attempt to supplement, by means of an investigation that is predominantly intensive, the already existing more extensive investigations of monozygotic twins reared apart.

Chapter 5

COLLECTION AND SELECTION OF MATERIAL

The final material for investigation comprises 12 pairs of monozygotic twins, 9 female and 3 male, all of whom have been reared apart since early life. The twins are all adults, varying in ages, reckoned from their incorporation in the investigation, from 22 to 77 years.

Brief account of the history of the investigation

Our investigation started in the summer of 1954, and was brought about by the chance coincidence of various circumstances, if chance, it may be called, since the investigator had, during the foregoing years, been particularly occupied with the possibilities of the twin method in psychiatric-psychological research.

The starting point was our contact with a 56-year-old female patient at the outpatient department of the State Hospital, Risskov, to which I was then attached. This patient stated that she was a twin and had been separated from her twin sister at the age of three weeks, and had, for various reasons, had no contact with her for a number of years. The information she gave seemed to indicate a case of monozygotic twins.

A few weeks later, I was approached by a journalist with a story of 35-year-old female twins, presumably monozygotic, who had been brought up apart. After having been separated since they were two months old, they had just been reunited, because they had been mistaken for each other.

As an investigation of separated, monozygotic twins had not previously been made in Denmark, I decided to make these two pairs the object of a closer observation and examination, which was then started. The psychometric examinations were made by a psychologist, *Alan Mogensen*.

We waited expectantly for the inevitable third pair to turn up, but this took some time. Meanwhile, my attention was drawn to the comprehensive, systematic registration of twins then just being started at the Institute of Human Genetics of the University of Copenhagen. *Harvald & Hauge* (1956, 1961, 1963) had here started a registration of every twin birth occurring in Denmark from 1870 to 1910, amounting to ca. 38,000 pairs, and they had begun to search out all living twins.

In the autumn of 1955, I became attached to the afore-mentioned institute, and the investigation material was mainly collected and examined, while I held this appointment, which lasted until the summer of 1959.

In the course of 1955, three further pairs were found, five pairs were included in 1956, and the last two pairs in 1957.

The procedure of the investigation of the first eight pairs was presented at "The First International Congress of Human Genetics" in 1956 (*Juel-Nielsen & Mogensen, 1958*). As, in the course of 1958, no further pairs were brought to light, it was decided in the summer of 1959 to close the search for further material and to bring our investigation to an end.

CRITERIA OF SELECTION

For including in the material, the following requirements had to be satisfied: The twins must be:

- 1) *alive*
- 2) *reared apart from early life*
- 3) *monozygotic.*

The primary material consisted of all twins born in the period 1870 to 1910 and appearing in the afore-mentioned twin register. As will be described below, the material also comprises twins, who were born after 1910 and were found in various ways.

MATERIAL FROM THE TWIN REGISTER

On the basis of the register at the Institute of Human Genetics, it was attempted to search out every pair of twins that were of the same sex, and, presumably, reared apart in childhood.

This search gradually brought about 40 pairs of twins to light. A rather large number of these pairs had to be ruled out as it was found that either one, or both, twins had died in childhood. According to *Harvald & Hauge (1963)*, between 50–60 per cent of the pairs in the primary material may be reckoned to have been separated by death before the 5th year.

In all, 23 pairs remained. These twins were carefully, and often laboriously, searched out and investigated. The following 15 pairs were ruled out as they did not satisfy the stipulated criteria:

In the first place, four pairs were excluded because either one, or both, twins, despite the most thorough searchings through the usual public registers and channels, could not be located; in one case it is most probable, considering their age (born 1875), that both were dead at the time of the enquiry; in another case, the twin partner had presumably died, although this could

not be verified. Thus, in none of these four cases could zygosity be established.

Then there were three pairs where one of the twins had died as an adult; in two of these cases the twins were indubitably monozygotic (see below).

In a further two cases, the twins had not been separated until relatively late in childhood, when about 10 years old. It is highly probable (see below), that one of these pairs was monozygotic.

Of the remainder, six pairs were classified as dizygotic twins, four having different blood groups and two showing very marked anthropological differences, particularly of eye and hair colour.

There then remained *eight* pairs who all complied with the stipulated criteria.

The three, presumably monozygotic, pairs mentioned above, who did not fulfil the selection requirements, either because one of the twins had died, or because they had not been separated until late childhood, present such interest from a psychiatric point of view that a brief description is justifiable:

Male pair (b. 1901). Legitimate, brought up on a farm. Separated when barely seven years old on the death of the father. *A.* with the mother, *B.* with foster parents. Essential psychological differences in the home environments, *A.*'s definitely more disharmonious than *B.*'s. *A.* committed suicide while awaiting conviction for assault, having served two previous sentences for the same offence. *B.* had also been to prison for assault, drunkenness, fraud and reckless driving. During a prolonged conversation, *B.* made no mentally remarkable impression, particularly not with regard to personality. From *B.*'s information, supplemented with photographs, the twins must be presumed to be monozygotic.

Female pair (b. 1901). Legitimate, brought up on a farm. Separated from the age of six months to six years, when they were reunited. *B.* was with the mother, and *A.* with the maternal grandmother. At the age of 54, *A.* was admitted to a psychiatric department after having gradually developed paranoid ideas during the 4-5 preceding years. Repeated subsequent admissions for observation for paranoid schizophrenia. She also suffered from bronchial asthma. *B.* had died of bronchial asthma when she was 37. She does not seem to have presented any certain psychopathological symptoms. From *A.*'s statement, supported by blood group testing of *A.* and of the children of both twins, it seems highly probable that this was a monozygotic case.

Male pair (b. 1893). Brought up together by prolific, poverty-struck small-holder. Separated when at the age of 9-10 years they left home to earn their own living. *A.* was from youth repeatedly convicted for larceny, arson and drunkenness. He was for a time under institutional care as a mental defective but was later discharged. *B.* had also had numerous convictions for larceny and drunkenness. At the age of 50, he was admitted to a State Hospital with manic-depressive psychosis, syphilis. The twins were strikingly alike and monozygosity was established by blood grouping. According to the extensive case records, it would seem that the twins were intellectually poorly equipped, and both, although more markedly in *B.*'s case, presented symptoms of manic-depressive psychosis, characterized by recurrent manic phases during which the various crimes had been committed. These twins have been described previously by *Jens Chr. Smith* (1930, case no. 106) and they are also incorporated in the twin investigations being undertaken by the Institute of Criminality in Copenhagen. (*Karl O. Christiansen*), (personal communication).

This last pair of twins have been ruled out of the investigation because the time at which they were separated cannot be said to be essentially differ-

ent from what is usual for most twins. As will be discussed later, it is of course an arbitrary matter where the line dividing separation in "early" and in "late" childhood is to be set.

MATERIAL FROM OTHER SOURCES

As has been stated already, the twin register of the Institute of Human Genetics only comprises twins born up to 1910.

In the course of the five years during which the investigation material was collected, seven pairs of twins, who were born after 1910 and who could be presumed to have been brought up apart since early childhood, were brought to my notice by chance.

Of these pairs, two were ruled out because one of the twins could not be traced; in both cases, it had to be presumed that the twin partner had died in childhood, and the question of zygosity could not be elucidated. In the third pair, the blood groups were different.

There remained *four* pairs who all complied with the criteria of selection.

DISCUSSION OF THE COLLECTION AND THE SELECTION OF MATERIAL

The total material for investigation thus comprises the four pairs just mentioned (I-IV) and the eight pairs (V-XII) found through the twin register (see *Table 1*).

During the five years' collecting period, no further cases of monozygotic twins reared apart were brought to our notice.

While the eight pairs were selected from a systematic twin register, objections may be made concerning the other four pairs since they were brought to our knowledge by chance and since it is impossible to exclude that pairs of twins, born since 1910 and reared apart, may have escaped our notice.

It is also open to suggestion that these four pairs of twins may have either come forward voluntarily or been found by the very reason of a great resemblance, particularly in personality.

The possibility of the existence of separated twin pairs who have not come to our knowledge does not solely apply to those born after 1910. In the period covered by the twin register, there may also be separated twins who have escaped registration; this may especially apply to those cases where the twin partner could not be traced or where the twins for some reason or other have with-held the information that they were brought up apart, but from my knowledge of the technique employed in the register, it is, however, improbable that a separation would have passed unnoticed where contact with both twins had been made.

On the other hand, four pairs, born in 1912-1934, against eight pairs, born

in a 40 year period, must be said to be a relatively high number considering the fact, that separation of twins, admitted to foster and adoptive homes, has, without doubt, declined considerably in this century; most foster- and adoption institutions in Denmark have, during the last decades, made it a rule to endeavour to place twins together.

As *Shields* has pointed out, it is difficult, on the basis of the number of pairs of monozygotic twins in the population and the frequency with which persons are accommodated in foster and adoptive homes, to arrive at even an approximate figure for the number of monozygotic twins, who will be reared apart within a certain area. That the present twin investigation does not include all monozygotic twins reared apart in Denmark has been confirmed*).

How many further pairs there may exist, is mere guess-work, but in comparison with the number of twins in the English investigation, 12 pairs in a country with a population of 4½ million must be said to be a relatively high number, at any rate, considerably higher than would beforehand have been deemed possible to register.

With regard to the possibility of the four pairs' being included in the investigation because they came forward voluntarily on account of the resemblance between the twins, one pair can be exemplified as relevant:

Pair I. One of the twins came forward and offered, in agreement with the twin partner, to take part in an eventual scientific investigation. The twins, undoubtedly, experienced each other as being very much alike in personality, but, as described in the case histories, our investigation disclosed marked differences in the twins and differences that can be said to be as significant as the points of resemblance.

The circumstances leading to the inclusion of the remaining three pairs in the material are rather more complicated:

Pair II was discovered by chance by a journalist on the occasion of their reunion, but the twins were approached by us. The twins' attitude towards their co-operation in an intensive investigation, and their ideas of the points of similarity between themselves, must be said to be very different.

Pair III was brought to our notice by a colleague to whom one of the twins had mentioned that she and her twin sister had been brought up apart. The attitude of these twins, who were mentally different, was also different, the sister being rather negative.

Pair IV was registered because one of the twins had been entered as a proband in a psychiatric investigation from which it was indicated that her twin sister had no psychiatric disorder. For practical reasons they were con-

*) (A case of, presumably monozygotic, male twins (b. 1907) reared apart has been registered in 1962).

tacted for investigation on the latter's admission to a psychiatric hospital. The attitude of both twins to the investigation and to each other can be described as rather "indifferent".

With regard to their co-operation and to their opinion of their mutual resemblances, it can be stated that, in this respect, these four pairs of twins did not deviate significantly from the eight pairs collected through the systematic registration. Among the last mentioned pairs, and between the twin partners too, there were also differences in their attitude and their co-operation, particularly in the cases of pairs V, VI and VIII. This last pair was, moreover, as has already been mentioned, found by chance, before their existence had come to our knowledge through the twin register at the Institute of Human Genetics.

As there were no other possibilities of registering twins, born after 1910, (an extension of the twin register to include twin births from 1910-1920 has since been started for Jutland) an insistence on the twin register as the only source of material for selection would have resulted in a series of relatively elderly twins, aged, exclusively, from 40 years and upwards.

The exclusion of the twin pairs derived from other sources would thus have given an age slant to the final material, and, furthermore, I felt it would have been particularly unfortunate to have excluded the younger pairs from an investigation of the importance of childhood environment.

In view of these various considerations, I have decided to include all 12 pairs in the material for investigation, and to abandon the theoretical advantage of a quite systematically collected twin material. The systematically selected pairs still comprise the main body of the material, the possible influence of the other pairs on the investigation results and our evaluation of them will, of course, require special consideration, particularly with regard to intrapair similarities, while it should be justifiable to attach full significance to differences.

Chapter 6

THE INVESTIGATION MATERIAL

The composition of the material with regard to sex, age at the beginning of the investigation, and age at the time of separation, appears in *Table 1*. In this table, the twins are arranged in ascending age order with priority for the elder twin in pairs I, II, IV, VII, X and XI, and chance order for the remaining as the order of birth in these cases is unknown. The names are all cover names.

TABLE I
The Twin Material

Twin Pairs	Age at the Beginning of the Investigation	Age at Separation
I Palle..... Peter.....	22 years	10 months
II Olga..... Ingrid.....	35 »	7 months
III Maren..... Jensine.....	37 »	6 weeks
IV Ingegerd..... Monika.....	42 »	12 months ¹⁾
V Kaj..... Robert.....	45 »	< 9 months ²⁾
VI Martha..... Marie.....	49 »	3½ years
VII Kamma..... Ella.....	50 »	1 day
VIII Signe..... Hanne.....	54 »	3 weeks
IX Karin..... Kristine.....	64 »	3 weeks
X Petrine..... Dorthe.....	70 »	12 months
XI Astrid..... Edith.....	72 »	3½ years
XII Viggo..... Oluf.....	77 »	5¾ years ³⁾

¹⁾ Reunited from 7-14 years. ²⁾ At birth or at aged 3 months? ³⁾ Separated incompletely when 4 and completely when 5¾ years old.

Sex

The material comprises a considerable excess of female over male pairs: 9/3. *Newman et al.* and *Shields* have corresponding ratios, 12/7 and 29/15 respectively.

Shields thinks that the explanation, in the case of his own investigation, lies in the fact that women are not only more willing than men to enlist for voluntary investigation, but they are also more assiduous television viewers. This seems plausible, but is not pertinent to the Danish investigation, not, at any rate, to the systematically collected twin material, where the same ratio obtains.

In collecting material under the criteria of live twins only, it is possible that more female twins would be registered if the mortality of boy twins was higher than of girl twins. *Harvald & Hauge* (1963) did not find any difference between the numbers of living male and female pairs, neither monozygotic nor dizygotic in the primary twin material.

That the difference is to be attributed to the very fact of separation, in that there should be a tendency, for psychological reasons, for boy twins to be less frequently separated than girl twins, does not seem very probable.

The possibility of a certain selection of the material, similar to that of the two former investigations, can hardly be precluded. On the other hand, the present material is so small that the excess of female pairs may well be a chance one.

Age Distribution

This differs considerably from the age distributions in the materials of *Newman et al.* and *Shields*. The ages are fairly evenly distributed over the 20–70 year groups, while in the two other investigations, there were several children, a great many young pairs, and none at all in the older age groups.

This circumstance must, undoubtedly, be attributed to the different methods by which the twins were recruited; many of the older pairs of twins in the present material would probably never have come forward for investigation in response to a public appeal.

THE SEPARATION

Time of Separation

All the pairs of twins were separated in early childhood. The age at the time of separation varies from the day after birth to $5\frac{3}{4}$ years.

As seen in *Table 1*, the twins, pair IV, were reunited from their 7th to their 14th years, but, as the selection was primarily based on separation in early childhood, and, as corresponding pairs have been included in the invest-

igations of both *Newmann et al.* and *Shields*, it was, after some consideration, decided to include this pair in the investigation.

There is, for pair V, some doubt as to the exact date of separation, (cf. *Table 1*). According to one of the twins, the separation took place immediately after birth; according to the other, it did not occur until they were three months old, but both statements were made with some uncertainty, and so it has merely been recorded that, according to the birth certificates, the twins were separated by the time they were nine months old.

The twins, pair XII, were not separated until they were $5\frac{3}{4}$ years old, but there had been a partial separation when they were four years as they had then lived apart during the summer months.

At what age of separation the line between the acceptance and the rejection of pairs of twins for our investigation is to be drawn, is, of course, a matter of question. It has already been mentioned that one pair, separated when about 10, was rejected.

As it is generally held that the early years of childhood, before school age, (in Denmark, usually the age of 6–7 years) are paramount for the development of the future personality and also for the development of psychiatric diseases, it can be emphasized that all the twin pairs were separated within this period. To those who wish to set even narrower limits, it may be stated that the majority, nine pairs, were separated during the first year, five, possibly six, at birth, or within the first 2–3 months.

The average age at separation corresponds very closely to *Shields'* material in which the majority had been separated during the first year. *Shields* included three pairs who were not separated until they were seven, eight and nine years old respectively, justifying it on the grounds that it might be of interest to see whether such pairs were more alike than those separated earlier. The twins in *Newman et al.*'s material were separated, on an average, at a later age, in one case, at the age of eight years.

Reasons for Separation

Of greater importance for the composition of the material than the age at which the twins were separated are, undoubtedly, the other circumstances attending the separation, in the first place, the position, social and psychological, of the parents at the time around the birth of the twins and in the second place the direct or subsidiary cause of separation.

Age, marital status and occupation of the biological parents

As it appears in *Table 2*, exactly half of the twins, e. g. pairs I, II, IV, V, VIII and IX, are born out of wedlock. In none of these cases, were the parents later married to each other.

TABLE 2
Biological Parents of the Twins

Twin Pairs	The Father		The Mother	
	Age	Marital status and Occupation	Age	Marital status and Occupation
I	25 years	unmarried labourer	16 years	unmarried domestic servant
II	19 »	unmarried brushmaker	17 »	unmarried domestic servant
III	42 »	married farmer	39 »	housewife
IV	27 »	unmarried herdsman	19 »	unmarried domestic servant
V	55 »	married wholesale merchant.	38 »	married ¹⁾ housewife
VI	32 »	married day-labourer	30 »	housewife
VII	41 »	married carpenter	34 »	housewife
VIII	23 »	unmarried baker	26 »	unmarried domestic servant
IX	30 »	married decorator	16 »	unmarried domestic servant
X	35 »	married butcher	35 »	housewife
XI	50 »	married staff sergeant	40 »	housewife
XII	47 »	married day-labourer	37 »	housewife

¹⁾ Not married to the father of the twins.

The average age of the mother at the time of the twins' birth was 29 years, varying from 16–40. The unmarried, as was to be expected, were young and the married all between the ages of 30–40. The average age of the fathers was 36 years, and varied from 19–55 years.

This small group of parents cannot, with regard to the distribution of their occupations, be said to be representative of the Danish nation as a whole, but it does, nevertheless, particularly in respect of the fathers, embrace a wide section. In one case, pair IV, the father was of Swedish extraction; in the others, the fathers and the mothers, like the twins themselves, were all Danish subjects.

All the pairs of twins were born in Denmark, six on Zealand, of which three were born in Copenhagen. The remainder were all born in Jutland. There were, thus, none from Funen or the other Danish islands. The distribution with regard to place of birth cannot be said to be in any way remarkable.

As it appears in *Table 2*, a strong co-relation must be presumed between illegitimate birth and the twins' separation. *Shields*, in his material, found relatively few pairs of twins who were illegitimate (7/44). This difference must, undoubtedly, be due to the different ways in which the material for investigation was collected.

Direct or subsidiary causes of separation

The separation of the twins rests, both for the legitimate and the illegitimate, ultimately upon causes that are more complex, mainly socio-economic and psychological, as appears from the following survey:

I. Illegitimate. The young parents fell out. Neither was in a position to take care of the twins who were then adopted through an institution and, in this way, separated quite haphazardly, perhaps because they had already spent four months apart, one in hospital, the other in a children's home.

II. Illegitimate. The father refused to acknowledge paternity. The young mother could not have the twins, and at the instigation of an institution, they were placed in separate foster homes because one foster mother wished to take only one of them.

III. The mother died when the twins were six weeks old. The father, when they were two years old. They were then, like their sibs, placed in different foster homes, each with a paternal aunt.

IV. Illegitimate. The father disappeared. The young mother could not keep the twins, and had one placed with distant relations and the other with strangers.

V. Illegitimate. The parents were both married, and the father had the twins adopted separately.

VI. The father left home. The mother, through the social authorities, got her many children placed in different homes, whereby the twins were separated, one going to distant relations and the other to strangers.

VII. The mother died in childbed. One twin stayed with the father, the other, in accordance with a previous agreement, was placed with strangers.

VIII. Illegitimate. The father refused to marry the mother, who could not keep the twins. The paternal grandparents took one, and the mother placed the other with strangers.

IX. Illegitimate. The father was married and had other children. The young mother could not keep the twins. The father's family had one placed with distant relations and the other with strangers.

X. The father died when the twins were four months old. One stayed with the mother, the other was placed with strangers who had persuaded the mother to give the child up on account of her many other children.

XI. The father died when the twins were four years old. One stayed with the mother, and the other was placed with strangers, who had persuaded the mother to give the child up on account of her many other children.

XII. The father died when the twins were four years old, and the mother when they were six. The twins, like their sibs, were put under care by social authorities and separated.

Illegitimacy was thus, in six cases, the primary cause of separation. In the remaining cases, the twins were separated because the home was broken up by the death of both parents (two cases), by the death of the father (two cases), by the death of the mother (one case), or by the disappearance of the father (one case).

Subsidiary causes of separation are to be found in the circumstances, psychological, financial and social, attending the birth of the twins; in the cases of the older twins, especially the large number of children already in the family. In several cases, the wishes of the respective adoptive or foster parents only to have one child was a contributory cause of separation; in other cases, the separation seems to have been dictated by pure chance.

With regard to the possibility of selective factors having been at work in the collection of the material with a foregoing effect on its composition and hence on the results of the investigation, the following can briefly be summarized:

The material for investigation comprises pairs of twins who all comply with the criteria: Both twins were alive when the investigation was instigated, they have been reared apart from early childhood, and they are monozygotic.

The main part of the material is derived from a systematic search through a register of all twin births in Denmark in the years 1870 to 1910. The remaining material comprises pairs of twins born after this period and found by chance.

The hypothesis that these latter twins may, compared with those of the systematically collected material, beforehand present greater intra-pair similarities cannot be taken to be a matter of course.

As in previous investigations of separated pairs of twins, this material contains a considerable excess of female pairs. No convincing explanation can be found for this phenomenon, and, in this investigation, it may be due to chance.

The age distribution of the material is, in contrast to earlier investigations, not remarkable.

With regard to the time of separation, this occurred, throughout the whole material, in early childhood, that is to say, before school age, and, in most cases, during the first year, in about half the cases, during the first months.

The main reasons for separation were, in half the cases, illegitimacy and the breaking up for the home owing to the deaths of one or of both parents or to the desertion of the father.

Contributory causes of separation were various social, financial or psychological circumstances at the birth of the twins, circumstances which do not, however, beforehand, give any certain reason for assuming that the parent group, as a whole, by personality, intelligence or with regard to mental illnesses, deviates in any significant way from the Danish population as a whole.

Chapter 7

INVESTIGATION METHODS

The investigation was carried out by means of medical-psychiatric interviews and clinical examinations, supplemented by various more special investigations. Psychometric examinations were performed concurrently, followed up by re-testings at suitable interval as will be described in the following.

In the examination of the 12 pairs of twins, every endeavour was made to make the observation of each individual pair as thorough and as prolonged as was practicably possible.

Owing to the relatively easy distances in Denmark, it was possible to convey the twins either to the State Hospital in Risskov, or to the Institute of Human Genetics in Copenhagen, for frequent examinations, and also to keep in touch with them by repeated visits in their homes. Altogether 12 probands, including six in Copenhagen, were domiciled on Zealand at the time of the investigation while 10 lived in Jutland, one on Funen and one in North Germany.

The initial contact with the twins was, as a rule, made by an unannounced visit to their homes. During these first conversations, every endeavour was made to establish an atmosphere that would be conducive to a further and more prolonged observation.

The initial attitude of the probands varied a good deal, although it was very positive on the whole, and only a few exceptions necessitated several conversations before a satisfactory co-operation could be secured. A deeper explanation of the investigation and its aim was only required in a couple of cases. In the main, the probands admitted, during the very first conversation, that they themselves considered their upbringing so unusual that it was not at all to be wondered at that a scientific examination of them was desirable. There were also some who, in one way or another, expressed their need for an opportunity to speak about their problems and their thoughts on their lot in life.

Shortly after the initial meeting, with one exception, where an examination at the local hospital was more practical, a thorough examination of the twins was made at one of the two above mentioned institutions. This first systematic examination was relatively long, taking two whole days, for which

reason accommodation for the twins often had to be found. The subsequent contacts were made by further examinations at suitable intervals, by renewed visits to the twins in their homes, by letter and by telephone.

The observation period varied in each case; on an average it lasted three years. In 1959, when the collection of the material was terminated, we had our last contact with every one of the twins.

MEDICAL-PSYCHIATRIC INTERVIEWS

The interviews were, for the most part, conducted at the institutions, although some took place in the homes of the twins, since I found it especially important also to observe the twins in their usual environment.

The twins were interviewed one at a time. In practice, it was the rule that one was interviewed while the other was being psychologically tested or examined in some other way, after which they changed over. Interviews also took place, when both twins were present, preferably in connection with the medical examinations.

The number of interviews varied a good deal from pair to pair. In one case, there were as many as 38, in some few of the others, under a dozen. For the most part, the twins were interviewed from 15 to 25 times, and the number of interviews given to each proband was more or less the same. There were, besides, many opportunities for brief conversations, and at the various stages of the investigation, there were no end of opportunities for making indirect observations of the twins. The duration of each interview was not irrevocably determined in advance, it was generally of an hour's duration, which seemed adequate from the interviewer's point of view.

The interviews were all conducted by the author and without the employment of any particular interviewing technique.

During the first interview especially, the interviewer remained on the whole passive, and encouraged the proband to present the material in a natural and unconstrained fashion. An almost overwhelming wealth of facts and information was the usual result. Towards the end of each interview, and during the subsequent interviews, a systematic attempt was made to develop the material furnished by each proband, and also to elucidate more precise statements concerning important data, partly for the purpose of the analysis of the material as a whole, and partly for comparison with the twin partner. In the opinion of the author, most of the general facts usually come out sooner or later after a relatively close contact, and protracted and irksome systematic questionings were thus largely obviated. On the other hand, the arrangement and the analysis of the very extensive material were correspondingly time-consuming.

It has been attempted to produce coherent surveys of the whole lives of

the twins and a history of their diseases. To begin with each proband was treated and described as a separate individual. A detailed account has been made of the childhood background including, not only the groups of persons with which it was filled and the outer circumstances in general, but also of the environment as it was subjectively experienced, together with an account of the psychological development during the interplay of environment and individual, as well as a description of the appearance of certain qualities, the outer and inner conflicts, and the eventual development of physical or psychic disorders.

Special attention has been paid to the twins' mutual experience of the twin relationship, utilizing its exceptional possibilities for throwing another light on anamnestic information, to say nothing of the unique opportunity that the study of monozygotic twins affords for analysing the twins' experiences of their own personalities as expressed through their mutual identification and projection.

The material obtained during the interviews was registered in different ways. As a rule, relatively few notes were taken during the actual interviews, but the information obtained was written down immediately after their termination. Particularly in the beginning, verbatim reports were, however, frequently made in most cases, and in a few cases, tape recordings were made too, although this was chiefly to enable the interviewer to be confronted with his interviewing technique.

Collection of supplementary information

The anamnestic information that came out during the interviews, was systematically illuminated by what could be elucidated from people who knew one or both of the twins well, and by the study of every available written source.

During my visits to the twins in their homes, I could often talk to their respective spouses, the grown-up children, or other relatives and persons connected with them. In some cases, I met the foster or adoptive parents and sibs. Finally, doctors, nurses and many others have helped me with their knowledge of the twins in question.

For every single twin proband, a number of public registers and records have been systematically searched. These include the national register, national assistance offices, local social and government offices, health insurance societies, census lists, regional public records, the criminal record office and other archives of a more special nature. In a few cases, information has been obtained from midwives' registers, children's homes, adoption documents, welfare authorities, school records and other documentary sources.

Finally the eugenic register at the Institute of Human Genetics has been systematically consulted.

In every case of hospitalization or in case of contact with medical-social institutions or with a medical specialist, the case records have been studied. In some cases, this case material has proved so extensive that, as appears from some of the case histories, (pairs IV, V, VIII), merely by collating these mutually independent documents, an objective and often instructive description of the twins can be obtained.

Similarly, and through the same channels, a systematic search has been made for records of the biological parents, the relatives, and others bearing an important relation on the life histories of the twins. In some cases (for instance I, II, V and VIII), a surprisingly extensive material has come to light, of special importance because it relates to circumstances entirely unknown to the twins themselves, wherefore I have considered it natural to append this supplementary information to the material obtained from the interviews and the clinical examinations.

MEDICAL-PSYCHIATRIC EXAMINATIONS

Apart from pairs V and VII, the direct clinical examinations were made with the twins standing side by side. The examinations of the general somatic state, especially neurological and cardiological, also comprised various anthropological measurements including height and weight, supplemented by a direct comparison of the twins with a view to their physical similarities and dissimilarities. Other examinations, particularly blood-groups and finger prints were made at this time; these will be discussed in detail in the chapter on zygosity.

In most cases, the twins were photographed and the pictures compared with earlier photographs. In two cases a film was made.

The somatic examination in the majority of the cases has been supplemented by the following special examinations: electroencephalography, in some cases, electrocardiography and special ophthalmological examinations, as well as some other special examinations in few cases.

No special technique, personology or psychiatric terminology has been employed in the psychiatric-psychological description or in the clinical evaluation.

The behaviour of the twins, and their personality are described in everyday language, and many clichés and frequently unclear psychological expressions have been deliberately avoided. Great importance has been attached to the comparison of, and a delimitation of, the differences and the similarities between the twins.

The clinical evaluation of each twin has then been resolved into a simple

diagnostic classification falling mainly into two categories: psychically "normal" or presenting some psychiatric disorder. The main points drawn from the whole anamnestic material and from the clinical findings have been summarized and discussed in an epicrisis.

PSYCHOMETRIC METHODS

The following psychometric methods were employed:

Intelligence Tests

The Wechsler-Bellevue Intelligence Scale, Form I.

Raven's Progressive Matrices (A-E, 1938).

Personality Tests

Rorschach's Test.

Rapaport's Word Association Test.

The twins were also examined with the following tests: 1) *Lüscher's* test (1945), 2) *Szondi's* test (1960), 3) a picture selection test, especially designed for this investigation, (*A. M.*), 4) a personality questionnaire a. m. *Murray* (1938) (in a Danish version adapted by *Tranekjær Rasmussen*).

The results of these tests are not included in the present work, but some of them have been published, *Mogensen & Juel-Nielsen* (1961, 1962).

General methods of testing

As has already been mentioned, the psychometric examinations were made concurrently with, but independent of, the medical-psychiatric interviews, in such a way that the psychologist in his testing and evaluation was without knowledge of the anamnestic material.

Testing usually took place when a satisfactory contact with the twins had been established. In most cases, the tests were done at one of the two institutions, but in a few cases, it was necessary to do them in the twins' homes. The twins were tested independently of each other, and it was considered important to perform the testing of both twins concurrently to avoid any interchange of experiences between them. The attitude of the twins to the psychometric examinations must be deemed co-operative on the whole, although the degree of co-operation varied from pair to pair, from twin to twin partner, and also, for each proband, from test to re-test.

As has already been pointed out, as far as it was practicably possible, an endeavour has been made to re-test the twins in order to produce a basis for evaluating the reliability of the tests employed.

All twins were tested with the two intelligence tests and with the Rorschach test. The association test was not tried on pairs VI and IX.

Re-testing with the W-B test was done on nine "whole" pairs; for various reasons (cf. the case histories), it was not done on pair VI and one of the twins in pairs II and V. Re-testing with the Rorschach test was not done on pair VI and one of the twins in pair V (cf. the case histories).

The intervals between testing and re-testing varied from pair to pair; they averaged about 12 months and were, in all cases, of six months or over. The intervals in the case of each pair were, to all intents and purposes, the same for each twin.

Most of the examinations were carried out by *Alan Mogensen (A. M.)*. One of pair IV was examined by another psychologist, because this proband had been admitted to a psychiatric hospital, but the examination was conducted and the evaluation made under the close supervision of *A. M.* The re-testings of pairs IX and XII were done by *Alice Theilgaard (A. T.)*.

The Wechsler-Bellevue Test

This test has the advantage of not only determining the intellectual level, but it can also be employed in the qualitative analysis of the intelligence functions and the whole personality structure.

The test system comprises 10 sub-tests distributed over two test sections. *The Verbal Part (V)* comprises Information (I), Comprehension (C), Digit Span (D), Arithmetic (A), Similarities (S). *The Performance Part (P)* comprises Picture Arrangement (PA), Picture Completion (PC), Block Design (BD), Object Assembly (OA) and Digit Symbol (DS). The Vocabulary test was omitted, partly on account of the special difficulties connected with its transference to a Danish material, and partly because it was very soon apparent that this test put too much of a strain on the co-operation of the twins.

From 0-2 points can be scored in each sub-test and these are denoted as raw scores (RS).

The distribution of raw scores obtained in each sub-test in a population consisting of 20-34 years old has been studied by *Wechsler*. These scores were converted according to a Gauss' distribution with a mean of 10 and a standard deviation of 3 (variance 9) into the so-called weighted scores (WS), which made a comparison of the subtests possible. In each single age group (consisting of 5 years) the sum of weighted scores for the standard population was noted (by simply adding them up, the five verbal tests become Verbal Points (VP), the five performance tests, Performance Points (PP), and the weighted scores of all 10 sub-tests, Total Points (TP)).

This sum of weighted scores is converted to 3 IQ distributions (Gaussian Distribution) to make the average IQ for each age group 100 with a standard deviation of 15 (variance 225).

The test was carried out in the usual way. In its evaluation, *Wechsler's* guide and tables were used.

There is no Danish standardization of the test. The transference of this test from American to Danish materials entails that the conditions aimed at above cannot be expected to be present in every detail or in every sub-test, a fact that must be taken into account in the evaluation of the results.

Raven's Progressive Matrices

This test, like the Dominoe Test employed by *Shields*, is a non-verbal test, and it is considered to be highly loaded with a general intelligence factor. Compared with the W-B test, it throws light on a considerably narrower field of intellectual function, especially on the ability to abstraction, to logical thinking and to the drawing of analogous conclusions. This test has the great advantage of being easily administered and of having been corrected for age. It has been standardized on a Scottish material, and the results are given in percentiles. The test has earlier been tried on Danish recruits. As it is considered to be a relatively "culture free" test, it should be possible to use it in a Danish investigation.

The test consists of a structured, visual material of patterns arranged as 60 tasks in 5 series with 12 sub-tasks in each and given in ascending order of difficulty. The score for each subtest is + or -, and the maximum score is thus 60 points.

In this investigation, the test was given as a self-administered individual test, the time taken was, in principle, unrestricted, and the testing was governed by the instructions laid down by *Raven* (1950). The answers were, however, written down by the test leader and, in a number of cases, the last and most difficult items were omitted (generally E_{8-12} and D_{6-12}). In some few cases the test was repeated immediately to see whether the score could be improved, but these results were not included in the statistical survey. The survey was made in the usual way in accordance with *Raven's* tables, partly with reference to the expected part scores for the given total scores, and partly with reference to the conversion of the total scores into percentiles.

Rorschach's Test

Rorschach's ink blot test (1921), which has its historical origins in the free association methods of psychoanalysis, is assuming an ever more prominent place among the so-called "dynamic" or "projective" tests. The test hardly calls for a detailed description.

It is based on a partly unstructured visual stimulus material consisting of symmetrical, coloured blots and it comprises 5 cards in black, white and gray, and 5 cards in other colours. The subject is requested to describe and interpret this material. The answers are converted into formulas, and classified in various categories depending, among other things, on the localization, the form, the movement, the colour, the content and a number of other qualities. On this information, a psychogram is made.

This test does not readily lend itself for investigations on validity and reliability, as the results can only be quantified approximately.

In the present investigation, the test was used in accordance with the common practice of psychiatric-psychological work, with, however, considerable reserve as it was a "blind test" analysis. The evaluation of the answers rests largely on *Rorschach's* (1921, 1954) material. A few features are, however, derived from *Klopfer* (1954). In determining the response localizations and the "popular" responses, *Beck's* (1950) revised tables were used. A statistical analysis of the results was considered of little value from the outset, instead, as will appear later on, a special "double-blind test" evaluation was made by another psychologist (*A. T.*).

Rapaport's Word Association Test

Like the Rorschach test, it is a projective test and it exists in a translation of *Rapaport et al.'s* (1945) revised test. It is usually done twice, one immediately after the other. The scores were written down by the test leader. The results have not been statistically evaluated.

DISCUSSION OF THE PSYCHIATRIC-PSYCHOLOGICAL METHODS

It has already been touched upon that the methods of investigation, be they interviews and clinical evaluations, or be they psychometric methods, are, with regard to their applicability and scientific worth, open to criticism, not only in the present investigation but also in principle.

The *interview method* is, in the truest sense, a subjective method of investigation. While in the ordinary routine of diagnostics and therapy, it is invaluable, it presents, in psychiatric-psychological research, certain methodological problems.

The interview, like the psychometric examination, is based upon the interaction of interviewer and subject, in the present case, each single proband or each pair of twins. This situation makes the interview complicated and difficult to control. In addition, the general, theoretical problems of observation, the conditions of observation, the difficulties connected with measuring and registration and the definition of objectivity are all to be found in the psychiatric-psychological interview.

Unless the interview is to be entirely rejected as a method of research, and unless one is to conclude that research of this kind had better be given up altogether, there does not seem to be any way of avoiding these principle conditions. There is nothing new in recognizing the existence of these conditions; psychiatric-psychological research has always laboured to get as far as is practicably and theoretically possible under the given conditions and with the means at its disposal. As is the case in other kinds of research, the significance of the results and conclusions naturally depend upon a thorough

evaluation of the material for investigation and of the possibilities and limitations of the methods employed.

In a study aimed at investigating the differences and the similarities between monozygotic twins, and aimed at evaluating these findings in relation to the dissimilarities and similarities of the environments, it is by no means given beforehand just how the methods of investigation will influence the results and hence the conclusions that are drawn by the investigator.

On the one hand, the investigator is, consciously or unconsciously, in a position to choose and emphasize similarities between the twins, and at the same time to omit to register, or be inclined to belittle, the differences.

On the other hand, a diametrically opposite attitude on the part of the investigator is just as likely. He can consciously, or unconsciously, register and give prominence to differences and thereby run the risk of overlooking similarities of a less conspicuous or trivial nature.

An unprejudiced attitude to the problems of heredity-environment inherent in this investigation can, presumably, only be achieved on the conscious plane. But, at all events, an endeavour can be made to accomplish the investigation and to present the material in such a fashion as to produce the best possible conditions for others to judge just where it is a question of hard facts and descriptions, which can hardly be influenced by the selectivity and evaluation of any investigator, and just where it is a question of observations and results, in which uncertainties of the methods and a subjective interpretation of the investigator have obviously been brought into play.

Nor in the psychometric examination can the subjective influence of the investigator be discounted. The psychological test is only relatively speaking less subjective than the interview. Even if one attempts to control the conditions of investigation by precise linguistic formulation, by a qualitative, possibly a quantitative classification, the results must still, at all stages, and not least in the final stage, be reviewed and interpreted by an investigator.

It has already been mentioned that the choice of the *psychometric methods* was determined in the first place by the purely practical circumstances in existence when the investigation was begun. There were, at that time, practically speaking, only two courses open, either to supplement the psychiatric interviews with the psychometric methods at hand, which is to say by the four tests above-mentioned, and which were well-known in general clinical practice, or to omit all psychometric investigation entirely. The latter course seemed in itself so unsatisfactory that it outweighed all the theoretical disadvantages of the former.

The modest size of the material and the aim of the investigation undoubtedly justify the choice of these tests. The test battery chosen is intended to give an all round description based on "dynamic" modes of observation, and it

produces, independently of the other examinations, a description of each pair of twins. Hence it makes possible an elucidation of the differences and discrepancies in the results derived from the different methods of investigation. The possibilities of making detailed, statistical comparisons were precluded from the start.

There was no possibility of employing more specific psychometric methods, such as those developed from factor analyses or experimental investigations (*Eysenck, 1947, Smith, 1949, Eysenck & Prell, 1951*).

The test results must be evaluated with caution, particularly with regard to the general conclusions. This is due, partly to the smallness of the material, and partly to the special difficulties connected with the transfer of these tests into this country from abroad, and most especially, because no Danish standardizations have been made. In evaluating the test results, we have relied on the practical, clinical experience obtained in Denmark in the use of these tests, and on a comparison between the present and foreign materials.

The *Wechsler-Bellevue* test has been widely employed in the psychiatric clinics of Denmark. It has been proved satisfactory in practice as the test results are usually in close accordance with the general clinical impression.

The material for investigation contains a considerable preponderance of pairs of female twins. With regard to age distribution, it contains relatively many elderly persons, since there is only one pair in the 20–34 age group.

In the conversion of weighted scores to IQ's, it cannot be expected that, in a Danish material, the age correction will be wholly satisfactory. It must be expected that in certain of the sub-tests, the distribution of the scores will deviate from the American mean and dispersion figures. The same conditions must be presumed to operate on the IQ's, although it is more difficult to say beforehand in which direction the tendencies lie.

In the final survey, both weighted scores and IQ's were used, since the material was found to approximate to the Gaussian distribution for the various weighted scores and IQ's, and hence the statistics of the normal distribution could be employed.

Opinion on the clinical application of *Raven's* test is divided. There is often a discrepancy between the test results and the general clinical impression, and the test seems to produce a relatively poor differentiation of the less intelligent, particularly in the higher age groups.

Opinion is similarly divided on the applicability of *Rorschach's* test, not only as an instrument of research, but also as a tool in general clinical work. The manifold possibilities for subjective interpretation of the method and the results have met with sharp criticism, and it has often been pointed out that its results are in no more than chance agreement with clinical, psychiatric diagnostics. As the present material does not comprise purely psychiatric patients, a comparison of such materials obtained from investigations of

psychiatric patients with the present Rorschach results will not be reasonable. The validity of the test is, as has already been mentioned, in principle difficult to evaluate, and a systematic evaluation of this kind on the basis of the present material has not been attempted. The value of the Rorschach results of the investigation lies in the possibility of comparing them, in the case of each pair of twins, with results produced by other methods of investigation.

To sum up, the methods of investigation employed, both by interview and by psychometrics, present from the start important limitations which must be taken into account in the evaluation of the final results of the investigation.

Chapter 8

DETERMINATION OF ZYGOCITY

As has already been pointed out, the twin method and the evaluation of its results rest fundamentally on the certainty of the zygosity diagnosis. This is especially true of the present investigation as the material is so small.

The state of the placenta, both for theoretical and practical reasons, is of limited value for the determination of zygosity. In the case of adult twins it is most exceptional for reliable information on the placenta and chorion to be available. Moreover, although all certainly monochorionic twins can be proved monozygotic, dichorionic twins need not to be dizygotic. *Curtius* (1930), and others, who made systematic examinations of twins about whom the state of the chorion was known, have shown that many dichorionic pairs, classified by classic criteria as dizygotic twins, were, anthropologically, as alike as monochorionic pairs.

Precise information on the placenta was available in only two cases in this material. These twins, pairs I and II, born at university clinics, were dichorionic. With the exception of pair XI, of whom it was related that there had been "one common afterbirth", there is no information of the placenta or chorion in the other pairs in this material.

As has been mentioned already, *Siemens* (1924) was the first to produce a practicable method for distinguishing between monozygotic and dizygotic twins without requiring knowledge of the state of the placenta. The "poly-symptomatic test of resemblance" is based upon a systematic comparison of twin pairs and an evaluation of their degree of resemblance with regard to a number of morphological characteristics which experience has shown to be very similar in monozygotic twins and very dissimilar in dizygotic. The original mode of procedure was, however, not very satisfactory either in theory or in practice, and has been criticized chiefly on account of the criteria on which the determination of zygosity was based. Difference in sex was the only certain proof of dizygosity, while the significance of dissimilarities in the other criteria depended on the subjective estimate and the experience of the investigator. There was no certain method of judging to what degree, or in what direction, errors in zygosity determination might be made, most especially, was there

no method of obtaining a numerical expression for the accuracy of the zygosity diagnosis. *Schiff & Vershuer* (1933) could, however, demonstrate that pairs of twins, classified as identical by the similarity method, always had the same blood groups (ABO-system), while identical blood groups were not more frequent in dizygotic twins than was to be expected in sibs generally.

An entirely satisfactory empirical basis was devised by *Essen-Möller* (1941 b), who collected a twin material with known chorionic information from a university maternity clinic. This material consisted of twins of like sex and was divided into three groups: the certainly monozygotic, i. e. monochorionic, the certainly dizygotic, i. e. with different blood groups (ABO and MN systems), and a third, intermediate, group consisting of dichorionic twins with identical blood groups of the afore-mentioned systems.

Essen-Möller constructed a formula by which a numerical expression of the similarity diagnosis can be obtained. This formula includes the frequency with which various grades of dissimilarities in a series of uncorrelated anthropological traits appear, partly in the certainly monozygotic twins and partly in the certainly dizygotic. Further, it contains a quotient expressing the ratio of like-sexed dizygotic twins to monozygotic in the initial material. Formulas, constructed on similar principles, have also been devised by *Smith & Penrose* (1955), and *Sutton, Clark & Schull* (1955).

Hauge (1962), who among other things, has proved that the blood groups of dizygotic twins are to pairs of single born sibs as monozygotic twins are to single individuals, has especially interested himself in the considerable possibilities for an expansion of zygosity determination which the development of serology in recent decades has rendered possible. The fundamental principle in the use of blood groups to determine zygosity rests upon the diagnosis of genetic discordance. Blood groups are determined wherever possible; all that then remains is to calculate the probability of monozygosity in same-sexed twins with identical blood groups in all the systems employed.

For the method of calculating the probability of monozygosity in the present investigation, the reader is referred, besides to *Essen-Möller* (1941 b), to an earlier publication, *Juel-Nielsen, Nielsen & Hauge* (1958) and to the later investigations of *Dencker, Hauge, Kaij & Nielsen* (1961) and *Hauge* (1962).

CRITERIA OF ZYGOCITY

Zygosity determination in the 12 pairs of twins rests upon the following 4 criteria:

- 1) *Blood and serum groups*
- 2) *Eye colour*
- 3) *Hair colour*
- 4) *Finger prints.*

In connection with the somatic examinations of the twins standing side by side, a number of measurements and comparisons were made bearing on various anthropological characteristics. Zygosity determination rested upon eye colour, hair colour and finger prints alone, as only these, according to the above-mentioned investigations, can be judged with sufficient accuracy.

All 12 pairs were tested for their ability to taste phenylthiocarbamide. There was concordance in every case. Recent investigations, for instance by *Dencker, Hauge & Kaij* (1959), have shown that there is a certain overlapping of PTC-tasters and non-tasters, so that by comparison with, for instance, blood grouping, this quality is not so satisfactory a discriminant.

Neither has electroencephalography been used in zygosity determination, although experience has proved that there is close similarity in monozygotic twins.

All 12 pairs were tested with the following blood and serum systems: ABO-, MN-, P-, Rh-, Le-, Fy-, Kell- and Lutheran and also Gm- and Hp-systems. The tests were done on venous blood. The blood grouping was done, and the probability of monozygosity determined, at the Institute of Human Genetics by *M. Hauge*, who had no knowledge of the results of the other investigations.

Similarity of eye and hair colour was examined by the author with the twins standing side by side. Two cases, (V and XII), however, were measured against standard scales (double assessment). Finger prints were taken and assessed by the author in all 24 cases.

RESULTS OF THE ZYGOCITY DETERMINATION

There was concordance for hair and eye colour in all 12 pairs. The findings of the blood and serum groupings appear in *Table A*, and of the finger prints in *Table B*.

In calculating the differences in finger print ridge counts, the usual principle of counting the highest whorl values was employed.

In calculating the absolute probability for monozygosity according to blood and serum groups, gene frequencies indicated by *Juel-Nielsen et al.* (1958), were used, and for eye colour, hair colour and finger prints, the conditions governing *Essen-Möller's* (1941 b) material was used; this material was drawn from a South Swedish population that, anthropologically, may be considered to be very close to the Danish.

In calculating the probability for pairs I and II, our knowledge of the chorion was taken into account, for, whereas a single chorion is a possibility in the other pairs, its probability in these two cases is equivalent to 0.

The calculated absolute probability for monozygosity for each pair of twins appears in *Table 3*.

TABLE 3
Absolute Probabilities of Monozygosity
Based upon Blood and Serum Groups, Eye and Hair Colour and Finger prints

Twin Pairs	Absolute Probability
III, IV, V, VII, IX, XI, XII.....	99.9%
I ¹⁾ , II ¹⁾ , VI, X.....	99.8%
VIII.....	99.5%

¹⁾ Separate chorions included in the assessment.

DISCUSSION OF ZYGOCITY DETERMINATION

In objection to the use of *Essen-Möller's* formula in the present material, it may be argued that we have no certain knowledge of the proportion of monozygotic to dizygotic twins in the initial material. As has already been stated, six dizygotic pairs were registered, of which the four were classified as dizygotic by their blood groups and the two others by their differences in hair and eye colouring.

If the number of monozygotic pairs of twins in the total material of separated twins were greater than in other twin materials, which is hardly probable, the quotient used in the formula would have to be reduced, but it would then follow that the final figure for the probability of monozygosity would be correspondingly greater. *Hauge* (1962) has, however, pointed out that a variation of the quotient within quite wide margins has no important effect on the final results when a large series of blood group systems is employed.

The calculated probability for monozygosity must be said to be satisfactorily high for all pairs. For 11 pairs it lies between 99.8 and 99.9 per cent. Pair VIII, with 99.5 per cent, lies a little lower owing to the relatively great difference in ridge counts, but this difference is not incompatible with monozygosity.

The author's subjective, clinical assessment of zygoty for *pair III* gives, as the case history shows, occasion for comment.

In contrast to the other pairs, their families, their friends and the twins themselves had some doubts as to whether they were mono- or dizygotic, and the twins were never mistaken for each other. These objections, as discussed in the case histories, can hardly be considered decisive for an adult, separated pair for whom everything had been done by their families not to regard them as twins, hardly as sisters.

As for the author's and other investigators' impression of these twins, some allowance must be made for a certain "halo-effect". Their outer appearance was very different, one wore glasses, was permanently waved and was heavily made up. Their personalities, too, seemed strikingly different, but a systematic,

anthropological comparison revealed no remarkable distinctions, a difference in facial appearance being ascribable to their different dentures.

The possibility of confirming or refuting the monozygosity of this pair by skin grafting was not considered, but a possibility for further testing will appear when a sufficient number of new blood and serum systems are available.

As there is no means, at the moment, of excluding monozygosity in the case of these twins, they have been incorporated in the material for investigation, but in the evaluation of certain results, especially the intelligence test scores, an analysis has been made of the significance the inclusion, or exclusion, of this pair can have had on the total results.

Chapter 9

INTRA-PAIR DIFFERENCES AND SIMILARITIES

The results of the medical-psychiatric examinations fall, mainly into four parts.

The first part deals with the general physical health of the twins, the second, the appearance of various somatic diseases and abnormalities, the third, normal psychical traits, primarily intelligence and personality structure, and the fourth and last part deals with certain psychiatric disorders in some of the twins.

In theory, intra-pair phenotypical differences appearing in any of these categories should be associated with and conditioned by differences operating in the environment, either of childhood or of later life.

Intra-pair similarities, to the extent that they are not attributable to similarities, or "insufficient" dissimilarities of environment, must, presumably, be attributed to the twins' genotypical identity.

An analysis of the observation data and of the verified information obtained from the clinical examination and comparison of the twins, from the medical-psychiatric interviews and other sources, must, as has been pointed out before, primarily be qualitative in character; very few results lend themselves to quantitative analysis, partly on account of the methods of investigation adopted, and partly on account of the small size of the material.

Even though, in these investigations, in principle, every endeavour has been made to distinguish finely between data that entirely defy any subjective evaluation or interpretation by the investigator, and data that of necessity are subjected to his selection and evaluation, it does seem, nevertheless, to be appropriate to discuss such conditions, as naturally belong to each other, together.

Certain intra-pair differences, incidental to factors, such as infections, injuries and the like, could so obviously be ascribed to environmental differences that it would be pointless to question an association.

In other cases, the difficulty lies, partly in assessing the certainty with which intra-pair differences can be ascertained, partly in assessing the extent to which a possible difference is to be associated with environmental differences, in each particular case and in general.

Correspondingly, similarities must be attributed to the twins' genotypical identity unless they permit of another explanation.

The environmental, especially social and psychological, differences and similarities will be treated in the following chapter.

GENERAL HEALTH

A detailed account of the general, somatic state of health of the twins is to be found in the case histories. The following main results are summarized below.

Height and weight

The average intra-pair difference in height was 1.0 cm, and in weight it was 6.32 kg (13.9 lbs.). In *Table 4*, the corresponding correlation coefficients are compared with *Newman et al.*'s and *Shields'* figures.

TABLE 4
Height and Weight
Mean differences of separated monozygotic twins

	<i>Height</i>		<i>Weight</i>	
	M cm	correlation coefficients	M lbs.	correlation coefficients
<i>Newman et al.</i>	1.8	0.97	9.9	0.89 (both sexes)
<i>Shields</i>	2.1	0.82	10.5	0.87 (male) 0.37 (female)
<i>Juel-Nielsen</i>	1.0	0.97	13.9	0.66 (both sexes)

While *Newman et al.*, in comparing their twins with control groups of un-separated, monozygotic twins, rather surprisingly found a greater similarity of height in the separated, *Shields* found the opposite to be the case. This difference was not significant, but there was a marked difference between monozygotic and dizygotic male twins.

In explanation of these intra-pair differences, *Shields* points out that they may be attributed to illnesses in one twin in early childhood, but he finds no general association between dissimilarities at the time of the investigation and dissimilarities in early environment.

Neither has the present investigation produced a general, presumptive association between these differences.

In one pair only, XII, was there a considerable difference in *height* (157.5/161.0 cm). For this there was a simple explanation, as one of these

77-year-old twins, a few years prior to the investigation, had suffered a severe lesion of the hip after which one of his legs had become shorter resulting in secondary scoliosis and a stooping posture. Otherwise the intra-pair differences were 2.0 cm or under.

In the following pairs, great differences in *weight* were seen. A qualitative analysis has shown a convincing association between these differences and the later lives and environments of the twins.

Pair VI. Weight difference 17.0 kg. There seems to have been a familial predisposition for obesity. Neither twin was excessively overweight in childhood. One married into a farming family with heavy eating habits; she had six children, put on a lot of weight during each pregnancy, and has remained obese ever since. The other twin never married and was never pregnant. In her youth she was somewhat stout but she lost weight when in hospital for a number of somatic and neurotic symptoms (cf. the case history). At the time of the investigation her weight was normal.

Pair VIII. Weight difference 10.5 kg. Familial predisposition for obesity. Neither twin was excessively fat as a child. One married early, had two children, put on considerable weight during pregnancy, continued to eat heavily, and was moderately obese at the time of the investigation. The other twin did not marry until she was 47, and had never been pregnant. She had been in hospital on numerous occasions (cf. the case history). She had never been overweight and had a slim figure at the time of the investigation.

Pair IX. Weight difference 10.5 kg. Possible familial predisposition for obesity. Neither twin was fat as a child. Both married, one had six, the other 11 children. Both were considerably overweight during pregnancy, but while one persevered with an effective diet and was slim at the time of the investigation, the other remained a hearty eater and was rather stout.

Pair II. Weight difference 8.5 kg. Familial predisposition for obesity. Neither twin was fat as a child, but began to put on weight during adolescence and, in both cases, this was augmented by marriage and pregnancy, one and four children respectively. The heavier twin continued to be a hearty eater, but the latter endeavoured to keep her weight down, although both must be described as rather stout.

Pair X. Weight difference 5.0 kg. Familial predisposition for obesity. Neither twin was fat as a child. Both became stout after marriage and pregnancy.

To summarize: the investigation of the heights and weights of the twins confirms on the whole previous investigation results from which it may be deduced that body height is largely determined by genetic and only slightly by external factors, while body weight is far more environmentally labile. The present results also suggest that environmental factors of pregnancy, childbirth, eating habits, and various psychological factors associated with them, play an important part in the development of obesity in women, al-

though a hereditary predisposition must also be presumed to interact with the environmental influences.

Cardiological examination

In the routine cardiological examination, apart from a labile, at times slightly increased, blood pressure in both twins in pair X, and a relatively great difference in systolic blood pressure in pair XII, nothing abnormal and no significant intra-pair differences were found.

In seven cases (I, II, IV, VII, VIII, X and XI) the examination was supplemented with an electrocardiographic examination. For each pair, there was great similarity with regard to normal, and, in pairs I and X, slightly abnormal but, clinically insignificant, qualities.

As could be expected the ECG-curve is predominantly determined by hereditary factors.

Neurological examination

In no case did the clinical-neurological examination reveal any objective signs of organic neurological diseases, nor were there any intra-pair differences of importance.

Both twins, pair VII, were ambidextrous, one, presumably, originally left-handed. One of pair X was left-handed. This frequency of left-handedness in monozygotic twins can hardly be considered remarkable (*Shields, 1962*).

Electroencephalographic examination

In nine cases (I, II, III, IV, V, VII, VIII, X and XI) an electroencephalographic examination of both twins was made. The results for eight of these pairs have been published (*Juel-Nielsen & Harvald, 1958*).

The analysis of the material includes an analysis of the frequency, the amplitude and the extent of the dominant activity, in most cases also examined under provocation with hyperventilation or flicker.

For all pairs, the examination disclosed, practically speaking, complete concordance, both with regard to normal qualities and slight abnormalities (pairs I and V).

The left-handed twin in pair VII had a somewhat greater amplitude over the left than over the right hemisphere, while this was reversed in the twin partner. In the left-handed twin, pair X, the amplitude was the same in both hemispheres, while it was greater in the right than in the left in the partner, but a clear electroencephalographic "mirror reflection" could not be demonstrated in any case.

These results confirm those produced by recent investigations. *Vogel* (1958), on a very large twin material, has clearly documented that the electroencephalographic curve is largely determined by hereditary factors.

The results of the present investigation serve, first and foremost, to refute the purely theoretical objection that EEG-similarities between monozygotic twins may be due to their common environment during upbringing.

Ophthalmological examination

The results of these relatively few examinations have been included chiefly because they serve to illustrate a methodological problem of principle interest to twin research.

In the case of such relatively exact methods of investigation a minute analysis renders possible the establishment of quite small, mostly quantitatively varying, differences, not only between the twins, but, apparently, also, just as much between the eyes of each individual, although such findings can still be registered as "normal" and the twins, in this respect "concordant".

Outstandingly concordant were the anomalies of refraction. For two of the remaining pairs (III and V), who were only examined by the writer, there was also concordance in this respect, although the twins appeared "discordant" for glasses, owing to different environmental attitudes to such aids.

In pair VII there was a marked dissimilarity. One was suffering from the after-effects of an operation for cataract in the right eye, corresponding to anamnestic information of previous *heterochromia* or iris bicolor. Heterochromia has been described as a discordance in monozygotic twins. In this pair it must be looked upon as a phenomenon of mutation. Apart from the almost complete loss of sight in this eye, both twins were slightly *hypometropic* and had a slight *convergent strabismus*. A thorough special examination of this pair was, unfortunately, not practicable. (cf. case histories).

Other examinations and conditions

No special examination of *dental conditions* was made. The case histories show, however, great intra-pair similarity as a whole, although allowances must be made for the less clear effect of environment on differences in the care of the teeth and the use of dentures.

Finally, some other intra-pair differences and similarities were found.

In pairs I and III, one twin, in contrast to the other, had conspicuous *naevi*; in pair XII, a "birthmark" had been removed.

In pair II, both twins had severe *acne*. Pairs IX and XI, were concordant for severe *varicose veins*. In pairs VIII, X and XI, both twins had *arthritis*, and there was *arcus senilis* in pair XII. In other pairs, there were several

other minor similarities due to age and obviously determined by heredity.

Anamnesticly verified information on some normo-physiological conditions such as *menstruation, pregnancy and childbirth* indicates a close resemblance in the twins for the advent of the menarche and the menopause.

In one case, *menstruation* set in at the age of 12, in four cases at 14, and, lastly, there were two cases in which there was an interval of one and two years, respectively.

Striking similarities with regard to more or less marked anomalies of menstruation were to be found in most pairs, but this was especially so for pair IV.

The *menopause* for four pairs varied from ages 42 to 54 years. The intra-pair differences were 51/51, 42/43, 49/51 and 52/54. Two further pairs were clearly approaching climacterium since the twins both had brief periods of menostasia and presented slight climateric symptoms. Both twins, pair IV, had been sterilized, when 32 and 42 years old.

Pair II is an illustration of how an apparently irrelevant, fortuitous or not fortuitous "concordance" with regard to physiological conditions can be associated with relevant psychological aspects.

Both twins, at the age of 18–19 years, at a time when they had no idea of each other's existence, had menostasia. Both believed themselves (wrongly) to be pregnant, and both induced their respective sexual partners to marry them. The determination to marry was, in both cases, prompted by the knowledge of their own illegitimacy and their mother's similar situation in adolescence. Their choice of husbands, who socially and psychologically, were very different, decided the subsequent course of their lives and accounted for certain personality differences apparent at the time of our investigation.

As regards *childbirth*, in three pairs, one twin had never been pregnant; two were unmarried and one did not marry until she was 47. In four of the remaining six pairs, both twins had given birth to three or more children.

The twins had, altogether, 77 children, 42 boys and 35 girls, none of whom were twins. It may be mentioned here that there was one case (III) only where one of the parents was a twin (opposite sexed), but in eight of the 12 pairs, there were several cases of monozygotic and dizygotic twins in the family, among siblings, grandchildren or more distant relatives.

SOMATIC DISEASES

Discordance with regard to the appearance of various medical or other somatic diseases was found in a number of cases, and these differences could, in the majority of cases, be easily explained by specific environmental differences either of childhood or of later life.

These were, first of all, diseases due to specific infections such as *pulmonary*

tuberculosis (pair I, the twin partner was vaccinated as an infant), *gonorrhoe* (II and V), *herpes labialis* (III), *scarlet fever* (III), *pneumonia* (I, III and V) and *typhoid fever* (XII).

There was also discordance for states following *injuries* and *accidents* (II, V, IX and XII). There were *hernias* (VII and VIII), clearly exogenous *skin diseases* (VI and V), and *salpingitis* (III).

Concordance for more or less well defined somatic, or psychosomatic diseases was present in many pairs.

Two female pairs, who were concordant for *migraine*, will be discussed in more detail:

Pair VI. Both twins developed migraine at the age of 15–16. In one twin it was exclusively unilateral, in the other the localization was diffuse, but otherwise the course and the symptomatology were practically the same.

Of the six children of one of these twins, two, at any rate, also suffered from migraine. The other twin was childless. The mother of the twins, as well as one, possibly two, of their sibs, with whom they had had no contact during their childhood, also had migraine, and, finally, several more distant relatives, including a cousin of the mother's, in whose home one of the twins was brought up, also had migraine.

Pair VII. Both twins had migraine from the age of 10–12. Similar symptomatology and course. Both had children, none of these had migraine, but there were several, who, like the twins, suffered from severe attacks of vertigo ("travel sickness"). The mother of these twins, and four of their sibs, as well as several more distant members of the maternal family, with whom neither of the twins had been in touch during childhood, also suffered from migraine.

Migraine patients are often said to have a characteristic personality structure, and migraine is reckoned to be one of the so-called psychosomatic diseases. In the literature, various more or less psychoanalytically bent theories on its aetiology and presumed psychogenesis have been expounded. It is, for instance, stated to be characteristic that its sufferers have had a specially hard or loveless childhood which is thought to result in the development, in sensitive patients, of an ambivalent and unconsciously aggressive attitude towards persons in their environment. As the mothers of these patients very often suffer from migraine themselves, it has been thought that the patient's choice of reaction can be explained as an unconscious identification with the mother.

In pair VII, one twin had been brought up by a foster mother who was a cousin of the natural mother and who had migraine herself, this hypothesis may be tenable, but it is not particularly applicable in the case of her twin sister, and not for the twins in pair VI either.

A genotypical predisposition for the development of migraine must be

considered the more probable explanation of the concordance for both these pairs. The psychological difference of the early environment (cf. the case histories) may have had a certain pathoplastic significance although this is not particularly apparent nor easy to interpret for any of them.

In pair X, both twins had since childhood been strongly *allergic for primula*. One of them had, after a severe attack at a relatively high age, developed an undoubtedly neurotic tic. Both had also uncharacteristic, but from their own descriptions very similar, attacks of abdominal pain (cf. the case histories), presumably of vascular-allergic origin.

Concordance for various, fairly well-defined, somatic disorders was found: in pair II for *urticaria* and *acne seborrhoica*, in pairs IV and VI for *chronic constipation and haemorrhoids*. Finally, pairs I, V, IX, and X showed great similarities for “*rheumatic*” complaints of various kinds, and in pair XI both had had *rheumatic fever*.

Pairs IV and VIII, both classified as presenting psychiatric diseases, will be discussed later. At this stage, it is enough to point out that the histories of these diseases are remarkably parallel in their accounts of various somatic symptoms. In the former pair there is a long “abdominal case history” and in the latter there are “vegetative disturbances”.

To summarize, it can be said that these investigations on the general health, on the various somatic diseases and other abnormal states show a number of unmistakable intra-pair differences and similarities. The latter, as would be expected of an investigation of biological conditions predominantly lying close to some of the criteria employed in the classical polysymptomatic similarity test, must, on the whole, be considered the more pronounced.

The investigations show further that the differences between the twins, both in general and for each individual pair, are clearly associated with differences present, either in the early environment or later in life. The intra-pair similarities that have been demonstrated, can, in the majority of the cases, be explained convincingly from the genotypical identity of the twins.

INTELLIGENCE AND PERSONALITY

A comparison aiming to demonstrate and define intra-pair differences and similarities of intelligence and personality structure with the ultimate object of deducing an association between them and differences of environment, meets with difficulties that are considerably more formidable than those connected with a comparison and demonstration of relatively simple causes of somatic conditions and diseases.

Intelligence

These difficulties are less in the evaluation of intelligence than in those of personality; in principle, at any rate, intelligence can be measured, although an ordinary clinical evaluation gives a somewhat rough classification and comparison.

With regard to intelligence, all 24 probands were to be found within the bounds of normal variation. The material for investigation shows, on the whole, an unremarkable distribution around the level of average intelligence, although the extremes must be said to be under-represented, since this investigation does not include persons of either high or low intellectual level.

As appears from each case history, the clinical examination and evaluation produced a marked intellectual dissimilarity in only a few cases.

In three pairs, I, V and X, there were distinct dissimilarities of intelligence functions.

These differences were, however, clearly associated with personality, inasmuch as the better endowed twin put his intellectual gifts to better advantage, which corresponds to the information of his considerably superior schooling already recorded. A clear dissimilarity of the actual level of intelligence or total intellectual capacity could, therefore, not be established with certainty. The differences in the remaining pairs were either so small or so uncertain that they could not in the general clinical evaluation be defined more precisely.

A thorough analysis of intra-pair differences and similarities of intellectual function has, therefore, been postponed, and will be found in the chapter on the systematic testing taken by means of the intelligence tests already described.

In the analysis of the intelligence test scores, an endeavour has been made to ascertain whether the intra-pair test score differences are significantly greater than the differences between the scores of each proband that were achieved at a first testing and then later after a suitable interval.

Furthermore, the intra-pair differences and similarities have been compared with the scores achieved by the other probands of this material, thus producing an analysis of the differences and similarities in the scores of unrelated persons.

Finally, the association between intra-pair scores and education have been analysed. The differences in education have been evaluated by the writer independently of the psychological testing.

Personality

In the clinical examination and evaluation of personality, the majority of the probands were classified as psychiatrically unremarkable, and hence within the limits of normal personality variation.

Many of the twins present, however, more or less marked neurotic symptoms or traits within an otherwise well integrated personality; Pair I was found remarkable in respect of personality.

As will be discussed later, one twin, pair VI, both twins, pairs IV, V and VII have been classified as presenting a psychiatric disorder, that is, a neurosis or a personality deviation of such severity that a need for psychiatric guidance had either been manifested, or must be thought to have been present at certain times.

As appears in the case histories, a description of the apparent personality of each proband has been made, together with a clinical evaluation and comparison with the total personality and those sides of the personality structure that were predominant in each proband or in each pair of twins as a whole.

If, on this basis, all the pairs are classified according to the total evaluation of their personality differences and similarities, the material can be divided into three loosely defined groups:

Group 1. Pairs III and VI. These twins presented personality differences on the whole clearly more predominant than the similarities.

Group 2. Pairs IX, XI, VIII and II. These twins presented personality differences as predominant as the similarities.

Group 3. Pairs V, I, XII, X, IV, and VII. The personality similarities were considerably more predominant than the differences.

The numerical order in which the twins appear in each group indicates a relative placing, pairs III and VII thus presented the greatest differences and the greatest similarities of personality.

A classification such as the above is, naturally, based primarily on the subjective evaluation of the investigator. It cannot altogether be precluded that the evaluation, at least unconsciously so, is influenced by such factors as his knowledge of the early psychological environment and the environment of later life, or the appearance of other differences and similarities between the twins, for instance with regard to somatic or psychiatric disorders.

The classification serves, chiefly, to show at a glance how the investigator has rated the total material, and to emphasize that, in all 12 pairs, certain intra-pair personality differences could be proved, and, finally, that these were very marked in some pairs, less so in others, while there was also a marked similarity in personality structure in the majority of cases.

If an attempt is to be made to define which side of the personality generally presents intra-pair differences and which side intra-pair similarities, the complicated conditions can best be surveyed if the extremes of differences and similarities are first pointed out.

In all 12 pairs there were marked intra-pair differences in that part of the personality governing immediate psychological interaction and ordinary human intercourse.

In their attitude to the investigator, and to others, the twins behaved, on the whole, very differently, especially in their cooperation, and in their form of and need for contact.

Corresponding with these observations, the twins gave, as a rule, expression to very different attitudes to life, and very divergent views on general culture, religion and social problems. Their fields of interest, too, were very different.

These personality differences found concrete expression in their references to, and attitude towards, their early environments, to their present situations in life and to their families. In this connection, it was remarkable that their spouses presented no similarities whatsoever, neither in personality nor in outward appearance, on the contrary, in every case they appeared quite different and accorded with the twins' own different attitudes as to how family, marital, and, particularly, sexual problems were to be treated. Those twins who had children treated, on the whole, their children differently, and their ideas on upbringing were, as often as not, diametrically opposed.

Characterologically, the twins presented differences in their ambitions and in their employment of an aggressive behaviour. Emotionally, there was a deep-going dissimilarity with regard to the appearance of spontaneous emotional reactions or to the control of affective outbursts. Various traits of personality found their expression in differences in taste, mode of dress, hair style, use of cosmetics, the wearing of a beard or of glasses. Finally, it must be noted that their handwriting seemed strikingly different.

The most striking intra-pair personality *similarities* were found in the twins' general appearance, especially in their motility pace, their carriage, their gait, their movements, their gestures and in small involuntary movements such as a turn of the head or the hands, their facial expression, especially their smile or their laughter, to say nothing of their voices which, both in tone and pitch, were strikingly alike in spite of the various differences of dialect, vocabulary and linguistic proficiency.

Striking, too, were the similarities between the descriptions of their symptoms, which often tallied remarkably, and must be expressions of similarly experienced physical and psychical phenomena. (Pairs I, II, IV, V, VI, VII, VIII and X).

Similarities such as those described above are frequent not only in the case of monozygotic twins brought up together, but are also seen in sibs and in even more distant relatives, but, while the similarities in these latter cases are often presumed to be predominantly due to imitative behaviour, whether

conscious or not, they must, in the present investigation, be taken to be a clear expression of hereditary behaviour. *Shields* (1962) makes the same point.

Between these general extremes of personality appearance, each twin pair presented, as is described in the case histories, differences and similarities of varying degree in their personality structure.

The personality of the twins at the time of the investigation was marked by the fact that their lives had, on the whole, run a very different course. (Table 5). As seen in the table, many pairs were discordant for marital state, age at marriage or number of children. With few exceptions, they had received different sorts of education, and, as far as the women were concerned, they had found a different socio-economic place in life through matrimony.

In the description of psychological conditions and interpersonal relations

TABLE 5

Marital Status of the Twins, their Occupations, Age at Marriage, and Number of Children at the Time of the Investigation

Twin Pairs	Marital Status and Occupation	Age at Marriage	Number of Children
I	Palle..... unmarried book-keeper..... Peter..... unmarried student.....		
II	Olga..... married to day-labourer..... Ingrid..... married to baker.....	19 18	1 4
III	Maren..... unmarried nurse..... Jensine..... married to journalist, nurse.....	29	1
IV	Ingegerd.... married to labourer..... Monika.... married to labourer.....	24 22	4 5
V	Kaj..... married commercial traveller..... Robert..... married draughtsman.....	(27) (35) 44 (29) 37 (47)	3 5
VI	Martha.... married to farmer..... Marie..... unmarried laundry manageress.....	32	6
VII	Kamma.... married to motor car mechanic..... Ella..... married to small-holder.....	21 19	6 7
VIII	Signe..... married to labourer..... Hanne..... widow of labourer.....	47 22	
IX	Karin..... widow of small-holder..... Kristine.... married to day-labourer.....	26 (18) 27	6 11
X	Petrine.... married to salesman..... Dorthe.... widow of shipmaster.....	22 19	6 4
XI	Astrid..... married to postmaster..... Edith..... widow of day-labourer (former grocer)..	30 23	3 2
XII	Viggo..... widower, former farmer..... Oluf..... married, former gardener.....	39 38	

The figures in brackets indicate age at previous, and later, marriages.

of the early environment, and in the account of the personality development of each proband, a quantity of data and information has been included, presumably relevant to the psychological development of each case and to intra-pair personality differences but the conditions on which the intra-pair comparisons have been based, and, hence, the problems on which they cast light, vary from pair to pair. This was only to be expected, if for no other reason, then because the ages of the 12 pairs under observation varied from youth to old age. General significance for the development of personality dissimilarities can, therefore, only to a limited extent, be attached to these environmental factors. With the methods of investigation employed here, it must not be expected that the existence and importance of some general or specific conditions can be proved. The investigation has primarily served to produce a material capable of describing, for each pair, differences and similarities of the course of the twins' personality developments. To the extent to which an association that is either immediately comprehensible, or more or less convincing, may be established, one can delimit environmental factors that are presumably significant for the differences observed in the twins' personality structure. The differences and similarities, found as a consequence of the interplay of the individual genotype and the given environmental conditions, lend themselves only to a limited extent to comparison with other differences and similarities found in the interplay of another genotype and other environmental conditions. Each pair of twins must, primarily, be discussed and analysed on its own.

In general, it can, however, as has been pointed out already, be emphasized that differences in personality structure and development have been demonstrated in every pair; the dissimilarities show an, on the whole convincing, association with environmental differences, although these are not those of early childhood alone, but also those of the whole course of the twins' later lives, as well as of their subsequent psychological environment.

At the same time, despite markedly different upbringings and later lives, outstanding similarities in the twins' personality appearance and development have been shown. These similarities must be related to the genotypical identity of the twins, and must be taken as an expression of the importance of genetic factors for the normal development of personality.

As appears in the section: *The twin relationship* in the case histories, the intra-pair personality differences and similarities have been elucidated especially.

It has already been mentioned that only one pair of twins had had close contact with each other during childhood. As adults, it goes for all pairs that their contact had, on the whole, been very slight. A few only, chiefly pairs I, VII, X and XII had directly endeavoured to keep in some sort of touch, but even so, this was less than is usual among brothers and sisters ordinarily.

Other twins, III, VI, IX and XI, had, from the moment they had got knowledge of each other's existence, been more or less openly ambivalent, or at times directly hostile towards each other.

Special interest attaches itself to twins I, II, V, VII, VIII and X, who were not brought to each other's notice until they were grown up, the first three particularly, who were 22, 35 and 40 years old, respectively, before chance mistakes of their identities brought them together, in the first two cases, immediately prior to our investigation.

While monozygotic twins brought up together must be presumed, gradually, to experience a mutual identification process and adjustment, usually leading to a harmonious, mutual balance, the case, psychologically, is undoubtedly very different for adults suddenly confronted with a "double" and hence a "mirror reflection" of their own personalities, an experience that most people are spared.

The case histories show that this kind of "self-confrontation" can be a considerable psychic strain which has produced varying consequences in the different pairs. In three of the above cases, pairs II, V and VIII, the interaction resulted in a complete break, chiefly because each found certain outstanding personality traits in the twin partner difficult or impossible to accept. As is related in the case histories, these personality traits were more or less predominant in *both* twins. It can hardly be an entire chance that these twins were, on the whole, relatively disharmonious personalities, nor that twins I, VII and X who developed a real sympathy for each other with a feeling of affinity, were far more harmonious in their personality.

PSYCHIATRIC DISORDERS

None of the twins showed any symptoms of severe psychiatric disorders during childhood, but a few of the probands developed slight neurotic or psychosomatic symptoms and reactions.

In pairs I, II, V and VII, there was a history of discordance for *enuresis* which under the circumstances may be considered a presumably psychogenic reaction to various psychological environmental conditions. *Shields* (1962) had seven concordant and only one discordant pair in his material. *Hallgren* (1960), in a large twin material, found a higher frequency of enuresis among twins than among non-twins, but no certain difference between mono- and dizygotic twins.

In pairs VI and XI, one twin had shown marked neurotic symptoms as a child, of anxious and depressive nature, and, presumably, a reaction to unfortunate and, undoubtedly, psychotraumatic environmental conditions (cf. case histories). Both probands had slight neurotic symptoms after they had grown

up, but in neither case, to such an extent as to classify them, at the time of the investigation, as presenting a psychiatric disorder.

In four cases, pairs I, II, III and VIII, both twins, despite marked psychological differences in environmental conditions, had had very uniform neurotic symptoms in childhood. In pair I, these were severe attacks of anxiety, nightmares, restlessness and nail-biting; in pair VIII, anxiety, fear of the dark or nightmares, and in pairs II and III, neurotic symptoms and disturbances of behaviour of a less characteristic kind.

In pairs II, IV and V, there were some slight differences during puberty, but also some possible points of similarity with regard to behavioural disturbances or tendencies towards them.

As has already been stated, one or both twins in the following pairs IV, V, VI and VIII were classified at the time of the investigation as presenting a psychiatric disorder.

Both twins, *pair IV*, were denoted as neurotics with marked psychosomatic, hysterical-anxiety and periodic, depressive symptoms. They presented marked similarities in personality, both appeared immature, emotionally labile and had a modest intellectual equipment, while differences in personality were not very noticeable.

The twins were illegitimate. Even before their separation at the age of 12 months, there seems to have been certain environmental differences, at any rate with regard to their possibilities for emotional attachment to their mother. They were then separated and placed in different homes with some, though not very marked, psychological and social differences, where they remained until their reunion at the age of seven.

Their mother had married, and, when they were taken to live with her, their stepfather and younger half sibs, both twins felt themselves emotionally frustrated by their mother and usurped by their half sibs. Their relations to their mother, however, were different in nature, or at least, so they were experienced by the twins (cf. the case history).

After a renewed separation at the age of 14, neither was particularly closely attached to any other person, and adolescence seems to have introduced in both a decisive, psychological phase. Both began to manifest neurotic symptoms in connection with the approach of puberty and the establishment of sexual relationships. Both married relatively young, and the neurotic symptoms were accentuated during a life of unwanted pregnancies in poor dwellings with social, financial and matrimonial problems. Both were frigid with a great fear of pregnancy, both developed a number of somatic symptoms, primarily gynaecological, as well as the neurotic symptoms already described. Both were sterilized, with a 10 years interval.

Both have been hospitalized numbers of times, one, exclusively in somatic

departments despite her, at times, obvious need of psychiatric guidance of which she refused to avail herself. The other was also admitted to somatic departments to begin with, but later she was, on several occasions, in psychiatric departments where she was treated with, among other things, anti-depressives. As discussed in the case history, the diagnosis: endogenous depression, was considered, but, in the writer's opinion, the grounds, neither for her disorder, nor for that of her twin sister, were insufficient to substantiate the diagnosis of a manic-depressive psychosis, even though an endogenous component cannot be excluded. The depressive symptoms are, however, especially when compared with the twin sister's case history, most probably psychogenic reactions in an undifferentiated and primitive personality.

The case histories of these twins present a striking parallel with outstanding symptomatological similarities. As appears in the case histories a cross-section at different periods in their lives shows some, especially psychiatric, differences, but these seem to be accounted for by a certain time shift, while, when considered longitudinally, the development and the course of their cases show extreme similarities, and the significance of the temporary differences is hereby greatly diminished.

In the case of this pair of twins, it must be pointed out that it was registered and included in this material by the investigator at a time when there was reason to presume considerable psychiatric deviation between them. It may also be argued that they were only separated during their very earliest childhood and that the environmental differences cannot be said to have been very great. But differences there were, especially with regard to the mother, although these can hardly be said to have had any decisive significance for the course and symptomatology of the psychiatric disorder. The very close resemblance between the case histories makes it natural to assume that the appearance of the phenotypical similarities are largely determined by their genotypical identity.

The twins, *pair V*, both displayed marked characterological deviations.

They were illegitimate, separated on adoption, at least before the age of 9 months, and were not reunited until they were 40 years old.

One twin grew up in a large city, was brought up very strictly by a domineering, adoptive father, lost his adoptive mother at an early age, got a new one, who did not like him, and who favoured her own children. He developed marked neurotic symptoms early in childhood. He received a good education, followed by a technical training, but had the greatest difficulty in settling down in this occupation, tried various other fields, had several positions of brief duration and led an altogether erratic and unstable existence.

The other twin was brought up in the country as an only child, exceedingly over-protected by his neurotic, adoptive mother, and without forming any

contact with his comparatively elderly, weak and passive, adoptive father. His childhood life was free, discipline was lax, and he early displayed various slight behavioural disturbances. He got a poor education, could not adjust himself to the trades he was put on, and never got a proper training. He was in conflict with the law at an early age, and was sentenced to prison, after which he was in and out of various jobs, moving around a good deal, and working, mostly, as a salesman in various lines of business.

In spite of the differences of early upbringing and education, there were, as appears in the detailed case histories, many parallels and similarities in the development of the twins' personalities, and in the course of their lives. The temperaments of both must be termed unstable and vacillating, each had more than ordinary difficulty in adjusting himself to the ordinary social norms of occupation and marriage, each held many brief positions, each married several times.

The former twin had sought psychiatric guidance on several occasions, and was classified as neurotic. The other had shown asocial activity, had been to prison, convicted several times, and had been involved in shady business transactions.

The differences in the personalities of the twins mainly concern their relations to, and interactions with, other people. The personality of the former seems to have been inhibited and restricted in its development, which has perhaps been most unpleasant for himself, but also very unpleasant for his wives and children, his colleagues and others in his immediate surroundings. The uninhibited, unrestrained development of the personality of the latter has been of greater inconvenience to the community and to those to whom he was closely related, although he does seem, at least to a certain degree, to have suffered from his deviation in character himself. The differences in personality must be said to have an immediate and convincing connection with the psychological differences of their childhood environments.

No matter whether the former twin is to be termed "character-neurotic" and the latter a "psychopathically stamped character", or whether they are both to be termed, as the writer is inclined to do, psychopaths, the similarity in the development and the structure of their personalities is remarkable.

They both lack the check and the control of fundamental, uniform impulses and urges of a similar nature. The significance that can be attached to the different psychological factors in their childhood environments is quite predominantly pathoplastic, although from a sociological aspect, this must be said to be highly significant.

It is reasonable to assume a massive, genetic predisposition for a disharmonious development of personality, and this assumption seems to find some support in the anamnestic information of their family history (cf. below).

In retrospect, it might be pointed out that neither childhood home was particularly suited to counteract the development of personalities such as here described, but on the other hand, the probability of the production of an "optimal" interplay of genotype and environment must, in practice, be taken to be small. There is reason to suppose that, under ordinary, environmental conditions, a disharmonious character would have developed under all circumstances, with a phenotypical variation within a pattern fairly corresponding to the two case histories described here.

Pair VI. The twins are of particular interest. One had a severe neurosis, with asthenic, hypochondriacal and psychosomatic symptoms, while the other only showed slightly neurotic, especially obsessional traits, and weak psychosomatic symptoms in an otherwise normal personality structure.

The former had repeatedly been hospitalized, but she had never had psychiatric treatment, although the need for it had, undoubtedly, been there. Somatically, as has already been told, the twins were greatly dissimilar; the former was almost on the thin side, while the other was extremely stout; both had suffered from migraine since they were children, and the disease had followed a practically identical course.

The twins were the youngest of six. The home had been given up when the father, owing to his disharmonious marriage, had deserted it, and the twins, like their elder sibs, were placed in foster homes and so separated. Geographically, the separation was a small one, since they grew up in the same town and attended the same school, but the differences between their environments were otherwise considerable.

One was placed with a cousin of the mother and grew up together with a foster brother, and was strongly attached to her neurotic foster mother. The other was brought up as an only child. Socially, the difference between the two homes was not remarkable, but there were considerable psychological differences, particularly of a religious nature. Both were strongly attached to their respective foster mothers, whose personalities, however, were widely different.

Until they were about 30 years old, their outer circumstances were fairly similar, but then the latter twin married a farmer, got five children, and entered an environment that differed quite considerably from that of her twin sister, who remained unmarried, and, practically speaking, mixed with no one but her adoptive mother.

The chief differences in the personality development of these twins and in the course of their lives, can be accounted for by sex and marriage, although certain personality differences have, presumably, always been present, evincing a clear association with early environmental differences, particularly in respect of the mother figures and the psychological atmosphere of each home.

Pair VIII. Both twins have been classified as neurotics, with psychosomatic, markedly hypochondriacal, and periodic, depressive symptoms.

One had been hospitalized numerous times and had also sought psychiatric assistance. The other had, likewise, frequently been in hospital and had occasionally consulted a neuro-psychiatrist in private practice.

The twins were illegitimate. One had been brought up by the paternal grand-parents, as what was tantamount to an only child, and was deeply attached to her paternal family. The other had been placed with strangers and had also grown up as an only child.

Socially and psychologically, there were significant differences between the two homes, and with these, dissimilarities in the personality development of the twins are clearly associated.

In the course of these twins' lives, there were outstanding differences, mainly in respect of sex and matrimony. One, after her engagement had been broken off, remained single until she was 47, when she married a widower with grown up children; the other married at 22, got two children and was widowed at an early age.

In spite of the differences in personality development described in the case histories, just as striking similarities were found in the symptoms and the course of their psychiatric disorders. A hereditary predisposition must be presumed to have entered in here.

It is natural to expect that the information concerning *psychiatric disorders of the biological family*, in parents, sibs or more distant relatives, would support an association between the points of similarity in the psychiatric disorders in the twins and their genotypical identity.

An investigation of twins separated in childhood carries the disadvantage of the probands often having been brought up without contact with, or knowledge of, their biological family.

An endeavour has been made, as has already been pointed out, to counteract this disadvantage by systematically collecting information from every other available source. Although much, genetically undoubtedly relevant, material, has been brought to light, there yet remain some twin pairs about whom the information obtained is incomplete, and for whom it cannot be precluded with sufficient certainty that close relatives have displayed severe psychiatric disorders or mental deviations. This may especially be true of the above four pairs about whom only fairly certain information of one of the natural parents and their relatives is available.

In the case of *pair IV*, the information about the father and his family is unsatisfactorily meagre; the twins' mother has stated that he was presumably characterologically deviating, vacillating and unreliable, a characteristic that, at any rate, is not gainsaid by the fact that he entirely evaded every

legal and moral obligation towards them. Very little is known of the paternal family, and severe deviations of character can in no way be precluded.

What can be ascertained about the mother gives no reason for assuming that she had any psychiatric disorders, or marked personality deviation, especially is there no immediate resemblance to the case histories of the twins. In the mother's numerous sibs and more distant relatives, various difficulties of social adjustment were met with, but there was nothing to justify the assumption of a predisposition for psychiatric disorders.

Information of the relatives of *pair V* is likewise scanty. The father, who came from a family boasting many highly intelligent and socially successful members, had, from what could be ascertained from the twins, a deviating temperament, very like their own, neurotic, or psychopathic, personalities. There is no direct information of the mother; the mental deviations and social maladjustments of the maternal half sibs can, as is pointed out in the case histories, probably not be considered relevant.

All that is known of the father of *pair VI* is that, in consequence of his disharmonious marriage, he left home and children. The mother's temperament may also have been remarkable, but a predisposition of psychic diseases, apart from the predisposition to migraine, has not been made probable.

The father of *pair VIII* does not seem to have been in any way psychopathological, but in the twins' family, both maternal and paternal, psychosomatic manifestations of various sorts were quite frequent. These took the form of obesity, gastro-intestinal, cardio-vascular, and, presumably, endocrine disturbances. The mother and a maternal aunt had, like one of the twins themselves, been suspected of having Graves' disease, but, as is discussed in the epicrisis, it is doubtful whether this diagnosis can be substantiated in the twins. The resemblances between the illnesses of the twins and of their mother are, however, so marked that they must be taken to be an expression of a hereditary predisposition.

Information of the family history of these four pairs though meagre shows, nevertheless, that some confirmation of a so-called family predisposition for psychiatric disorders can be obtained. The closer association between such a predisposition and the points of similarity in the psychiatric disorders of each pair of twins cannot be said to be either exhaustively, or even fairly satisfactorily, elucidated by so casual an inspection. Nor was this to be expected, if for no other reason, then because we have here a complicated interplay of heredity and environment, while our knowledge of hereditary conditions, especially their mode of inheritance, is as yet but scant.

The difficulties in assessing the significance of a family history comes out even more clearly when one considers some of the pairs, with a considerable family history of psychiatric disorders, that on the diagnostic classification have, nevertheless, been termed "normal".

Pair I had a heterogenous, psychiatric family background. There is no doubt of the father's deviating personality; he committed minor offences during periodic bouts of drunkenness, and seems to have been a dipsomaniac. Some slight criminality among the paternal sibs and more distant relatives has been registered, but the information is insufficient to permit any psychiatric classifications.

Little is known of the twins' mother. She seems to have been neurotic, but there is nothing to suggest that she ever suffered from a psychiatric disorder and certainly not a psychotic. In her immediate family, however, both on the paternal and the maternal sides, there are detailed histories of many severe psychiatric disorders of different kinds, including manic-depressive psychosis, schizophrenia, mental deficiency and other mental abnormalities.

At the time of the investigation, these twins were 22–24 years old, and had, thus, as yet experienced very little of the manifestation periods of the psychiatric disorders in question. Although both their adoptive fathers had been heavy drinkers, they did not even display a tendency towards alcoholism. The clinical evaluation puts them as normal or somewhat deviating personalities, but within the bounds of normal variation.

The parents of *pair II* must both be termed asocial and psychopathic. The father seems to have been a vacillating character, and had been convicted for various minor offences. The mother, who later became a prostitute, had numerous convictions and suffered from alcohol and medicine abuse. There was much social maladjustment and criminality in her family.

There were no socio-psychological deviations of this kind in the twins, although one of them, who had been brought up as an "institution child", may perhaps have been on the verge of them.

There can be no doubt that for these two pairs, the early environment counteracted possible tendencies towards social unhinging, and that they would have been much worse off if they had been brought up with their natural families.

An undoubted predisposition for manic-depressive psychosis existed in the family of *pair III*. The father had had repeated depressions and committed suicide, and there were several cases of psychiatric disorders of a depressive nature in his family, other members of which, including the twins' sibs, had depressive personalities.

Up to the time when they were investigated, at the age of 37–38, neither twin had shown any definite signs of manic-depressive disorders.

Other mentally unobtrusive pairs, too, had more or less marked psychiatric disorders or abnormalities in their families.

In obtaining the family history, a registration of deviations from the normal has not been the sole object of the investigation, but an attempt has also

been made to produce as clear a picture as possible of the personalities of the sibs and other relatives and of their socio-psychological conditions. A statistical evaluation of these data has not been considered as the material is so small, but a comparison in every case between the twins and their sibs is instructive, as it illustrates the often considerable phenotypical variation that can exist among siblings.

Correspondingly, a cross comparison, for instance, between pairs of approximately the same age, as pairs II and III, or pairs X and XI, shows just how much chance selected, unrelated persons can vary phenotypically.

Phenotypical variation between unrelated persons is conditioned partly by their variation in genotype and partly by the interplay of the genotype and the particular environments. The special constellation of genes, which the individual genotype represents, varies considerably from individual to individual, and this is also true of relatives, as sibs, for instance, on an average, have only half their genes in common.

The results of the present investigation confirm that persons equipped with identical genes, i. e. monozygotic twins, present a certain phenotypical variation. How great this intra-pair variation can become, hardly depends upon environment alone, but also to some extent upon the particular genotype. In some cases, pair VI, for instance, one gets the impression that there may be many possible variations of the phenotype; in other cases, such as pair V, it seems as if the influence of environment is somewhat limited. Phenotypical similarities between monozygotic twins can thus be entirely, or quite predominantly, genetically conditioned by the particular combination of genes that characterize the common genotype.

Similarities in psychiatric disorders need not necessarily find expression in a familial occurrence of psychiatric disorders, and especially, it must not be expected that corresponding similarities are to be found among sibs. In family studies the methods of investigation must be relatively rough, which makes it especially difficult to define the limits of such diagnoses as neuroses or personality deviations lying beyond the limits of normal variation, since the available information is frequently either uncertain or too meagre. In some cases, relatively severe psychiatric disorders may appear in near relatives, and sometimes the points of resemblance in the family histories are so marked that one is left with the impression that this must be due to a dominant gene transmission; in other cases, no familial occurrence can be disclosed.

A far-reaching concordance in monozygotic twins, associated with a considerable phenotypical variation, or a modest appearance of corresponding similarities, among sibs or other relatives, accords with the assumption that the quality, or the disease in question is primarily conditioned by a number of genes in co-operation. Normal, biological and psychical, characteristics, that vary quantitatively, such as height and intelligence, must be supposed to be

polygenetically determined, and it is natural to assume that the normal development of personality and the appearance of certain psychiatric disorders, especially neuroses and anomalies of character, which can be considered as extreme, quantitative deviations from the limits of normal variation, must also be conditioned by a multitude of factors.

The twin method can illustrate the phenotypical variations; a direct study of heredity, especially the mode of inheritance, must rely on other statistical-genetic methods of investigation.

The present material concerning hereditary predisposition for psychiatric disorders has been produced by means of a relatively intense clinical investigation and the results serve, first and foremost, to emphasize the fact that in psychiatry, the interplay of heredity and environment is complicated and difficult to assess.

The conclusions that one may be so bold as to draw both in general and in each particular case, are very different from the frequently hard and fast conclusions drawn from corresponding anamnestic information in clinical diagnostics. This applies particularly to genetic counselling, and to the administration of practical provisions based upon current legislation concerning abortion, sterilization, adoption, marriage guidance and family planning. In such socio-psychiatric problems, a genetic approach or point of view is often important and a decision taken is sometimes irrevocable, but the information on which these decisions are based is, at times, exaggerated in importance, and at other times under-estimated, or even ignored. Our knowledge of the genetic aspects of psychiatric-psychological problems must be said, as yet, to be so incomplete that the greatest caution should be exercised when making eugenic or other decisions in this field.

The present investigation has cast some light on the fate of a number of children who have been brought up in foster homes, or who have been adopted, and this material can be used in discussions on the problems of heredity-environment in connection with the above-mentioned counselling and guidance, when practical measures are to be instituted. Follow-up investigations are still called for, extensive as well as intensive, that a considerably more comprehensive material may be procured. No matter how difficult in various ways, such investigations may be, they ought to be carried out none the less, so that the invaluable work of adoption institutions may come to rest upon an empirical basis as firm as possible.

To sum up: our medical-psychiatric examination has shown that, with the methods employed, it is possible to demonstrate definite differences and convincing similarities between the twins, but the degree of difference and similarity varies with the conditions under observation, and with each pair.

Phenotypical differences, no matter whether they are somatic, normo-

psychological or psychiatric, have, in the majority of cases, an immediate and convincing association with differences that, according to the collected information, presumably existed in the twins' environments, not only during childhood but also in their later lives.

A satisfactory explanation of the similarities could usually be found in the twins' genotypical identity, for somatic, normo-psychological as well as psychiatric qualities.

A rough division of differences and similarities into the "somatic" and the "psychic" shows for both categories, a logical sequence between extreme differences at one end of the scale, grading off, through varying degrees of differences and similarities, to extreme similarities at the other end.

On the "somatic" plane, the clearest differences appeared as the result of environmental influences of a gross, distinct or specific nature, such as infections or injuries.

Correspondingly, outstanding points of similarity are found in electroencephalographic, electrocardiographic and ophthalmological examinations, and also in other somatic conditions that, biologically, come close to the criteria established for the polysymptomatic similarity test.

Between these extremes, a series of conditions and disorders are found, all showing varying grades of phenotypical dissimilarity or similarity, and expressive of the interplay of genetic factors and environmental influences.

On the "psychic" plane, the differences between the twins are most marked where the conditions or criteria under observation are entirely, or predominantly, sociological criteria, as, for instance, criminality or other asocial behaviour and, in fact, they all appear within the field of the immediate interplay of the individual and his environment.

Similarities are most striking in personality qualities associated with the biological appearance of the individual, such as outward behaviour, motility and associated personality traits.

As was the case for somatic conditions, corresponding variations of phenotypical differences and similarities of intellectual function, personality structure, and psychiatric symptoms and disorders are found.

A rough, total evaluation of the investigation material shows, that, somatically as well as psychically, the similarities between the twins are the more predominant, perhaps just because they are more conspicuous.

Differences on the somatic plane hardly give rise to comment, and similarities of this nature are also easier to accept. Psychological-psychiatric differences and similarities between the twins lend themselves far more readily for discussion, especially it might be argued, that the latter are naturally due to certain social and psychological similarities of the twins' early environments, corresponding to the general statement, that most homes are probably rather "alike".

The relation between phenotypical differences and similarities and childhood differences and similarities, in so far as an association has seemed immediate, has been pointed out. In the following chapter, a closer analysis of the differences and the similarities between the early environments of the twins, partly on the basis of the total material, and partly for each single pair, will be made.

Chapter 10

ENVIRONMENTAL DIFFERENCES AND SIMILARITIES

Before presenting the results of the investigations on the differences and similarities between the childhood environments of the twins, and before analysing them with the object of providing further evidence of the presumable influence of a number of social and psychological factors upon the intra-pair differences, we must consider the circumstances and environmental conditions of the twins from their birth and until their separation.

CIRCUMSTANCES BEFORE SEPARATION

We have already seen in *Table 1* that most of the twins, nine pairs, were separated during their first year; five, of perhaps six, pairs were separated either at birth or within the first months.

Information concerning the circumstances of the twins from birth until separation has mostly been procured from the insufficient data that the twins themselves could give, although this has been confirmed and supplemented, wherever possible, from other sources.

The birth

Direct and exact information of birth and early infancy was only available in a few cases. (*Table 5*).

It has already been mentioned that the order of birth is unknown for four pairs, V, VI, VIII and XII. The exact birth weight is known for two pairs only, I and II, these two pairs having been born at a university clinic. In both cases the difference in birth weight is considerable, and this difference in weight continued throughout the first months at any rate, but at the time of our investigation, however, the difference was reversed.

Relatively great difference in birth weight was seen in other pairs also, e. g. pair IV.

One twin in each of pairs I, X and XI weighed under 2500 g. In pairs IV and VI both twins weighed under 1500 g.

TABLE 6
Circumstances Attending the Birth of the Twins

Twin Pairs	Birth Weight	Complications	Breast Fed
I Palle.....	2600 g/47 cm	normal (by forceps)	+
Peter.....	2100 g/45 cm		»
II Olga.....	2700 g/47 cm	»	—
Ingrid.....	3000 g/51 cm		—
III Maren.....	?	»	—
Jensine.....	?		+
IV Ingegerd.....	ca. 1375 g	2 months premature	+
Monika.....	ca. 1125 g		+
V Kaj.....	?	normal	?
Robert.....	?		?
VI Martha.....	?	»	?
Marie.....	?		?
VII Kamma.....	together ca. 2500 g	»	—
Ella.....	Kamma > Ella		—
VIII Signe.....	?	»	?
Hanne.....	?		?
IX Karin.....	Karin > Kristine	»	—
Kristine.....			—
X Petrine.....	ca. 2500 g	» , "Convulsions"	+
Dorthe.....	< 2500 g		+
XI Astrid.....	ca. 2500 g	» Asphyctic (half an hour)	—
Edith.....	ca. 2250 g		—
XII Viggo.....	?	normal.	?
Oluf.....	?		?

In seven of the eight cases where the birth order is known, the first born twin was the heavier.

In nine pairs, pregnancy and birth are stated to have run a normal course, although in one case, I, one of the twins was delivered by instruments. In pair X, one of the twins was seized with "convulsions" immediately after birth, in pair XI, one twin was asphyctic for a brief period, and, in both of these cases, the twin in question is said to have been the weaker during infancy. Pair IV was born two months prematurely and both twins showed symptoms of low viability during the first months.

There may be some association between birth order or higher birth weight and the later on ascertainable differences between the twins. This possibility will be considered in connection with the analysis of intelligence scores in the following chapter.

Breast feeding

With respect to feeding the information is uncertain. In four pairs, II, VII, IX and XI, neither twin was breast fed. In three pairs, I, IV and X, the mother nursed both twins for some months; beyond this, nothing is known of how these twins were fed.

There was, in one case only, *pair III*, a clear difference in feeding: After the separation at six weeks, one twin was breast fed by a neighbour, while the other seems to have been bottle fed from the start. The significance of this difference in feeding with respect to the development of the somewhat considerable differences in personality that characterize this particular pair is, however, not immediately clear.

With regard to the other eleven pairs, it is, at any rate, safe to state that their phenotypical differences are not attributable to known differences in breast feeding.

Early psychological circumstances

As is to be expected of a retrospective study made without the help of special deep-probing psychological methods, the information of the psychological circumstances of infancy, and of those prior to the separation especially, is sparse and uncertain.

This may give rise to all sorts of surmises on the significance of early environment.

It is natural to suppose that the twin partners experienced, from birth until separation, environments that were probably fairly alike, and also that they may have been exposed to certain psychological influences of significance. On this assumption, the hypothesis is possible that points of marked similarity appearing later, particularly with regard to personality structure and the development of psychiatric disorders, are entirely, or predominately, an outcome of the common, harsh, environmental influences associated, for instance, with their having both been put into an institution or with their having both suffered a prolonged period of "maternal deprivation" before separation.

Freud drew attention to the possible significance of early emotional experiences for the development of personality traits or mental abnormalities in adult life, and psychoanalysis has produced a special method of investigation that, among other things, aims at analysing and interpreting phenomena occurring during the early phases of the interplay of mother and child. *Bowlby* (1952), who was the first to make a thorough survey of most of the current literature on "early maternal deprivation", came to the conclusion that a prolonged separation of mother and child during the first three years has a permanent and characteristic effect on the development of personality structure, which, among other things, finds clinical expression in the child's

becoming so emotionally withdrawn and isolated that throughout childhood, as well as later in life, the normal emotional relations and attachments to other individuals cannot be established. Furthermore, he suggested that a special association may exist between prolonged "deprivation" during early life and the development of an "affectionless, psychopathic character".

These hypotheses of *Bowlby*, even though later studies by *Bowlby et al.* (1956) have caused them to be considerably modified, have often been accepted uncritically or, if questioned, then only on a purely theoretical basis. In a survey of the long series of investigations, "*Public Health Paper*" 14, 1962, published by WHO, it is emphasized that the concept of "maternal deprivation" embraces a whole set of problems which do not easily lend themselves to research, and, further, it is clearly pointed out that the investigations in this field have not produced results justifying definite conclusions or even broad generalizations.

That a mother—and a father too for that matter—is not only desirable, but is also most beneficial for the child is probably beyond all scientific debate, but that any prolonged separation of mother and child must necessarily entail serious emotional deprivation; that all children who are exposed to severe emotional deprivation, or who are placed in institutions at an early age, should develop a personality structure as described above; that such children alone who have been exposed to such influences should develop these characteristics, and that a biological mother is invariably to be preferred to any other person or institution, is clearly refuted by numbers of direct investigations of these problems; even in the present numerically so slight, material, there are examples to show that the matter is not that simple.

A complete survey of the literature of "early maternal deprivation" and an exhaustive discussion of the many hypotheses made on this basis is not called for here. It would, however, be natural to discuss, on the basis of the present material, what might be gained by attaching significance to conditions over which the amnesia of infancy has cast a protective veil, and, especially, what theoretical consequences such deliberations would have on the problems posed in our investigation.

If the emphasis is solely to be laid on the very earliest phases of life, and, especially, on the time preceding the separation, very considerable points of environmental similarity may be presumed, but, in the first place, one is then confronted with the fact that the time of separation varied from pair to pair. While, in some cases, the common environment continued for a few years, in the majority of cases it lasted only for one year or less, and, in those cases, where separation occurred after a few weeks, not to mention the pair of twins separated after one day, a discussion of the significance of such environmental differences and similarities before separation becomes rather absurd.

Nor must it be forgotten that if a relation between the phenotypical similarity at the time of the investigation and certain purely hypothetical similarities in earliest life are to exist, it would also be logical to assume that a corresponding association is to be found with regard to differences. To assume, beforehand, that a common environment is first and foremost identical with very similar conditions of environment is a statement which is hardly probable and which rests largely upon our slender knowledge of the early psychological conditions.

In spite of all, it is most probable that even had the twins remained together, there would still have been certain differences in their psychological environments, although it is difficult to say what significance these differences might have had.

In the case of some of the pairs, especially of those twins who were separated rather late, there are, in fact, certain grounds for presuming that the environmental conditions were not "similar" even before the twins were separated. The twins' relation to their mother and other persons in their surroundings, were different; this is true of pairs VI, X and XII, in whom some differentiation of personality and distribution of rôles between the partners seem to have begun before the separation.

Twins, pair IV, were separated when they were one year old, but before then, they had been placed in a children's home together with their mother; only one of them was, for the most part, looked after by the mother, while the other was looked after by a friend, also employed at the home, with the result that this twin was later placed with the friend's parents. It is natural to connect these early conditions with the twins' later relations to their mother, partly during their subsequent childhood together, partly after they had grown up and right up to the time of our investigation. Even though neither of the twins came to feel that she was accepted by the mother, and the attitude of both towards her was ambivalent in consequence, the mother seems, nevertheless, to have been experienced differently by each. It is not, however, clear how the differences and similarities in this respect have had any bearing on the development of their later psychiatric disorders.

Three pairs (V, I and II) had been under institutional care of varying duration before the separation; Pair V had been placed in a children's home, exactly for how long is not known, but it was at any rate for less than nine months, possibly only for a few months or even less; the twins, pair I, were with their mother at the clinic where they were born and were then moved to a children's home and stayed there until they were 10 months old. No further information is available about their environmental conditions during this period, nor can the possibility of their having attached themselves emotionally to different members of the staff be precluded. From the time of their separation, and at any rate until the time when they were placed in their

respective adoptive homes, 4–5 months later, their external environments were certainly very different, one having remained at the home, and the other having been hospitalized for various somatic disorders. Similarly the twins, pair II, remained with their mother at the clinic where they were born until they were separated when two months old. Neither for these twins is any information available of environmental differences, but, on the other hand, in the period preceding their removal to their foster homes there were marked differences; one went to his foster parents straight away, while the other stayed at the clinic until she was about six months old.

In none of these cases can it be said to be immediately apparant how the differences or similarities here described have had significant influence on the differences and similarities in personality or psychiatric disorder, although they can not of course be precluded in theory.

If any importance is to be attached to such early “primary” differences, it must be fully realized that the significance to be attributed to the differences appearing in the psychological environments later must be either reduced to the rank of secondary factors or be cancelled altogether. As has already been emphasized in the preceding chapter, it has been possible to point out an immediate, and in the majority of cases a convincing, association between phenotypical differences and differences in the childhood environments of the twins after separation, and it is, therefore, not easy to see the advantage, from the point of view of research, of adhering fanatically to the theoretical possibility, that these differences must have started at birth or immediately after.

To summarize, it can be stated that the available information on the environmental circumstances of the twins before their separation is sparse and uncertain, especially with regard to its psychological aspect. Even though it can be presumed that the environment has in many ways been for the most part alike, it can not be precluded that differences relevant to the later development of the personality have been present, in some cases at any rate. In the material as a whole there seems, first and foremost, to have been marked differences in birth weight and immediate viability. In association with such primary differences, a different development of personality in the way of intelligence and personality structure might find expression and, as will be discussed later, the possibly significance of some of these differences will be analysed, particularly in relation to the analysis of the results of the intelligence testing.

SOCIAL, PSYCHOLOGICAL AND INTER-PERSONAL CONDITIONS DURING UPBRINGING

Before analysing the differences and the similarities between the childhood environments of the twins, two circumstances that may possibly have pro-

moted similarities and also to a certain extent dissimilarities must be discussed.

In the first place, it is of interest to ascertain when the twins became aware of their position as foster or adoptive children, and what significance this fact may have had on their psychological development.

Secondly, and this to some extent overlaps the foregoing, the question of when the twins became aware of each other's existence must be considered together with the depth of their subsequent mutual contact.

In the three cases in which the probands grew up in their own homes together with brothers and sisters and one of their parents, the twins had "always" known who their parents were. Of the 15 who were brought up as foster children by strangers or relatives and of the six who were adopted, the majority were told the facts of their natural families at about the time when they started going to school i. e. at 6-7 years. In four cases they were told much later, two pairs for instance, VII and X, were not told until they were 12-13 and pair V not until they were 16-17 years old, and finally, to pair I the fact was not divulged until their chance meeting when they were 22 years old.

The emotional reactions occasioned by this information varied very much from pair to pair and between the twins as has been described in the case histories of pairs I, II, III, V, VII, X and XI. In some cases, notably pairs I, II, III and VII, each proband felt himself emotionally strongly attached to his childhood home and the persons there, and in these and in some other cases also, the probands more or less clearly expressed their dissatisfaction and disapprobation of their biological parents and other relatives.

Even though the majority of the probands thus grew up as foster or adoptive children their placing as such was very different from pair to pair and from twin to twin, and it is true of them all that during the development of their personality, in their early childhood and in some cases until they were grown up, they experienced their foster and adoptive parents and their eventual step-sibs as their natural family and their real homes.

With regard to mutual contact during childhood, six pairs only can be said to have grown up completely apart, I, II, V, VII, VIII and X.

The twins, pair I, were unaware that they were twins, until they were confronted with each other when they were 22 years old. One of the twins in pair II had known for some years that she had a twin sister somewhere or other, while her twin did not know this, until their meeting at the age of 35. In pair V, both twins, as far as can be ascertained, had known of the existence of a twin-brother from adolescence, but for some reason or other, they did not meet until they were 40 years old. The twins in pair VII had a chance meeting when they were 12, but did not form a closer relationship until they were grown up. In pair VIII, the twins knew about each other when

they were 12, carried on a desultory correspondence and met for the first time when they were 20. Finally, the twins, pair X, had got to know that they were twins when they were 12, but they did not see each other until they were 16.

Special interest is attached to the four pairs, I, II, V and VII, who met by chance because the twins were mistaken for each other, particularly, the twins, pair I, who were examined in direct connection with their reunion.

Three pairs, I, VII and X, had after the reunion as adults, continued to keep in rather close touch with each other, the twins, pair II, broke off all relationship with each other after a short time, and the twins, pair V and VIII, had, at the time of our investigation, had nothing to do with each other for several years.

The remaining twins, pairs III, IV, VI, IX, XI, and XII, had all had some contact with each other during childhood. It was a close relationship for one pair only, pair IV, during the last part of their childhood, but they lost sight of each other when they grew up; the contact between the other five pairs was very slight, mainly because the various respective foster and adoptive parents discouraged it; the twins, pairs XI and XII, alone can be said to have kept in touch with each other as adults.

In conclusion, the mutual contact between the twins must on the whole be said to have been slight. Half their number had no contact during childhood and only a few of them as adults; the remainder twins had had but the slightest contact with each other during childhood and since.

In the case of the incompletely separated twins it can not be entirely precluded that the contact between them may have contributed to the appearance of certain points of similarity between them, for instance in pairs IV and VI who attended the same school. Apart from this, it is not reasonable to presume that the slight contact between the twins can have been important for the points of intra-pair similarity that have been found, rather must it be supposed that in those cases where one twin grew up with relatives and the other with strangers, especially as in cases X and XI, where a considerable difference in social and psychological position has been present, the twins' knowledge of their rightful place in society created marked differences in environmental conditions.

With regard to *the social, psychological and inter-personal conditions in the early environment*, let us take the differences and similarities of a general cultural nature first.

As all the twins were brought up in Denmark, the geographical distance between the childhood homes was on the whole small, and owing to the relatively uniform social, educational and cultural structure of the country, great diversities of environment are not to be expected.

In three cases, the twins grew up in different counties which, especially formerly, were said to be characterized by their own peculiar linguistic and cultural traditions as well as mode of living and general attitude to life. To this must be added the fact that these twins also grew up in different types of homes: V: mid-Jutland village/Copenhagen, VIII: harbour town on Funen/mid-Jutland village and X: West Jutland fishing hamlet (later East Jutland harbour town)/mid-Zealand village. In two other cases, I and XI, both twins grew up in Copenhagen but in different parts of the city.

In the remaining seven cases the twins grew up in the same county but at varying distances from each other, in three cases they were living in neighbouring parishes, in one case in the same small railway town.

Even though the investigation has produced certain dissimilarities and similarities between the twins in the way of dialect, language and a certain local colour, these circumstances can not be said to have been in any way predominant.

The investigator is acquainted with two cases only of monozygotic twins where one twin has grown up in Denmark and the other abroad.

One of these is mentioned by *Newman et al.* (1937). They stated that while collecting their material, they registered a male pair, one of whom had grown up in USA, while the other lived in Denmark. This pair was excluded from their study, and I have not succeeded in tracing the Danish partner.

In the other case I got into touch with one of the twins. This was one of the pairs studied by *Shields* (1962), female twins (case Sf 19), one of whom had been brought up in Denmark, the other in Chile. In spite of their entirely different upbringing circumstances, cultural as well as a religious, the twins showed only slight differences, but on the other hand, many outstanding similarities in personality structure.

Differences of *religion* or religious denomination in childhood were found in five cases. In pairs I, II and VIII one of the twins grew up in a strongly religious atmosphere, in the first of these cases the family was Roman Catholic (This religion has very few adherents in Denmark when compared with the National Lutheran Church). The twin partners in these three instances were brought up in homes that were virtually indifferent to religion.

The homes of both twins in pairs III and VI were strongly religious, but they belonged to very different denominations.

In the case of pair I, the differences of religion seem to have had real significance for certain differences in the personality development of each twin, particularly in their attitudes to ethical, sexual and other problems, and also, for pairs III and VI, religious differences in childhood environment seem to have exerted some, partly indirect, influence.

Differences related to *schooling* and education were more marked. The author has divided them into four rough groups: no certain differences (0), slight differences (+), moderate differences (++), marked differences

(+++). This classification has had the aim of excluding later differences in education and training even though it is difficult in each individual case to distinguish sharply.

In the first category are five pairs, III, IV, VI, XI and XII. The remaining seven pairs are distributed as follows: group A (+): two pairs, VII and IX, group B (++): two pairs, II and VIII and group C (+++): three pairs, I, V and X.

As has been mentioned already, a certain association between dissimilarities in intellectual appearance and differences in schooling was found at the ordinary, clinical evaluation in the first mentioned three pairs only. A more searching analysis of these conditions will be made in connection with the analysis of the intelligence test scores in the following chapter.

The most important circumstances concerning the *external structure of the environments* appear in the following summary which shows the twins' homes, foster, adoptive or natural, the parent figures (F and M), the ages of these at the time when the twins were placed with them, their eventual relationship to the twins, the occupational and, to a certain extent, socio-economic class of the home, and finally the outer inter-personal environmental constellations, particularly the place of the twin in the family group.

I

Palle: Adoptive child. F.: bricklayer's labourer, 27 years. M: 27 years. Only child.

Peter: Adoptive child. F: newspaper seller, 27 years. M: 27 years. 3 year younger step-sister, 12 year younger step-brother.

II

Olga: Foster child. F: rag and waste dealer. 22 years. M: 24 years. 3 year younger step-sister, 5 year younger step brother, 6 year younger step-sister (From the age of 7 in a children's home and under supervision care till 18 years old).

Ingrid: Foster child. F: farmer. 45 years. M: 43 years. Only child.

III

Maren: Foster child. F: farmer. 47 years. M: *paternal aunt*, 45 years. 6 step-sisters and 9 step-brothers (first cousins), 9-33 years older.

Jensine: Foster child. F: farmer. 46 years. M: *paternal aunt*, 40 years. 2 step-sisters and 3 step-brothers (first cousins), 11-18 years older.

IV

Ingegerd: Complicated foster childhood: 1) some months with *maternal uncle*, labourer, 20 years. 2 elder step-sisters (first cousins). 2) some

months with married labourer, many elder step-sibs. 3) F: *maternal grandmother's half brother*, small-holder, 42 years. M: 41 years. 1 year older and 1 year younger step-sisters.

Monika: Complicated foster childhood: 1) some months with *maternal uncle* as above. 2) F: tailor, 44 years. M: 40 years. 12 year older step-brother and 9 year older step-sister.

From their 7th to 14th years the twins lived with their *mother*, 26 years. F: carpenter, 27 years. 5 year younger half sister, 7 year younger half-brother, 15 year younger half-sister.

V

Kaj: Adoptive child. F: groom, 50 years. M: 32 years. Only child.

Robert: Adoptive child. F: naval petty officer, 35 years. M: 34 years. 8 year younger step-sister, 10 year younger step-brother, 11 year younger step-brother.

VI

Martha: Foster child. F: mill-stone grinder, 31 years. M: 31 years. Only child.

Marie: Foster child. F: day-labourer, 28 years. M: *maternal cousin*, 26 years 2 year younger step-brother (second cousin).

VII

Kamma: Foster child. F: game keeper, 34 years. M: 32 years. 4 year older step-brother.

Ella: *Natural father*. Sawyer, 41 years (and his housekeeper). 6 year older (natural) sister, 9 months younger step-sister.

VIII

Signe: Foster child. F: *paternal grandfather*, small-holder, 52 years. M: 48 years. 11 year older and 9 year older step-sisters (paternal aunts).

Hanne: Foster child. F: beer vendor and boardinghouse keeper, 31 years. M: 28 years. Only child.

IX

Karin: Foster child. 1) unknown foster home till aged 3. 2) F: small-holder, 50 years. M: 50 years. Only child.

Kristine: Foster child: 1) and 2) unknown foster homes till aged 4 years. 3) F: small-holder, 50 years. M: *paternal grandmother*, 44 years. 13 year older step-brother (paternal half-brother), 4 year older step-brother. 4) from 10–14 years: F: *Father's half-brother*, labourer, 23 years. M: 24 years. 5 younger step-sibs (cousins).

X

Petrine: Adoptive child. F.: independent, well-to-do owner of fishing vessels, 34 years. M: 27 years. Only child.

Dorthe: *The biological mother*, widow of a butcher, 35 years. One half-brother and 3 half-sisters, 17–13 years older.

XI

Astrid: *The biological mother*, widow of non-commissioned officer, 44 years. 4 full sister, 15–4 years older and 2 year younger full sister.

Edith: Adoptive child. F: bookbinder, 35 years. M: 38 years. Only child.

XII

Viggo: Foster child. F: farmer, 45 years. M: 38 years. 7 year older step-sister (when 12 years old also 2 year older step-sister).

Oluf: Foster child. F: small-holder 60 years. M: 34 years. 23 year older step-brother, 13 year older step-sister.

From this very rough survey, if from nothing else, it would be farfetched to maintain that the external environmental constellations have presented striking points of resemblance for all the pairs of twins.

The conditions that prevailed in the case of pair III might at first glance seem very much alike but this is counteracted by the different psychological circumstances characterizing the two homes; in this connection, it should not be forgotten that these twins are among those classified as presenting the most marked differences in personality development and structure.

The twins, pair IV, spent a good deal of their childhood together, but, as has already been mentioned, considerable psychological dissimilarities have, undoubtedly, been present, particularly in relation to their mother.

Pair IX resembled each other in their foster home childhood which, however, qualitatively was very different.

In the remaining pairs, there are a number of differences in the early environments of the twins, varying from pair to pair with regard to the purely external frame of their lives.

The placing of the twins in adoptive or foster homes has already been discussed in this chapter and requires no further comment.

With regard to the *age of the parental figures*, in four cases, II, V, VIII and XII, there was a great difference in the ages of the father figures at the time when the twins were placed with them.

With regard to *the parents' relationships with the twins*, in three cases, one of the twins grew up either with the natural father (VII), or the natural mother (X and XI), together with full brothers and sisters, while the twin parter grew up as an only child among strangers.

In pair IV, the circumstances were, as we have seen, very complicated since one was with her mother's relatives and the other with strangers until they were both taken to live with their natural mother, maternal half-sibs and step-father.

One of the twins in pair VI was brought up by the mother's cousin, and one in pairs VIII and IX grew up with paternal relatives while the twin partner in these three cases were brought up by strangers. In pair II both twins grew up with relatives: their paternal aunts.

Finally, there were four pairs where both twins were brought up by strangers.

In the case of 10 pairs altogether, the twins grew up with families who were not related. In *Shields'* material there were relatively many, 30 out of 44 pairs, who had grown up in related families.

The significance that may possibly be attached to differences and similarities in the childhood environments in this connection has been discussed earlier.

With regard to the *occupational and socio-economic circumstances of the home*, there were considerable differences for five pairs, II, V, X, XI and XII, although these differences were by no means extreme and apart from some difference in education they were hardly very important.

In eight cases, pairs I, II, V, VI, VIII, IX, X and XI, one twin had been brought up as an *only child*, while the other had been placed in families comprising a number of full sibs, half sibs, step sibs or more distant relatives. In *Shields'* material 27 out of 44 pairs were distributed in this way.

To conclude, this analysis shows that with regard to various purely external conditions in the childhood environments of the twins a number of differences were present, and in comparison with these, the similarities were inconspicuous.

In some cases, there were differences of a general cultural, religious or educational nature, in other cases the differences were associated with the ages of the parent figures and with their relationship to the twins, or with the occupational, social and economic situations of the homes. In most cases, there were differences in the inter-personal constellations in the homes and in the twins' position in the family group.

These purely external differences in the intra-pair childhood environments correspond on an average very closely to the differences in environments found in this material from proband to proband and to the differences that may obtain on an average from one Danish home to another.

To this must be added the fact, that with regard to the relations of each twin proband to the parent figures, or other persons in his childhood background, and with regard to the given possibilities of each proband to form emotional attachments and finally, as has been very thoroughly described in

each case history, with regard to the whole psychological structure of the home, its atmosphere, its special conditions and environmental influences, there have been intra-pair differences, more or less marked, in the childhood environments of every one of the 12 pairs of twins.

As has already been said, partly for the material as a whole, and partly for each single pair, every endeavour has been made to show an immediate and convincing association between these differences in environment and the differences in the twins. A more detailed description of the interplay of each proband and his childhood environment, especially with regard to its psychiatric-psychological aspects will be found in each case history. A numerical analysis of these conditions has been considered without point.

There remains the question of the extent to which phenotypical differences between the twins could not be established, especially those of psychiatric-psychological nature that could be associated with certain differences supposed to have obtained in the childhood environments, or to put it in another way, the extent to which, from the knowledge of such differences in the childhood environments, dissimilarities in the twins might have been expected.

This is a question to which we can hardly give a definite answer. In some cases, as for instance in pairs III and VI, the twins presented at the examination marked differences of normal and psychiatric personality even where the differences in childhood environment had been inconspicuous. This finding could of course be explained by an insufficient presentation of relevant data and information by the investigator, a possibility that can hardly be ignored. In other cases, as in the cases of pairs V, I, XII, X, IV and VII, the points of similarity between the twins were very marked in spite of great differences in the early environments with regard to a number of social, psychological and inter-personal conditions.

The chief objection that may be made to this analysis of the differences and similarities between the early environments of the twins lies in the fact that the whole investigation was made by the same person, but it must not be forgotten that a number of the data and the results produced by the analysis are not the outcome of a subjective evaluation alone.

Before making the results of the investigation the object of a general discussion, and especially before a summary of the conclusions is to be made, the results produced by psychometric methods of investigations will be presented and analysed. The psychometric investigation results have been produced independently of the other methods of investigation, and it will therefore be of particular interest to see whether they correspond with, or whether they are in contradiction with the results and conclusions produced by the medical-psychiatric interviews and examinations.

Chapter 11

PSYCHOMETRIC INVESTIGATIONS

INTELLIGENCE TESTING*)

Wechsler-Bellevue Intelligence Scale, Form I

The results of the investigations with this test are seen in *table C*. This table contains the *W-B* weighted scores (WS) for the first test (I) and the re-test (II), partly for each subtest, partly for each section. Finally, the IQ's have been calculated.

The test scores have been analysed with reference for: 1) *inter-individual* differences, i. e. between the 24 probands, 2) *intra-individual* differences, i. e. measured by test-retest, and 3) *intra-pair* differences, i. e. between the twin partners.

Inter-individual differences

Table 7 shows the mean (M) and the variance (s^2) of weighted scores, at the first testing and at the re-testing. It appears from the table that the mean for the first test, for a considerable part of the subtests, is less than the desired value, 10.0, just as most variances are less than 9.0. The means deviate significantly from each other, as do the variances; the variance for Arithmetic is remarkably great.

As the twin material comprises relatively many elderly persons, one could expect low means and perhaps small variances. With *Wechsler's* method this condition has been corrected when converting to IQ's.

The IQ's in *table 7* show that the means for PIQ, and therefore TIQ, lie somewhat higher than was expected (100), while the variances are considerable below the variance (225) aimed at.

Against this tabular arrangement, it can be argued that the variance calculations have been made on the assumption that all 24 observations were made independently, an assumption that, as will be seen later, is not upheld, since there was some connection between the test scores of the twin partners; this has, however, little influence on the variance but it has, undoubtedly, on the number of its degrees of freedom.

*) In collaboration with *Alan Mogensen*, psychologist, and *Arne Nielsen*, statistician.

TABLE 7

Wechsler-Bellevue-Test Results. Means and Variances of Weighted Scores

	1st testing			retesting		
	N	M	s ²	N	M	s ²
Information (I)	24	9.8	6.3	20	10.6	7.4
Comprehension (C)	—	9.5	7.7	—	9.7	7.4
Digit Span (D)	—	6.3	3.9	—	6.2	5.6
Arithmetic (A)	—	7.8	12.3	—	7.9	10.5
Similarities (S)	—	10.6	6.2	—	10.4	7.2
Picture Arrangement (PA)	—	7.7	4.7	—	8.7	5.0
Picture Completion (PC)	—	9.1	4.9	—	10.0	3.2
Block Design (BD)	—	8.5	6.8	—	8.6	8.8
Object Assembly (OA)	—	10.3	4.6	—	11.6	3.2
Digit Symbol (DS)	23	7.8	8.0	—	7.8	8.8
Verbal Points (VP)	24	44.0	92.2	—	44.8	101.6
Performance Points (PP)	—	43.6	82.0	—	46.7	94.9
Total Points (TP)	—	87.6	295.1	—	91.4	348.8
Verbal IQ (VIQ)	—	102.0	108.1	—	103.4	109.5
Performance IQ (PIQ)	—	109.8	67.5	—	114.2	73.1
Total IQ (TIQ)	—	105.5	92.2	—	108.5	96.2

TABLE 8

Influence of Age on W-B Weighted Scores

	7 pairs < 55 years		5 pairs > 55 years	
	M	s ²	M	s ²
I	9.9	8.0	9.7	4.7
C	9.4	10.4	9.7	4.7
D	6.3	3.5	6.4	4.9
A	8.2	16.0	7.2	7.8
S	11.1	6.8	9.9	5.0
PA	8.6	4.1	6.5*	3.2
PC	9.3	3.6	8.8	7.1
BD	9.4	7.1	7.3*	4.0
OA	11.1	3.9	9.3*	4.0
DS	8.8	10.8	6.5*	1.7**
VP	44.8	115.2	42.9	66.8
PP	47.3	74.5	38.4*	50.7
TP	92.1	325.9	81.3	208.2
VIQ	100.4	121.6	104.1	91.9
PIQ	108.3	57.8	111.9	81.0
TIQ	104.4	90.2	107.1	100.8

* P ≤ 5%, ** P ≤ 1%.

The influence of *age* on the *W-B* scores appears further in *table 8*. Here, the material has been divided into two groups, one consisting of those seven pairs who were under 55 years of age at the time of the investigation, and the other, of the five older pairs. In four performance sub-tests and for PP the means for the older groups are significantly lower than the means for the younger.

In one of the sub-tests (DS) there is significantly less variance for the older than for the younger group; such an isolated finding can, however, not be considered especially remarkable when there are, as here, 13 comparisons; it is presumably of greater importance, that in ten places altogether there is a tendency to less variance for the older pairs.

With regard to the 3 IQ's there is, on the other hand, no remarkable differences in the means or in the variances for the two age groups.

Wechsler's method for age correction must therefore be said to operate satisfactorily in this material.

Intra-individual differences (Test-retest)

From *table 7* it appears further, that in retesting, which comprised 20 probands, there is, by comparison with the scores gained in the 1st testing, an increase in the means, especially for the performance tests and, through them, for PIQ also.

TABLE 9
W-B. Test-Retest.

Means of weighted scores at the retest minus weighted scores at the 1st testing and variances on this difference. Test-retest correlations and Wechsler's reliability coefficients

N=20	M	s ²	Test-retest correlations (Pearson's r)	Wechsler's test-retest-correlations
I.....	0.7	1.2**	0.92***	0.86
C.....	0.1	3.4	0.76**	0.74
D.....	-0.1	2.6	0.75**	0.67
A.....	-0.2	4.3	0.83***	0.62
S.....	-0.2	5.0	0.63*	0.71
PA.....	1.3	3.7**	0.62*	0.64
PC.....	0.9	3.6*	0.55*	0.83
BD.....	0.1	1.6	0.91***	0.84
OA.....	1.6	5.3**	0.32	0.69
DS.....	0.2	1.1	0.94***	0.80
VP.....	0.3	19.6	0.90***	
PP.....	4.0	14.6***	0.92***	
TP.....	4.3	47.3**	0.93***	
VIQ.....	0.7	23.8	0.89***	0.84
PIQ.....	4.9	21.1***	0.86***	0.86
TIQ.....	3.0	23.1**	0.89***	0.90

* P ≤ 5%, ** P ≤ 1% and, *** P ≤ 0.1%.

The score differences between test and re-test have been calculated for each person and these differences for the whole material are presented in *table 9*.

From this table it appears that for four subtests (one verbal and three performance subtests) there is a significant increase from test to re-test. The same applies to PP, TP, PIQ and to TIQ. In the table, the reliability coefficients (test-retest correlations) can also be seen, derived from the present twin material and from *Wechsler's* material respectively.

For the IQ's and for Points as well as for certain sub-tests, the reliability is fairly satisfactory (approximately $r = .90$), however, in some subtests, S, PC and especially OA, there remain a good deal to be desired.

Intra-class differences

In *table 10*, in the first column, the correlation coefficients (*Pearson's r*) for the scores gained by the twin partners at the 1st test are seen. The numbers in brackets indicate the correlation coefficients if pair III (see p. 63) is omitted.

TABLE 10
W-B Correlations

	Intra-pair correlations (1st testing)	Test-retest correlations	Variations for WS	Part-total correlations (1st testing)	<i>Wechsler's</i> part-total correlations
N	24	20	24	24	
I.....	0.77**	0.92***	6.3	0.68**	0.71
C.....	0.40	0.76**	7.7	0.62*	0.68
D.....	0.59*	0.75**	3.9	0.55*	0.52
A.....	0.84***	0.83***	12.3	0.44	0.67
S.....	0.58*	0.63*	6.2	0.62*	0.73
PA.....	0.46	0.62*	4.7	0.55*	0.63
PC.....	0.42	0.55*	4.9	0.59*	0.60
BD.....	0.62*	0.91***	6.8	0.74**	0.73
OA.....	0.19	0.32	4.6	0.46	0.51
DS.....	0.74**	0.94***	8.0	0.70**	0.70
VP.....	0.77**	0.90***	92.2	0.70**	
PP.....	0.66*	0.92***	82.0	0.70**	
TP.....	0.69**	0.93***	295.1		
VIQ.....	0.78** (0.81)	0.89***	108.1		
PIQ.....	0.49 (0.56)	0.86***	67.5		
TIQ.....	0.62* (0.68)	0.89***	92.2		

* $P \leq 5\%$, ** $P \leq 1\%$ and *** $P \leq 0.1\%$.

The figures in brackets indicate the findings for the pairs minus pair III (cf. p. 63).

For the sums of all three Points there is a significant association between the scores of the twin partners. The conditions for each single subtest and for the IQ's are more unequal.

If one compares the correlations of the twin partners (1st column) with the test-retest correlations (2nd column), there seems to be a clear tendency for a common variation by which the correlation between the scores of the twin partners is the greater, the greater the reliability of the test sections and the score-variances.

The different intercorrelations of the test sections with total scores (column 4) are presumably of some significance. These correlations lie close up to *Wechsler's* correlations (column 5).

The present numerically small material hardly lends itself to elucidating theoretical questions concerning the structure of the intelligence functions; an inclusion or an exclusion of an extreme pair alter both variances and correlations considerably.

When the intra-pair correlations are compared with the test-retest correlations, it is seen that the former are, as a rule, somewhat smaller than the latter. This must be an indication of the ability of this intelligence test to show differences between the twin partners that are greater than the errors of measurements (expressed by the test-retest method). This is demonstrated by a variance analysis in the case of the IQ's (*Table 11*).

In a variance analysis the total score variation observed is divided into different components. We have chosen to concentrate ourselves on 3 components: 1) the test-retest-effect, which has already shown itself significant. 2) the difference between the twin partners. 3) the real error of measurement. Besides these, other components could be imagined, as for instance the age of the twins, the order of birth (born first/born last), the birth weight (heavier/lighter), the degree of separation (completely/incompletely), differences in education between the twins of each pair, or various combinations of these factors. Some of these factors will be examined separately later.

TABLE 11
Variance Analysis for W-B IQ's

Source of Variation	VIQ		PIQ		TIQ	
	Variance	D. F.	Variance	D. F.	Variance	D. F.
1. Test-retest.....	5.0	1	240.0	1	87.0	1
2. Between the twin partners	40.3	12	44.7	12	46.3	12
3. Real error of measurement	11.9	19	10.6	19	11.2	19
1 versus 3.....			22.6***		7.8*	
2 versus 3.....	3.4*		4.2**		4.1**	

* $P \leq 5\%$, ** $P \leq 1\%$ and *** $P \leq 0.1\%$.

From *table 11* it appears that the variance between the partners is significantly greater than the error variance for all 3 IQ's. It further appears that the test-retest variance is significantly greater than the errors of measurement for PIQ and for TIQ, but not for VIQ (which corresponds to the findings of *table 9*).

Furthermore, early in the variance analysis it appeared that the variance between the twin partners was significantly greater than the errors of measurement, so that it could be said with certainty that at any rate not *all* co-twins could have the same theoretical test level.

In an analysis of the intra-pair differences, the following conditions: *birth order* and *birth weight*, and other factors, can be thought to be important. Birth order was ascertained for eight pairs; of these only seven pairs were retested. The mean differences in the scores between the first born and the last born were for all subtests, points and IQ's rather small and none of these were significantly different from 0 (t-test used). Neither was there any thorough going tendency with regard to difference in \pm sign (\pm sign test used). In the case of seven pairs it could be ascertained which twin was the heavier or the lighter at birth. Neither does this condition seem to have had any significance for the intelligence test scores.

Finally, the material has been divided into two groups, one containing the six pairs for whom the separation was complete during childhood and the other containing the six pairs for whom the separation was less complete. A greater variance for the completely separated twins might perhaps be expected than for the incompletely separated.

The results for Points and IQ's are found in *table 12*.

TABLE 12
Variances of W-B-scores. (1st testing). Completely versus Incompletely Separated Pairs

	Completely separated 6 pairs	Incompletely separated 6 pairs
VP.....	57.0	38.9 (37.8)
PP.....	46.6	48.0 (42.2)
TP.....	158.7	150.3 (134.9)
VIQ.....	73.7	38.2 (35.3)
PIQ.....	50.4	62.5 (53.4)
TIQ.....	64.4	60.6 (53.9)

The figures in brackets indicate the findings for the six pairs minus pair III (cf. p. 63).

The expected tendency does appear but only in a very slight degree and none of these differences are statistically significant.

There then remains the *differences in education*, that is to say the differences in respect of formal schooling.

As has already been mentioned, the environmental differences in this respect have been judged by the author according to the following simple scale: No certain differences (0), slight differences (+), moderate (++) and marked (+++). In the first category there are five pairs (III, IV, VI, XI and XII), the remaining seven pairs are distributed as follows: Group A (+): two pairs (VII and IX), group B (++): two pairs (II and VIII) and group C (+++): three pairs (I, V and X).

In *table 13*, the means for score differences for the subtests and points are seen. These are reckoned with \pm signs: score of the best educated minus score of the less educated.

TABLE 13
Influence of Differences in Education (1st testing and retesting)
Mean score differences for pairs with greater differences in education (group C)
and for all pairs with differences in education (groups A+B+C)

	1st testing		retesting	
	Group C M	Group A+B+C M	Group C M	Group A+B+C M
N	3	7	3	7
I.....	1.0	1.6(*)	2.5	2.2
C.....	3.0	2.4	3.5	2.3
D.....	2.3	1.6*	2.5	0.8
A.....	-1.0	-1.6	-0.5	-0.3
S.....	2.0	1.7	2.5	1.0
PA.....	-0.3	1.3	0.0	0.2
PC.....	1.3	1.1	0.5	1.3
BD.....	2.0	1.3	1.0	0.8
OA.....	1.3	0.0	0.5	1.2
DS.....	0.0	0.0	3.0	1.0
VP.....	7.3	7.1*	10.5	7.5
PP.....	4.3	5.3	5.0	5.7*
TP.....	11.7	12.9*	15.5	11.5*

* $P \leq 5\%$;

(*) Indicates that the findings are on the significance limit.

As is seen from the table there are only a few places where the differences in score reach statistical significance, apart from VP and TP; if one considers the sign, it is seen that nearly all the means for the score differences are positive.

The results therefore show that differences in education must be said to have had some influence on the subtest scores and the Points.

The same applies for certain of the IQ's, which appears in *table 14*.

In this table certain differences are seen for VIQ, pointing towards higher

TABLE 14

Influence of Differences in Education. (1st testing and retesting)
Significance testing for IQ-differences between the more and the less educated partner

Group	1st testing			retesting		
	C	B+C	A+B+C	C	B+C	A+B+C
N	3	5	7	2	4	6
VIQ.....	0	*	0	*	*	0
PIQ.....	0	0	0	0	0	0
TIQ.....	0	0	0	0	*	0

* $P \leq 5\%$.

scores for the best educated and most marked for greater differences in education. For PIQ no such tendencies are seen. The tendency for TIQ comes thus quite predominantly from VIQ. This difference between the performance- and the verbal sections in *W-B* must be said to be expected from the knowledge of there being a greater correlation between education and verbal proficiency than between education and non-verbal proficiency.

Raven's progressive matrices

Inter-individual differences

The Raven-scores appear in *table 15*.

The *raw scores* show a considerable range from 18–52, the mean is 28.7, and the variance 86.5. Via *Raven's* tables, which, however, do not differentiate for low scores in persons over 35 years, the raw scores have been converted to a percentile placing. The percentiles also show a good differentiation but there are, however, relatively many placings in the intervals 25–50 per cent.

The distribution of the *solution times* is not remarkable. The mean is 30.6 minutes and the variance 86.6.

All in all, this test must be said to function well when applied on the present twin material. Re-testing was not done.

An investigation of the significance of age has been made in the same way as for the *W-B-test*. The results are seen in *table 16*. For the older pairs the variance is significantly less than for the younger group. Presumably the score-level is also lower; at least the latter was to be expected from *Raven's* (1950) standardized results. There are, however, no differences for the level of solution time and the variance.

TABLE 15
Raven's Progressive Matrices. Raw-scores, Percentiles and Solution Times

Twin Pairs	Raw Scores (RS)	Score difference	Percentile	Time (minutes)	Time difference
I	52	1	75-90	52	8
	51		75-90	44	
II	34	3	25-50	25	1
	31		25-50	26	
III	33	6	25-50	40	3
	27		25-50	37	
IV	32	0	25-50	30	10
	32		25-50	20	
V	41	15	75-90	35	12
	26		25-50	23	
VI	31	10	25-50	?	-
	21		5-25	?	
VII	18	4	5-25	26	3
	22		25-50	29	
VIII	23	2	25-50	36	8
	21		25-50	28	
IX	25	5	50-75	30	0
	20		25-50	30	
X	33	1	75-90	41	1
	32		25-50	42	
XI	26	5	50-75	20	5
	21		50-75	15	
XII	20	4	25-50	17	3
	24		50-75	20	
M	29.0	4.7		30.3	5.0
s ²	81.4	37.5		86.6	39.4

TABLE 16
Influence of Age on Raven-scores

	Pairs < 55 years			Pairs > 55 years		
	N	M	s ²	N	M	s ²
Raw Scores	7	32.2	102.0	5	23.6	27.7
Solution times	6	32.3	90.9	5	28.6	82.9

Intra-pair differences

Raw scores. As the conditions seem to allow it, Pearson's correlation coefficient has been calculated to evaluate the association between the scores of the twin partners. This amounts for raw scores to .79, which corresponds to the *W-B* VIQ findings (*table 10*). The mean of the score differences is 4.6 raw score points (column 2, *table 15*), the variance of the differences is 37.5.

Thus the scores gained by the twin partners are more than chance resemblances.

Solution times. The correlation coefficient for the twin partners is .84 (not presented in the table), which is of the same range as for the raw scores. The same applies to the mean for time differences, 5.0 (min.) and the variance of the differences is 39.4.

The findings indicate, that a similarity between twins, at any rate under certain circumstances, can be just as marked for the self chosen test solution time as for test solution capacity.

As for *W-B*, the possible significance of birth order, birth weight and completeness of separation has been examined. The differences between the raw scores of the first born and the last born have been calculated with \pm signs; the mean of the difference was + 2.4 points, which is not significantly different from 0. The mean of the raw score differences, that is raw scores for the twin with the higher birth weight minus raw scores for the twin with the lower birth weight is + 2.7, which is not significantly different from 0.

The variance on the difference for the entirely separated pairs compared with the incompletely separated is respectively 42.6 and 32.6. This difference points in the expected direction, but is not statistically significant.

Finally, in the same way as for *W-B*, an analysis has been made of the differences between the twin partners in relation to the differences in their education. There is no significant difference.

Comparison of W-B- and Raven-test results

Both tests seem to differentiate well between the pairs. The means and variances, especially *W-B* IQ and *Raven's* percentiles, do not deviate significantly from those aimed at by the standardization method.

The test results characterize the twin material as being: a normally intelligent group with significant differences between the twin pairs.

Both *W-B-* and *Raven-*scores also show fairly well the expected sensitivity to age factors.

Parts of the *W-B-*test results, but not, on the other hand, of the *Raven-*test show a tendency towards a greater difference between the twin partners, the greater the difference in education between them.

Neither the *W-B-test* nor the *Raven-test* demonstrated any certain association between the test scores and the following factors: Birth order, birth weight and separation completeness.

TABLE 17
Raven RS and Wechsler-Bellevue WS Intercorrelations

N = 24				
Raven RS versus W-B VP: 0.71 ± 0.11				
»	»	»	»	PP: 0.83 ± 0.06
»	»	»	»	TP: 0.83 ± 0.06

TABLE 18
Intercorrelations between W-B Subtests and Raven RS and for Comparison, Part - Total Correlations for W-B

W-B subtests	Pearson's r	W-B part - total correlations
BD.....	0.76 ± 0.09	0.74
DS.....	0.76 ± 0.09	0.70
A.....	0.65 ± 0.12	0.44
I.....	0.60 ± 0.13	0.68
PC.....	0.56 ± 0.14	0.59
OA.....	0.52 ± 0.15	0.46
S.....	0.51 ± 0.15	0.62
PA.....	0.51 ± 0.15	0.55
C.....	0.38 ± 0.18	0.62
D.....	0.33 ± 0.19	0.55

From *table 17* it appears that *W-B*-points and *Raven's* raw scores correlate with each other, ($r = .71$ to $.83$), that is to say, that the two intelligence test scores show at least as great an association with each other as do results obtained by the twin partners at each of the tests. In the same way, in *table 18*, intercorrelations are seen between *Raven* raw scores and subtest weighted scores from *W-B*. By and large these intercorrelations correspond to the size of the correlations between *W-B*-subtests and TP (column 4, *table 10*). These figures are repeated in *table 18*.

In the preceding a comparison has been made of the raw scores and the weighted scores. Finally, an attempt has been made to calculate *Raven's* IQ's in the same way, so as to make them comparable with *W-B* IQ's. These conversions have been made via *Raven's* percentile-table, where the raw score values have been noted with the corresponding probit-values (with regard to the age grouping). From these figures, the *Raven* raw scores have been converted to IQ's (mean 100, S. D. 15). The mean for the 24 persons is 98.8 and the variance 78.3. This variance corresponds fairly well with the *W-B* IQ's (*table 7*), while the level is somewhat lower, especially lower than for PIQ and TIQ (*table 7*). The correlation of the twin partners on these *Raven* IQ's is $.73$, which corresponds to the findings for *Raven* raw scores and, at any rate, for *W-B* VIQ. The conversion of *Raven* raw scores to *Raven* IQ can be compared with *W-B* IQ's (*table 19*).

When these IQ-correlations are compared with the earlier Points-correlations (*table 17*) it is seen, that there are small differences in their mutual size relations, while all three correlation-coefficients remain in the same range $.71$ to $.82$.

TABLE 19
Raven IQ and W-B IQ (1st testing) Intercorrelations

Raven IQ versus W-B VIQ : 0.82 ± 0.07
Raven IQ versus W-B PIQ : 0.71 ± 0.10
Raven IQ versus W-B TIQ : 0.82 ± 0.07

This seems to indicate that the two intelligence-test systems not only resemble each other in form of test and solution functions but also in their compensation for the age factor. If the *W-B* IQ's are experimentally compared with the unconverted *Raven* raw scores, considerably lower values are obtained, .52, .56 and .55 respectively. The increase from these values to the values in *table 19* can, at any rate, to a certain extent be accounted for by age compensation, as, for instance, the variance of the *Raven* raw scores (81.4) is of the same order of size as it is for *Raven IQ* (78.3).

A satisfactory agreement has thus been found between the intelligence test results for *W-B* and *Raven*, both for points and for the IQ's.

In the above analysis of the intelligence test results, emphasis has been laid on a numerical survey, but there is reason to point out that the intelligence tests have also produced a material, which gives a qualitative description of the intelligence functions of the twins and of their behaviour and reactions during the different test situations, the more free situation of *Raven*, the relatively more tied of *W-B*. These results are given in each case history.

Before the results of the intelligence testing and the general conclusion drawn from them are summarized, the material, that has been produced by the help of other psychometric methods of examination, must be discussed.

PERSONALITY TESTING

Rorschach's Test

Word Association Test (a. m. Rapaport)

Together with the psychologist collaborators and with other experts, it has been much discussed, how one most satisfactorily could work out and analyse the results of the testing with the *Rorschach* and the *Word Association* test.

As has been pointed out in the chapter on the investigation methods, a thorough, statistical analysis of these test results had to be abandoned from the start, partly on account of the small size of the material, and partly because these personality tests do not lend themselves easily to such an analysis.

The twin material is not only small but also heterogenous comprised, for instance with regard to age. This factor is probably of considerably greater consequence for personality testing than for intelligence testing where, as has been described, it can be corrected.

Furthermore, the material comprises not exclusively psychiatric patients; most of the probands were within the limits of normal personality variation and only a minority displayed marked personality deviations or psychiatric disorders. Even though the results of personality testing of this material may be interesting, it must not be forgotten, that the suitability of the tests and their value in the examination of normal persons is still more uncertain than for the investigation of psychiatric patients.

The results that can be produced by help of perceptual-associative personality tests such as those used can only to a limited extent be quantified. The use to which projective tests, especially the Rorschach-test, have been put in clinical psychology and psychiatry is not primarily based on systematic investigations and quantitative analyses, but on an expanding experience, gained from clinical and practical use. Even the value of the Rorschach-test in such a work is open to question, and, as mentioned in *chapter 7*, opinions are much divided. It must, however, be stated that a practical satisfactory agreement between results of the Rorschach testing and of diagnostical-therapeutical classification in ordinary clinical work has been obtained.

The validity of the Rorschach-test is without doubt related to its special characteristics: its similarity to a controlled, but at the same time flexible interview, its open test-instruction, and its unstructured stimulus-material. To this can be added that the observations and interpretations that an experienced, clinical psychologist can make by its help correspond to the method of approach used during an interview and an ordinary clinical evaluation. These circumstances are without doubt of considerable importance for the value of the test in clinical work, but at the same time they display its drawbacks from the point of view of research.

In the intelligence testing, the probands could score rightly or wrongly, and each test was constructed to produce a 1-dimensional consistence-analysis. The answers given by the probands in the Rorschach-testing are complex, and the possibilities for giving different answers intentional, and the number of "variables" in this respect is very considerable for the total material. Even for such variables that might be dealt with statistically, as for instance, reaction time and number of answers, the tests have not been standardized in a satisfactory way.

In conclusion the nature of the personality tests and the complexity of the results make a complete analysis of the whole material for investigation considerably more difficult than the analysis of the intelligence test scores, which were partly made on the basis of foreign standardizations and partly on the basis of the scores of all 24 probands.

There remains the value of the test results for the description and analysis of each single pair of twins. On the basis of the tests, concurrently with, but independently of the other investigations, a detailed personality descrip-

tion and evaluation, partly of each single proband, and partly of each pair of twins, was made.

Just as a prolonged and detailed observation has been attempted for the whole investigation, so has it been attempted by means of retesting to elucidate the reliability of the tests and the agreement of the test-results with the results produced by the other examinations.

The twins in each case were examined one by one by the same psychologist (*A. M.*). This testing was done "blindly", that is to say without the psychologist having any knowledge of the material or results, produced by the other methods of investigation.

It can rightly be argued that the test, when employed in this way, did not have the conditions and possibilities of ordinary clinical testing, but it was chosen, partly for purely practical reasons, and partly because, as has been stated above, it was thought natural and desirable to include the testing as an independent, parallel investigation.

The twins were retested after a suitable interval, and the retesting was, with two exceptions (pairs IX and XII) done by the same psychologist (*A. M.*), who thereafter combined the test-results for each individual pair in a comparison of the differences and the similarities between the results of the twin partners.

This material should provide a possibility for making, at any rate a rough, qualitative evaluation of the Rorschach-results obtained, when the test is used as a blind-analysis-method in testing and retesting under uniform conditions of examination. Furthermore, it gives a possibility for comparing the intra-pair variation in the test-results with the test-retest variation, and finally for comparing the test-results for each single pair with the results derived from the other methods of investigation.

The Rorschach-results have further been elucidated through a "purely" blind interpretation or rather a "double-blind" interpretation (cf. the case histories). This evaluation was done by another psychologist (*A. T.*). The method of procedure in this analysis was as follows:

The "pure" Rorschach-protocols, that is to say the protocols for the 24 first testings, without information of any data that could identify the probands, were numbered at random. The material was then presented to the psychologist who had therefore no knowledge neither of the age nor the sex of the proband, nor of his behaviour during testing, and hence his degree of acceptance, nor of the formulas and psychograms made out by the first psychologist. Furthermore, this last psychologist had no knowledge of how the twin-material was put together.

On this basis, the psychologist has worked out formulas and psychograms for each single proband.

Such a procedure limits, it goes without saying, the possibilities of the test,

and from the psychologist's point of view such a special double-blind interpretation was only thought permissible in view of the experimental nature of the investigation. Psychograms worked out under such conditions will naturally be encumbered with a considerable degree of uncertainty; in this connection, it must not be forgotten that the number of answers are relatively small, owing to the fact that the material is not purely psychiatric; thus eight probands gave between 10 and 15 answers, nine between 16 and 20, four between 21 and 25, and only three had more than 25 answers. As appears from the case histories, the psychologist accordingly confined herself to outlining the most important personality traits for each single proband.

On the basis of the material thus produced, an attempt was also made to evaluate certain quantitative criteria in the Rorschach-results by the help of a matching-procedure. The mathematical-statistical principle in this matching, by which all 24 Rorschach-protocols are matched against each other, has been described in an earlier publication, *Juel-Nielsen & Nielsen* (1958).

In the matching, emphasis has been laid on the following criteria: Introversion-extraversion ratio (*Erlebnistypus*), Manner of approach (*Erfassungstypus*), F + %, F %, M-responses (Figures in humanlike action), A % number of responses, number of popular interpretations, the sum of the responses to the last three cards in per cent of the total sum of responses, shock reactions, rejections, "concrete" attitude, content of interpretations.

The following results were obtained: of the 12 pairs three (*II*, *VI* and *X*) were correctly matched, for the first mentioned pair, alternatives were, however, given: Olga/Jensine (*III*) and Ingrid/Kristine (*IX*).

The following can be said of the three correctly matched pairs.

III: Similarities: Manner-of-approach, F + %, F %, m-responses, vascillating concreteness in interpretation. Dissimilarities: Olga: Many colour-responses, Ingrid: many white-space-responses, more inhibited.

VI: Doubt with regard to sex and age-placing. Similarities: F %, A %, introversion-extraversion-ratio, manner-of-approach, Shading-responses. Dissimilarities: F + %, number of responses; Martha: "labile", Marie: "rigid".

X: Similarities: F %, A %, rejection-tendencies. Dissimilarities: white-space-responses, Dorthe only.

Of the wrongly matched pairs, *I* and *V* are of interest, since the respective twin partners were "cross matched": Palle/Kaj: Similarities: men, extroverted, "smart", adventurous types. Dissimilarities: Palle: many macabre interpretations; Kaj: responses with anatomical content.

Peter/Robert: Similarities: men, intelligent, selfassertive, the sum of the responses to the last three cards in per cent of the total sum of responses, obsessive-compulsive features. Dissimilarities: Peter: no-colour-responses; Robert: responses with anatomical content, high number of responses.

The other matchings presented nothing of special interest.

Even though in matching the 24 Rorschach-protocols two or three pairs, could thus correctly be linked together, which approaches statistical significance, these results of matching cannot be considered particularly instructive. They rather confirm the difficulty of making a meaningful, quantitative.

tive analysis of Rorschach-results and does not correspond to the pregnant intra-pair similarity, found when comparing and qualitatively assessing the psychograms.

A comparison of the psychograms worked out by the two psychologists should, as has been said, give a possibility for assessing the reliability of the Rorschach-test. There is an outstanding agreement between their description and assessment, but this agreement cannot be said to be particularly surprising. Taken all in all it may be an expression primarily of the fact, that these psychologists use the test, analyse and interpret its results in more or less the same way, which is equivalent to their also having had a relatively uniform training in this field.

A more systematic analysis of the reliability of the Rorschach-test has not been made, partly because this was thought to fall outside the aim of the investigation, and partly because the material is not sufficiently comprehensive to permit it.

On the other hand it might be considered natural to try to assess the validity of the Rorschach-test on the basis of a comparison of the test-results with the material that was produced during the interviews and the other investigations; but neither has such a systematic comparison been made, partly because the psychologist collaborators doubted that the material for investigation justified it, and partly because it proved to be practically speaking impossible to recruit persons, who felt themselves sufficiently competent or who were willing to act as "judges" in such an analysis. Both materials have been presented in such a way that it should, however, be possible for anyone interested to try to accomplish such an analysis for himself.

The present writer has, by a rough perusal, tried to form a total impression of the differences and similarities between the personality test results and the investigation results that he himself is responsible for. This assessment can be accredited limited value, but as a starting point for a discussion on this part of the investigation it may have some interest, that a few of the more conspicuous conditions of principal interest are pointed out.

In the first place, in the author's opinion, there is on the whole a remarkable agreement between the personality-description and evaluation in the personality-testing and the general clinical description and assessments. This agreement seems to be still more marked, if the double-blind-test-results alone is used as a basis for comparison, undoubtedly owing to the fact, that the personality-evaluation is here considerably less nuanced and easier to survey.

In the personality-testing, just as in the ordinary, clinical examination and evaluation, a series of intra-pair differences and similarities have been pointed out.

The dissimilarities in the test results seem in the first place to comprise the

behaviour of the probands, their ability to form contacts and their need for contact, as well as their psychological defense-mechanisms. Differences in this respect are, for instance, remarkable in pairs II, III, V and VI, but for some other pairs too there were, more or less marked, dissimilarities of this type, even though there were also points of similarity.

The points of similarity between the twins seem for the remaining pairs most marked in those sides of the personality-structure, that can be considered as more or less "basic" characteristics. Such similarities could be shown in practically speaking all the pairs, but were specially remarkable in pairs I, IV, V, VII, VIII, X, XI and XII. Distinct qualitative dissimilarities in the personality-structure could hardly be stated with certainty in any case.

These conditions with regard to differences and similarities applied both to normal-psychological and also to important psychiatric qualities. In this connection it ought perhaps to be pointed out that in the psychometric descriptions by the psychologists there seems to be a certain tendency for comprehending each probands as rather more psychopathological or at any rate more difficult to assess in this respect, for instance pairs VII, X and XI, when compared with the psychiatrist's evaluation and rating.

Another, rather surprising finding is that a study of the psychometric material often leads to the impression that there is a greater similarity between the twin partners than is immediately apparent from the psychiatrist's clinical descriptions and from the case histories. This lends itself to several interpretations, for instance, the Rorschach test may be regarded as a relatively rough test that do not register many slighter differences and finer nuances of personality structure, or it may be regarded as a test that "cuts through" phenomena that are predominantly conditioned by the test situation and are, presumably, superficial. Conversely, the interview and the investigations connected with it, may be regarded as an essentially more finely differentiated instrument of investigation that registers a series of slight dissimilarities and nuances and, altogether, a number of phenomena to which different values may be attached; they may be considered insignificant, but they may also be considered important from a psychiatric-psychological point of view.

As has been pointed out already, an attempt at a systematic investigation of validity has seemed out of place. Judged from the material produced by the ordinary methods of investigation the results of the personality testing can hardly be termed "false" or directly misleading in any case, but on the other hand, it cannot be said that very comprehensive or essentially new material has been produced by the psychometric testing. The tests have supplemented or developed the personality description already forthcoming and the conditions treated in the psychograms can relatively easily be deduced from the information to be found in the case histories or derived from the clinical evaluation.

Summary of the results and conclusions of the psychometric investigations

Intelligence testing with *Wechsler-Bellevue Intelligence Scale, Form I*, and *Raven's Progressive Matrices* has primarily shown, that these two test systems, in spite of the theoretical and practical problems of their use on a Danish material, have been proved satisfactory in the investigation of the present twin material.

Both tests seem to differentiate well between the twins. The means and variances of the test scores, especially for *W-B* IQ's, and *Raven's* percentiles, do not deviate significantly from the standardization aimed at. Both sets of test results show the expected sensitivity for the age factor, and for the *W-B* test-scores the age correction is satisfactory.

Both the *W-B*- and the *Raven*-results characterize the twin material as a group of persons of normal intelligence with significant differences between the twins.

The reliability of the *W-B* test is satisfactory. Expressed in test-retest correlations, for the Total IQ the correlation coefficient was .89, for Verbal IQ, .89 and for Performance IQ, .86, which corresponds fairly closely to the test-retest correlations found by *Wechsler* (.90, .84 and .86). Retesting with *Raven's* test was not done.

In the testing, differences as well as similarities were found between the scores of the twin partners.

The differences between the test scores of the twin partners were significantly less for both *W-B* and *Raven* than the differences between the total test scores of all the probands, but the intra-pair differences were, as it could be shown by a variance-analysis for the IQ's, significantly greater than were the errors of measurement, expressed by the test-retest correlation.

An analysis of a possible association between the intelligence scores and certain differences between the twins, such as birth order and birth weight, showed no systematic tendencies.

A division of the material into two groups, one comprising those twins, who during their childhood had been completely separated and the other, consisting of pairs, who had had a certain mutual contact, showed a tendency towards a greater variation in intelligence test scores for the completely separated pairs, but the differences were not statistically significant, neither for *W-B* nor for *Raven*.

Differences, on the other hand, between the twin partners' test scores showed an association with significant differences in schooling; this association was most marked in those cases, where there were great differences in education, but statistical significance towards the better educated partner having higher scores could, however, only be demonstrated for the verbal tests in *W-B*, but not for the performance tests, or for *Raven's* test.

Both for *W-B* and for *Raven*, a marked resemblance was found between the test scores achieved by the twin partners. Expressed as correlation coefficients, the association between the partners' scores for *W-B* were as follows: *Total IQ: .62 (Verbal IQ: .78 and Performance IQ: .49)*; for *Raven* Raw Scores: *.79*.

For the dissimilarities in *WB-* subtests, it is doubtful whether there is a difference in the degree of association between the twins' test scores, since the dissimilarities that appeared in the scores are primarily a reflexion of the varying reliability of the different test sections.

In short, the intelligence testing shows that the twin partners resemble each other more than do chance selected persons (the total proband material) but they do not resemble each other so much as each individual twin proband resembles himself on test-retest after a relatively brief interval.

The resemblances between test scores of the twin partners must in this investigation, as the partners were separated during childhood, be presumed to be determined predominantly by the genotypical identity of the twins and they indicate therefore that genetic factors played a considerable rôle in the intelligence test achievements.

The investigation results produced by the personality testing with *Rorschach-* and *Word Association-*test are presented in detail in the case histories. It should be possible, within the limits of each pair of twins, to get an impression of the reliability and validity of these tests.

A more systematic, especially statistical, analysis of the total test results from the personality testing has not been made, partly because of the small size of the material and its heterogeneous composition, partly because of the special character of these tests.

The agreement of the psychometric results with the corresponding results of the interviews and general clinical evaluation will be discussed further in the following chapter.

Chapter 12

INFLUENCE OF MATERIAL AND METHODS ON THE RESULTS

The aim of this work has been to contribute to the elucidation of the interplay of individual and environment on the basis of an intensive psychiatric-psychological investigation and an analysis of phenotypical differences and similarities between monozygotic twins, who have been separated from their earliest childhood and who have grown up each in his own environment.

What has the total investigation shown and how do the results produced and the conclusions drawn compare with those of corresponding investigations?

As has been pointed out earlier, the results and the conclusions produced by such investigations are primarily determined by the possibilities and the limitations of the material and the apparatus of investigation at hand. In *chapters 5 and 6* the material, and, in *chapters 7 and 8* the methods, are accounted for, and, in connection with this a number of the different arguments that can be raised against the investigation has been discussed.

In the following, only the most important of these objections will be summarized in a discussion of the extent, to which they may have influenced the total results of the investigation, especially the possibility that the collection and the selection of the material can have produced a bias in favour of a group of twins who, as a whole, presented marked phenotypical similarities or who can be said to have been brought up in very similar childhood environments.

Both *Newman, Freeman & Holzinger* and *Shields* collected their twin series on the basis of enquêtes whereby twins who had grown up apart were particularly invited to come forward and place themselves at the disposal of research. Furthermore, a few other pairs were registered in different ways and were included in the material for investigation.

In both these investigations very great efforts were made, among other things, by the production of an investigation of control materials comprising twins, who had grown up together, to meet the criticism that can be di-

rected at this way of collecting material, especially against the argument, that the twins might have come forward of their own accord, and therefore could be presumed to have volunteered, because they themselves were of the opinion that, in spite of the separation, they presented specially striking or specially interesting points of similarity.

Even though these materials of separated twins cannot be considered as representative, systematically chosen sections of the twin population, or rather of all the separated twins in the respective countries, it can, however, as emphasized by *Shields* not be clearly stated in which direction a selection points. *Shields* found, that the twins, who had not had any closer knowledge of each other during their childhood, were just as similar as those who had known each other well, and furthermore, that some of the twins emphasized the differences rather than the similarities, so that a selection in a direction away from the above mentioned could also be said to be a possibility; in the present investigation examples supporting this aspect can also be found.

Of the 12 pairs comprised by the present investigation, the eight come from a systematic registration made of all twin births in Denmark in the period 1870 to 1910 by *Harvald & Hauge* (1956) at the Institute of Human Genetics at the University of Copenhagen. This part of the investigation material can be considered to have been systematically collected, since it comprises all pairs of twins, born within the above mentioned period, who complied with the criteria of selection, *viz.* that they were alive, that they had grown up separately from their earliest childhood and that they were monozygotic.

The remaining four pairs were all born after the period embraced by the above mentioned register. As has been described in *chapter 5*, these pairs were found by the investigator in more or less chance fashion. To the question of whether these pairs ought to be excluded or included in the investigation it can be stated, that from the twins' primary, co-operative attitude to the investigation and from their mutual experience of each other, there did not seem to be any reason to suppose, that these pairs as a whole deviated in these respects from the twin pairs who had been registered systematically. Neither on the basis of the investigation results produced later, have reasons been found, that were sufficiently weighty to justify the exclusion of these pairs from the investigation in order to obtain the theoretical advantage of an entirely, systematically collected material.

In the material for investigation we found, just as in *Newman et al.*'s and *Shields'* materials, a considerable excess of female pairs. Even though the probability of this being an expression of a selection caused by the material-collection must not be ignored, the possibility nevertheless remains, as was concluded in *chapter 5*, that in the present relatively small material this may be a chance finding.

With regard to the age distribution of the probands, the material deviates

considerably from the two previous investigations in that there is a fairly even distribution throughout all adult age groups, while in the two other materials there was an accumulation of the young or fairly young, but, no elder pairs. This difference between the materials has undoubtedly a relation to differences of collection methods.

The criteria for selection has to be discussed. First the "separation" and its possible significance for the results. By the criterion: separated in early childhood, has been understood in the present investigation, that all twin pairs were separated before reaching school age, and in fact nine pairs were separated during the first months, while only three pairs were separated later, with $5\frac{3}{4}$ years as the upper limit. One, undoubtedly monozygotic, pair excluded from the investigation was not separated until the age of 10 years; this was a male pair, who presented extremely marked points of similarity for psychiatric diseases.

Where one is to put the limits for inclusion or exclusion on account of the time of separation must be an arbitrary question. It would in theory be ideal if the twins had been separated during the first 24 hours after birth, but this occurred in one case only. The limitation has been determined partly by the above mentioned distribution of the time of separation and partly by the circumstance, that *Newman et al.* and *Shields* used a very similar criterion for separation. Whether there is an association between the degree of similarity and the time and the duration of the separation has been analysed by *Shields*, who did not find any support for such an assumption. In the present examination we have investigated whether the intelligence test scores of twins who had spent their childhood entirely apart differ from the scores of those, who had had a certain contact with each other; this assumption could not be confirmed.

In connection with a discussion of the separation criterion there may be reason to repeat the methodological advantage of investigating separated, monozygotic twins. The advantage has, first and foremost, theoretical importance and is quite simply this, that it makes possible the investigation of genetically, identically equipped persons, *who have not*, as is otherwise the case with twins, *had a common environment*. It then follows, that in analysing differences and similarities one is able to let a series of complicated possibilities of interpretation out of consideration.

The circumstance that the probands did not grow up together, is, however, not tantamount to their having automatically acquired entirely different environments. What can be precluded from the outset, is the general assumption that these environmental conditions will be "alike". There is, however, no possibility for predicting how "unlike" they will be, either in each particular case or in the material as a whole, even though it can reasonably be expected that various differences of environment will be marked for some pairs and less so

for others. That some of the twin pairs in the present material would presumably have been even more dissimilar, had they grown up under environments that had been more different than they were in actual fact, is an obvious theoretical possibility. To this it can only be said that an investigation of twins who have been exposed to unusually different environments in childhood was not the aim of this investigation. The intra-pair differences and similarities that have been found illustrate how the interplay of a given genotype and two given environments with their more or less different constellations in actual fact has run, or how it can run.

The total material of 24 childhood environments shows, partly through their intra-pair relations with the 12 genotypes, and partly mutually, a certain variation with regard to social, psychological and inter-personal environmental constellations, as was described in *chapter 10*. This environmental variation must be presumed to correspond to the chance variation existing between any two Danish homes. It is on the importance of such environmental variation, and not on the importance of some theoretical or specially interesting environmental constellations, that this investigation has been able to throw some further light.

Finally, another theoretical question connected with the criterion of separation must be discussed, as so far it has only been touched upon indirectly. This has to do with the possibility that perhaps just because of this criterion, pairs of twins were collected who might have certain common characteristics, socially and psychologically, and perhaps also biologically.

If using a concept of "broken homes" corresponding to the concept used by *Lomholt* (1958) in a comprehensive analysis of the childhood environments of a Danish material of patients, the homes of every twin pair in the present investigation must be said to belong to this category. This common characteristic of the twins can hardly surprise, since it is this very background that was the prime cause of their ever having been separated; but otherwise their backgrounds differ from pair to pair and within the total material. For instance, one half was legitimate by birth. The relatively high frequency of twins who were born illegitimately is undoubtedly due to the systematic collecting of the material.

There is nothing in the results of the investigation to justify the assumption that the twins, as a whole, present characteristics of a biological character that cause them, as a group, to deviate from other people.

Apart from these theoretical possibilities, from the point of view of the investigation, the most important fact is that all the probands were placed each in different homes in early childhood, where they all during their early childhood, at any rate, and some right until maturity, experienced their home as their very own and, what is important, have experienced their childhood differently. Among these childhood environments, there were only three homes

that can definitely be characterized as "broken homes"; this frequency corresponds to the frequency in the above mentioned Danish investigation, and, in all three cases (pairs II, X and XI) the partner grew up in a home that had a normal parent-child constellation.

The accuracy with which zygosity could be established is an important criterion of selection influencing the total investigation results. The exclusion of a monozygotic pair or the inclusion of a dizygotic pair may, owing to the smallness of the material, influence the total investigation results. There is no reason to suppose that monozygotic pairs, who otherwise comply with the criteria of selection, have been excluded from the investigation, and the probability for the inclusion of dizygotic twins in the material must, as it appears in *chapter 8*, be considered very slight. The pair (III) that, in the investigator's opinion, especially occasions a discussion was found, on the total clinical evaluation, to be the very pair that presented the greatest differences in personality structure; the differences at the psychometric testing were also relatively marked. As shown in *chapter 11*, the inclusion, or the eventual exclusion of this pair does not, however, significantly shift, for instance the total intelligence results of the testing.

The investigation methods, the medical-psychiatric interviews and the clinical and more special examinations connected with them, as well as the psychometric tests, have been discussed in *chapter 7*.

While it is obvious that these methods of investigation are of decisive importance for the certainty, with which the results can be evaluated and hence from which the conclusions can be drawn, it cannot be said to be immediately apparent that their use will result in a one-sided over-emphasis on the similarities between the twins. In the clinical investigation and evaluation as well as in the psychometric examinations there are, as has been stated before, possibilities for the differences between the twins to come out relatively strongly and to be overrated.

The avoidance of both these possibilities has been sought, partly by the longitudinal and relatively intensive observation of the twins, partly by the retesting, and, finally, by the fact that the investigations were made and the results analysed, primarily, independently of each other. This procedure should establish a basis on which the significance of intra-pair differences and similarities might be assessed, especially the question of, whether these are to be considered as being more chance, temporary or apparent or, whether they are permanent and indubitable. In retesting, special conditions were also established for elucidating whether the differences or variations in the test results between the twins were significantly greater than the differences and variations due to the errors of measurement of the tests that appeared after retesting of each single proband.

The influence that can be thought to derive from the investigator's, more

or less unconscious, attitude to the problems dealt with in this investigation, is likewise discussed in *chapter 7*, where, among other things, it is emphasized that the immediate importance to be attached to this fundamental source of error can in no way be said to be clear. In principal, it will ensure both an over- and an under-evaluation of differences as well as similarities. In our opinion, the data and the results, appearing from twin investigations often set very narrow limits to these possibilities, and the problems are, in practice, relatively less significant, than theory leads one to expect.

That the results, apart from the certainty on which they are based, can be made the object of a discussion and can be interpreted in different ways is another matter.

RESULTS AND GENERAL CONCLUSIONS

The difficulties in making an analysis of the total results of the investigation lie not only in the material and the methods but also in our endeavour to make as comprehensive and thorough an investigation and analysis of each individual pair of twins, as was possible.

This has produced a large mass of material, out of which the author has selected that which he thought was significant and indubitably verifiable. It can, undoubtedly, be very difficult to survey clearly not only the whole material but also the data and the results incorporated in each single case history. The intense, and at the same time diffuse, tracking down and registration of a long series of more or less predominant differences and similarities, serving to elucidate conditions and problems characteristic of each single pair, are admittedly in direct contrast to efforts designed to make a comprehensive, and possibly statistical, analysis of the material with the aim of producing results, which are generally applicable and which may lead to unequivocal general conclusions. This last is only possible if from the whole material, certain data (cf. *Table 20*) are isolated and, if possible, collected in groups or in units that lend themselves to fairly certain demarcation, and if the investigation is directly aimed at elucidating the relative significance that heredity and environment may have had for the conditions in question. It is clear, that those results that can be made the object of such an analysis only represent a minority of the data produced in the whole material, and that many of the results that in the present investigation only apply to single pairs of twins might have been generally applicable in an investigation comprising another material and other methods of investigation.

The investigation results that come from the collected material or from relatively large parts of it fall mainly within four groups: 1) *The general state of health*, 2) *The appearance of certain somatic disorders*, 3) *Intelligence functions and personality structure* and 4) *The appearance of certain psychiatric disorders*.

Survey of Major Environmental and Intra-pair Differences and Similarities

Twin Pairs	Age in years	Age at Separation	Mutual Contact During Up-bringing	Both Twins Brought up by Relatives	Educational Differences	Differences on Intelligence Testing		Socio-Psychological Differences in Environment	Personality Differences on Rating	Psychiatric Disorders in the Twins	Psychiatric Disorders in the Biological Family
						W-B (1st test)	Raven				
I Palle Peter	22	10 months	-	-	+++	-	-	++	+	-	Various psychiatric disorders, especially in the maternal family (schizophrenia and manic-depressive psychosis)
II Olga Ingrid	35	7 months	-	-	++	-	-	+++	++	-	
III Maren Jensine	37	6 weeks	(+)	+	-	++	+	+	+++	-	Manic-depressive psychosis in the paternal family
IV Ingegerd Monika	42	12 months	++	+	-	+	-	+	+	Both neurotics	Personality disorders in the paternal family (?)
V Kaj Robert	45	9 months	-	-	+++	+	+++	+++	+	Both personality disorders	Personality disorders in the paternal family (?)
VI Martha Marie	49	3½ years	(+)	+	-	+	++	++	+++	One neurotic, the other slight neurotic symptoms	Personality disorders in the paternal family (?)
VII Kamma Ella	50	1 day	-	-	+	+	-	+++	+	-	Personality disorders in the paternal family (?)
VIII Signe Hanne	54	3 weeks	-	-	++	-	-	+++	++	Both neurotics	Neuroses in the maternal family (?)
IX Karin Kristine	64	3 weeks	(+)	-	+	++	+	+++	++	-	?
X Petrine Dorthe	70	12 months	-	-	+++	+	-	+++	+	-	-
XI Astrid Edith	72	3½ years	(+)	-	-	+	+	+++	++	-	-
XII Viggo Oluf	77	5¾ years	(+)	-	-	++	-	++	+	-	?

- no, + slight, ++ moderate, +++ considerable differences.

Ad 1). As it appeared in *chapter 9*, the investigation results only showed few intra-pair differences, whereas the similarities in respect of ordinary somatic health conditions were very remarkable.

Only with regard to weight could certain differences be demonstrated, which in comparison with the results of earlier investigations of separated, monozygotic twins, must be considered marked. While an association with the differences in childhood environments could not be proved, there was, however, in female pairs, who presented relatively great differences in weight, a convincing association with marked differences in their later lives and in their environmental conditions of pregnancies, births, heavy eating habits and, presumably, also certain psychological mechanisms associated with these, which seem to have favoured the development of obesity in one twin in contrast to her partner. The, expressed with correlation coefficients, relatively great agreement between the twins with regard to weight and the occurrence of obesity that was registered for several pairs in their biological families, indicates that genetic factors also play a considerable rôle, perhaps especially within the field of normal variation or its moderate deviations.

The investigation of height showed no significant differences. The close agreement between the twins in this respect corresponds to the results of earlier investigations and indicates that height is quite predominantly determined by genetic factors.

In the electrocardiographic, the electroencephalographic and ophthalmological examinations the results, both with regard to normal, and to abnormal but clinically insignificant, qualities, showed so far reaching agreement between the twins, that the establishment of practically speaking complete concordance can for once in a while be said to be justified. The results confirm, that these conditions are quite predominantly determined by heredity and leave no room for ordinary environmental influences.

In the investigation of different normo-physiological and age-conditioned, somatic conditions, there were no specially remarkable results.

On the basis of these results, it can be concluded that, apart from the variation in weight, which showed an association with various environmental factors, general somatic conditions of health must be considered quite predominantly genetically determined.

Ad 2). Concerning the various somatic disorders, appearing among the probands, the examinations showed, as appeared in *chapter 9*, both clear intra-pair differences and marked similarities.

The differences included firstly dissimilarities with regard to relatively distinct exogenous factors such as specific infections, injuries and accidents, partly of childhood, and partly of later occurrence.

The similarities were prominent in the appearance of disorders which are commonly supposed to be quite predominantly conditioned by genetic factors as, for example, migraine.

The examination results give, apart from those mentioned, no other cause for general conclusions.

Ad 3). In the investigation of intelligence functions and personality structure, both in the ordinary clinical evaluation and in the psychometric investigations, points of intra-pair dissimilarity as well as remarkable points of similarity could be demonstrated.

There was in some cases, on the ordinary clinical evaluation, an immediate difference in the intellectual capacity of the twins, corresponding to differences, especially educational differences, in their respective childhood environments. In the systematic intelligence testing with the *Wechsler-Bellevue Intelligence Scale, Form I* and *Raven's Progressive Matrices*, significant differences between the test results of the twin partners could be found. For *W-B*, these differences were significantly greater than the errors of measurement of the test, i. e. the variance in test-retesting, but less than the differences between the test results of the total proband material.

The intra-pair differences showed for the verbal tests, but not for the performance tests, or *Raven's* test, a significant association with the dissimilarities in schooling in as much as the partner with the better intelligence test score had also had the better education. This association was the closer, the greater the differences in education had been.

The similarities between the intelligence test scores of the twin partners were considerably more remarkable than the differences. Expressed in correlation coefficients for *W-B* Total IQ there was an agreement of .62 (Verbal IQ .78 and Performance IQ .49). For *Raven's* test, the coefficients for IQ were .73 and for Raw Scores .79.

In comparison it can be stated, that *Newman, Freeman & Holzinger* found the following correlation coefficients: *Binet IQ* .77 and *Stanford Educational Age* .58 for separated, monozygotic twins. *Shields*, who used the non-verbal *Dominoes Intelligence Test* and *The Synonyms Section (Set A) of the Mill Hill Vocabulary Scale (Form B)*, found a correlation coefficient for *Total Intelligence Score* of .77.

The relatively good agreement, especially for the non-verbal test results, between these correlation coefficients obtained by different methods must, however, be taken with reserve. In the *W-B*-testing a relatively modest IQ-variance was found for the total investigation material. This affects the size of the intra-pair correlation coefficients, since the given coefficients are smaller than they would have been if the variance in the material for investigation had been the same as that aimed at in the test construction.

A variance analysis of the test results showed, that the twin partners resembled each other more than persons chosen at random, but they do not resemble each other so much as each single proband resembled himself on retesting within a brief interval of time.

While *Newman et al.* found that monozygotic twins reared apart present greater resemblances with regard to their intelligence test scores than do dizygotic twins, but not so great a resemblance as monozygotic twins who have grown up together, *Shields* could not show any significant difference between the test scores of monozygotic twins grown up apart or together, but like *Newman et al.* he found, that the resemblance between monozygotic twins was significantly greater than the resemblance between dizygotic twins. For both categories of twins the resemblance, assessed by the correlation coefficients, must be said to be greater than the intra-family correlations (about .50), which are produced from a comparison of the intelligence test scores of parent and child and of siblings (*Alström*, 1961).

On the basis of the investigation results it can be concluded, that these, in the main, confirm the investigation results of other corresponding investigations: the test score a person achieves in intelligence testing is, to a certain extent, conditioned by environment and education, but is quite predominantly determined by genetic factors.

In the ordinary, clinical investigation, and in the psychometric tests of *Rorschach*- and *Word Association*, there could, for all pairs, be shown both differences and similarities in the twins' personality structure.

From a clinical total assessment of the relative degree of differences and similarities only a few pairs showed differences, that, in comparison with the points of similarity, can be said to be considerably more predominant; the remaining pairs showed similarities that were either as marked as the differences or considerably more marked than these.

As was stated in *chapter 9*, the dissimilarities were greatest for those parts of the personality that affect the immediate interaction and association with other people: the twins' attitude to their surroundings, their cooperation, their form of contact and need of contact. Furthermore, their differences in personality were expressed in their different attitudes to life in general and their points of view, partly on cultural, religious and social questions, partly on marital, sexual and family situations and domestic problems. Characterologically, the differences seem to be greatest with regard to ambitions and aggression, emotionally and temperamentally with regard to spontaneous reactions. Finally, in their choice of education, or in their fields of interest as well as in their personal tastes, they were, with the exception of a few pairs, very different.

From pair to pair, the differences between the twins with regard to these and other personality traits were of varying degree, but for each single pair, an association between the differences, especially with regard to the psychological conditions and inter-personal relations in the childhood environments or in the later environment, could relatively easily be deduced, and this association was, in the majority of cases, immediately comprehensible and convincing.

The predominant points of similarity in the personality structure concerned the twins' ordinary appearance, their motility, their carriage, their gait, their movements, gestures, facial expressions, especially smiles and laughter and the tune and pitch of voice. As it appears in the case histories, in most pairs, there were also considerable points of similarity with regard to more profound personality traits, both characterologically and emotionally, and finally it must be emphasized, that their verbal descriptions, especially of their symptoms, were often strikingly alike.

While most of the resemblances described here, when occurring among sibs or other relatives, with a common environment are thought to be quite predominantly dependent upon conscious or unconscious imitation of behaviour and identification, in the present investigation, they must be considered as a clear indication of the twins' genotypical similarity and therefore as a strong proof of the decisive rôle played by genetic factors for the appearance of such traits in the personality structure.

In personality testing too, a series of clear differences and similarities could be demonstrated. The test results must, on the whole, be said to show good agreement with the personality description and evaluation, which was made on the basis of the ordinary clinical investigation, even though similarities in the test results seem perhaps to be considerably more apparent than differences. As accounted for in *chapter 7* and *11*, a systematic or a special statistical analysis of the results has not been made.

Newman et al., in their investigation, laid chief emphasis on the statistical analysis of the personality test scores. As has already been mentioned in *chapter 4*, they emphasize that these results were considerably more dissimilar than the intelligence test results. They could not show any statistically significant association between differences in personality and differences in environment either social or educational and in the discussion on this, they themselves emphasize that such an association does not seem to be an especially natural possibility, while a thorough evaluation and analysis of the case histories serves a more useful purpose when it deals with the demonstration of associations between personality development and childhood environment; to the extent that the material allowed, they also sketched such an analysis for some of the pairs. As has already been mentioned, *Newman et al.* found by one of the personality tests used by them (Woodworth-Mathews Personal Data Sheet), that the test results for monozygotic twins grown up apart were in fact more alike than for those grown up together; a result which will be commented upon below.

Shields, who used the Self-Rating Questionnaire devised by *Eysenck* (1958) for the investigation of personality dimensions of "extraversion" and "neuroticism", found no certain dissimilarity between separated and unseparated monozygotic twins. The results show a tendency for greater similarity between

the separated twins with regard to both personality dimensions than between twins who had grown up together. *Shields* found in his analysis of the presumed causes of differences in personality, reason to assume that dissimilarities in the case of twins who had grown up together could be derived from the twin situation itself, and that the association that could be demonstrated between leadership and extraversion in monozygotic twins living in the same environment might possibly explain, why their personalities, especially with regard to extraversion, became more dissimilar than did the personalities of monozygotic twins brought up apart. While *Shields* could not show any statistically significant association between the personality test scores and the differences in the early environment, he found, in a rating of similarities, that those twins who had grown up apart were less alike than those who had grown up together, and in an analysis of the case histories a relation between personality dissimilarities and childhood environment could be shown, even though *Shields* emphasizes that the differences in early environment do not appear as a predominant reason for the differences in the development of personality.

At first glance, these investigation results and conclusions produced by various investigation methods may seem incompatible. They combine, however, to give a fairly clear picture of our problems of research, especially the problems of the twin method.

In the first place, they illustrate the difficulties, both theoretical and practical, of analysing statistically the relations between personality and childhood conditions, and they illustrate moreover, that personality tests do not lend themselves to immediate comparison with other instruments of measurement like intelligence tests for instance, especially with reference to reliability and satisfactory differentiation.

In the second place, many of the results indicate that the early psychological environment of monozygotic twins, who have grown up together, may be more different, than for monozygotic twins, who have grown up apart, a finding which beggars the value of control materials of twins who have grown up together, especially in the case of personality research.

Finally, these investigations show, what is presumably the most important, that an intensive, qualitative, clinical investigation and analysis, in contrast to investigation methods aiming at a quantitative statistical analysis, led to results and conclusions that, apart from their more uncertain scientific value, have greater meaning. This has also been pointed out by *Newman et al.* and is substantiated by their case material. *Shields*, as mentioned, found in his personality rating and in an intensive, qualitative analysis of the material, that, in contrast to what was the case with the psychometric testing, differences could be found between the personalities of twins, who had grown up apart, and further, these differences could be associated with certain differences in environment.

In the present investigation in which an intensive, clinical analysis of each single pair has been aimed at, and in which psychometric tests, that correspond to at wide extent to the psychiatric interview, have been used, the above mentioned investigation results have further been confirmed. It is clear, but not surprising, considering the nature of the object under investigation and the complicacy of the problems, that under such circumstances the possibilities of making a quantitative analysis and of arriving at statistically verifiable results become even more remote. This is, however, not tantamount to a principle admission of the impossibility, for instance by the help of other materials and other methods of investigation aimed at investigating other dimensions of personality or well defined units of normal personality structure, of producing investigation results that can be termed statistically significant and that may lead to meaningful conclusions.

It may be concluded from the present investigation, that with the methods of investigation employed, remarkable differences in the personality structure of the twins have been disclosed. Furthermore, these differences are associated with the psychological differences present in the childhood environment and later. It is thus clearly established, that environmental factors play a decisive rôle in the development of personality.

At the same time the investigation have disclosed remarkable points of similarity between the personality structures of the twins, even though they had grown up in environments that psychologically must be said to be, more or less, different. This similarity must derive from the genotypical identity of the twins and, therefore, convincingly indicates that genetic factors play an important part in the development of the normal personality.

Ad 4). Both twins in *pair IV* had suffered from a severe neurosis, dominated by sexual-neurotic, anxious-hysterical, psychosomatic and periodic depressive symptoms, which for both had entailed numerous admissions to hospital, and, for one of them, admissions to a psychiatric department also; but there can hardly be said to have been any real difference in their need for psychiatric assistance. Both were frigid, suffered from dyspareunia and fear of pregnancy, which led to both seeking and obtaining permission for sterilization.

The twins in *pair VIII* are likewise considered as inveterate neurotics with grave hypochondriacal, psychosomatic, especially vegetative symptoms, that in periods were marked by anxiety and depression. For both, the neurotic symptoms had entailed a number of hospital admissions, and one had also been treated at a psychiatric out-patients' clinic, but there cannot, for this pair either, be said to have been any real dissimilarity in the twins' need for psychiatric assistance.

Finally, the twins, *pair V*, have both been classified as characterologically deviating or psychopathic personalities. One of them had, on account of his

“character-neurotic” symptoms, sought psychiatric guidance; the other’s life had been rather “asocial”; he had been convicted for a number of minor offences but had never at any time sought contact with a psychiatrist.

In some of the remaining pairs there were also, partly in childhood and partly later, both outstanding differences and striking similarities with regard to slight, neurotic symptoms, psychosomatic and character traits falling within a personality development and structure of the twins, that was otherwise psychiatrically unremarkable, and also in these cases the intra-pair differences showed a meaningful association with differences in environmental conditions.

The differences between the twin partners with regard both to the symptomatology and the course of the psychiatric disorder can be said to be as outstanding as the points of similarity, even though, in assessing the picture of disease, it can be extremely difficult to state precisely to what extent, or on what plane, there really can be said to be a difference or a similarity. Even if the dissimilarities are regarded as quantitative differences, there can yet, in all the pairs, be said to have been proved clear differences, that had an immediate and, in far the greatest number of cases, a convincing association with the dissimilarities that, according to the information available, must be presumed to have been present in the early childhood environments or the later environments of the twins.

Both in the childhood environments’ outer and inner structures there have been dissimilarities, especially with regard to the inter-personal constellations, the twins’ relations to the parent figures, and with regard to the whole psychological atmosphere of the environment. In those cases, where such differences were outstanding, there is special reason to emphasize the psychological and psychiatric points of close resemblance between the twins.

In some cases the dissimilarities between the twins could be related to differences in the environment in the actual situation or to different influences of adult life. This, of course, does not preclude that it might have been possible to have traced an association far back in childhood, but the retrospective investigation methods that have been employed can, however, not directly elucidate the interplay of individual and environment in early childhood. It should, however, undoubtedly be possible through the presented descriptions of the differences and similarities between the twins and between their environmental conditions to demarcate a number of those problems that would also be relevant if the case histories were to be assessed from more special aspects and theories of depth-psychology.

Newman et al. have, in their investigation, only slightly sought to elucidate problems concerning psychiatric disorders; but a perusal of the case histories shows that the investigation has comprised several pairs possessing marked differences as well as striking similarities with regard to neurotic and charac-

terological deviations. *Shields* has, partly in his case histories and partly in a special section, discussed this in more detail. He emphasizes two pairs, particularly, who were incorporated in the investigation either because one or because both twins had been treated in psychiatric departments. In one case, both twins, despite their having grown up in environments that presented great cultural differences, developed typical schizophrenia. In the other pair, one had grown up under unfortunate environmental conditions and had developed an anxious personality and what is termed a "compensation neurosis", while the partner, who had had more favourable childhood conditions, was found to be psychically normal. Among the other pairs there were also remarkable similarities as well as differences between the neurotic conditions of the twins or their personality deviations.

If, in spite of the reserve already stated, one still endeavours to give a short concluding summary of the results produced by the present investigation, this must be, that our investigations show primarily that not only environmental factors, but also genetic factors must be presumed to play a considerable part for the development of neurosis and personality disorders. What general importance is to be attached to these environmental and genetic factors can, however, not be elucidated on the basis of the present investigation, apart from the fact that there is reason to suppose that their relative significance must vary considerably both between different syndromes or symptoms and between one genotype and the other.

SOME GENERAL AND FINAL COMMENTS

It has been repeated indefinitely, that the development of every human quality is conditioned by an interplay of heredity and environment, and is not a question of an "either-or". In the present investigation an attempt has been made to contribute to our knowledge of this interplay, by examining and analysing a series of differences and similarities between monozygotic twins reared apart in childhood, with regard to the development of general health, various somatic disorders, intelligence functions and personality structures, as well as certain psychiatric disorders, neuroses and character deviations.

That certain human qualities, as for instance blood-types, are entirely determined by genes, and are developed independently of environmental conditions, and that the same applies to a long series of other characteristics, as for instance skin-, hair-, and eye colour, can be said to be generally accepted. That electroencephalographs or electrocardiographs of individuals are practically exclusively determined by heredity, both with regard to normal and abnormal qualities, and that only extremely harsh or special environmental factors are capable of influencing these, can hardly be disputed. With regard to many somatic abnormalities and disorders, it has also been clearly establish-

ed that these are primarily conditioned by genetic factors, without this indicating any nihilistic therapeutic attitude.

For normal psychological functions or qualities such as intelligence and personality, it is obvious that a more complicated interplay of heredity and environment is present. Intelligence, defined as the result an individual obtains in a systematic intelligence testing, seems to be quite predominantly conditioned by genetic factors, while environmental factors, unless these deviate extremely from the inter-human conditions of environment that are usual within fairly well defined cultural communities, only have a relatively modest influence. In an assessment of the significance of the interplay of heredity and environment for the development of normal personality, there are, from the point of view of research, even greater difficulties when, for instance, assessing whether the phenotypical variation observed in monozygotic twins is significantly greater than is allowed for by the degree of accuracy conditioned by the methods of investigation.

Personality deviations and neuroses shade into the so-called normal area and can primarily be considered as quantitative deviations of this. Just as the development of a series of quantitatively varying normal characteristics, including intelligence and also personality, must be assumed to be determined by a multiplicity of genes, so also can personality disorders and neuroses be presumed to be polygenetically conditioned.

That environment plays a significant part in the development of psychiatric disorders will hardly surprise any psychiatrist, but that heredity may be just as significant ought not to be surprising either. Nevertheless, it is justifiable to state, that many psychiatrists, not to speak of psychologists, seem to feel it necessary to belittle, or ignore entirely, the possible significance of genetic factors for the development of neuroses. This is especially remarkable, because the dynamic approach of psychiatric, especially psychoanalytic, theories and of genetic views offer certain points of similarity and cannot be said to be incompatible in principle. *Stengel* (1956) has emphasized that even though *Freud* only occasionally expressed an opinion on this, it is unjustified to assert that he ignored the significance of heredity. In contrast to most of his successors, he has clearly stated his view points on several occasions. *Stengel* quotes in this connection *Freud's* "An Outline of Psychoanalysis" (1949): "The determining causes of the varying forms of human mental life are to be looked for in the interplay between inherited dispositions and accidental experiences. Thus it may happen that one particular instinct is innately too strong or too weak, and that one particular capacity is stunted or insufficiently developed in life, while on the other hand it may happen that external impressions and experiences may make stronger demands upon one individual than upon another. What the constitution of one person can deal with may prove an unmanageable task for another. These quantitative differences will

determine the differences of the result". To this *Stengel* adds the following prophecy: "Possibly the time is not far off when psychoanalytically trained psychiatrists and geneticists, whose outlook and aims seemed incompatible not so long ago, will join forces to the great advance of mental science. Such combined studies would be very much in keeping with *Freud's* views on what *Francis Galton* called the "relative powers of nature versus nurture". This is an area of psychiatric research in which *Freud's* influence has only just begun to make itself felt".

While former twin investigations dealt primarily with psychoses, oligophrenia or other severe mental disorders and abnormalities, the twin-method is increasingly employed in the research of neuroses.

In recent years, a number of investigations of probands with neuroses and various forms of psychopathy made by the classical twin method have been published. Besides the earlier investigations of *Slater* (1953) and *Eysenck & Prell* (1951) the investigations of *Braconi* (1961) can be mentioned and also of *Ihda* (1961), *Slater* (1961) *Gottesman* (1962) and *Tienari* (1963). These investigations combine to emphasize the considerable importance of genetic factors for the development of psychopathies and of neuroses. In the case of the latter, heredity seems to be particularly significant for the development of compulsive, obsessive neuroses, while this does not seem to be the case with, for instance, conversion-hysterias.

Twin investigations have been much criticized for their methods of collecting material, their poor representativity considering the predominance of hospitalized probands, the concepts of concordance-discordance and of diagnosis and the zygosity criteria employed. New twin investigations of psychiatric disorders are therefore still required. These should, like any other scientific investigation, be carried out as objectively as possible, especially should they be free of conscious prejudice or attempts of employing the twin method for the proving of certain theories, as for instance that schizophrenia has no association with genetic factors. The results derived from investigations of the heredity of schizophrenia, not only by the help of the twin method, but also by other genetical-statistical methods are still so significant, that they can only be refuted by results produced by investigations on comprehensive materials which, with regard to the collection of material and its analysis, are far more convincing than the few lesser investigations which have hitherto been published, to substantiate that this disease has nothing whatever to do with genetics.

It seems at the moment probable that the concordance rates recorded in the literature for the psychoses must presumably be modified with the publications of investigations of twin series collected outside psychiatric hospitals and institutions. On the other hand it should be emphasized that investiga-

tions on the genetics of the neuroses seem to have come to the front, and that this field of research is as yet so little cultivated that there is reason to expect fruitful results. Twin investigations will not, however, as has already been pointed out, be able to elucidate questions concerning the mode of hereditary transmission, for this, other methods of investigation must be employed.

SUMMARY

Chapter 1

In a short survey of the problem of heredity and environment the theoretical possibilities of the twin method for elucidating the psychiatric-psychological aspects of the complicated interplay of individual and environment are outlined.

Chapter 2

The aim of the work is to add to our knowledge of the interaction of the individual and his environment by means of an intensive psychiatric-psychological investigation and analysis of phenotypical differences and similarities between monozygotic twins who have been reared apart from early life.

The theoretical advantages and the practical difficulties of accomplishing such an investigation are discussed.

Chapter 3

An account of the twin method used in psychiatric-psychological research is made. The arguments raised against the theoretical requirements of the method, that there exist two kind of twins, monozygotic and dizygotic, are discussed.

The traditional use of the twin method and of the concepts of concordance and discordance in psychiatric-psychological research are treated and made the object of discussion.

The special twin methods that lay emphasis on an investigation and analysis of intra-pair differences in monozygotic twin partners are discussed.

On the basis of the literature the social and psychological aspects of being a monozygotic twin are elucidated, and the reasons for evading the theoretical sources of error associated with this, by examining monozygotic twins who have grown up each in his own environment, are substantiated.

Chapter 4

The relatively few publications on separated pairs of twins are considered; and the two greater, systematic investigations of respectively *Newman*, *Free-*

man & Holzinger and *Shields* are described, especially with reference to the collection and selection of materials, as well as the methods of investigation. The chief results and conclusions of these investigations are summarized.

The present, Danish investigation is characterized and placed in relation to the earlier investigations.

Chapter 5

The collection and selection of the investigation material is accounted for. The material derives partly from a systematic registration of all twin births in Denmark in the period 1870 to 1910, which has been made at the Institute of Human Genetics of the University of Copenhagen, and partly from a tracking down, made by the author, of separated twins born after this period.

An account is given of the criteria of selection and of the twin pairs who were not included in the investigation because they did not comply with them.

The representativity of the twin material is discussed.

Chapter 6

The material for investigation consists of 12 monozygotic twin pairs, nine female and three male, who at the time of the investigation were of ages ranging from 22–77 years.

The composition of the material with regard to sex, age, time of separation, and the reasons for separation is analysed and compared with the materials produced by the earlier investigations.

Chapter 7

The methods of investigation embrace, partly medical-psychiatric interviews and clinical and special investigations associated with them, and partly psychometric methods, intelligence and personality tests.

The methods in the various examinations are described and their theoretical and practical limitations for research are discussed.

Chapter 8

The principles in the establishment of the zygosity diagnosis are laid down. The criteria, and the results of the examinations are presented and discussed.

Chapter 9

The results of the medical-psychiatric investigations fall mainly into four groups: The first including the general health of the twins, the other includ-

ing the occurrence of various somatic diseases and abnormalities, the third their normal mental qualities, intelligence functions and personality structure, and under the last heading the development of certain psychiatric disorders, neuroses and personality deviations, in some of the probands.

The interplay of individual and environment and the conclusions that can be drawn concerning the relative significance of environmental and genetic factors are elucidated through a systematic account and discussion of the intra-pair differences and similarities which could be established.

Chapter 10

On the basis of the information available concerning the environments of the twins, especially with reference to social, psychological and inter-personal environmental constellations, a corresponding analysis is made of the differences and similarities in the environmental conditions during childhood and later.

Chapter 11

The results of the psychometric examinations, which were made concurrently with but independently of the other investigations, are presented. The results of the intelligence testing is made the object of a statistical analysis, while the results of the personality testing are assessed from the results produced by the general psychiatric-psychological evaluation.

Chapter 12

The total results and the conclusions of the investigation are treated to a general discussion, and a comparison is made with results and conclusions from the earlier investigations of monozygotic, separated twins.

It is emphasized that, by means of the methods of investigation employed, it has been possible to disclose a series of phenotypical differences and similarities between the twin partners, from which conclusions can be drawn concerning the relative importance that can be attached to environmental and genetic factors for the development of the human individual.

The possibilities of the various methods of investigation for establishing intra-pair dissimilarities or similarities are discussed, especially those differences that in this respect exist between ordinary clinical, psychiatric-psychological methods of investigation and psychometric investigations which aim at a statistical analysis of the interplay of individual and environment.

In the final comments the importance of genetic factors for the appearance and development of neurotic symptoms and disorders, and the possibilities of

research for a detailed elucidation of the interplay of individual and environment are stated.

It is pointed out that the difficulties and limitations of investigations of monozygotic twins reared apart do not derive from the twin method as such, but from the conditions that characterize psychiatric-psychological methods of investigations and problems in general.

ELEMENTARY TABLES

TABLE A
Blood - and Serum Grouping

Twin Pairs	A ₁ A ₂ BO	MN	P	Rhesus	Lewis	Duffy	Kell	Lutheran	Hp	Gm
I	A ₂	MNs	P+	R ₁ r	Le(a-)	Fy(a-)	K-	Lu(a-)	Hp 2-1	Gm(a+)
II	A ₂	Ms	P+	R ₁ r	Le(a-)	Fy(a+)	K-	Lu(a-)	Hp 2-1	Gm(a+)
III	A ₂	Ns	P+	R ₁ R ₁	Le(a-b+)	Fy(a+)	K-	Lu(a-)	Hp 2-1	Gm(a-)
IV	B	Ns	P+	R ₁ r	Le(a+b-)	Fy(a+)	K-	Lu(a-)	Hp 2-1	Gm(a+)
V	A ₁ B	Ns	P+	R ₁ r	Le(a+)	Fy(a-)	K-	Lu(a-)	Hp 2-1	Gm(a+)
VI	O	MNs	P+	R ₁ R ₂	Le(a-b+)	Fy(a+)	K-	Lu(a-)	Hp 2-2	Gm(a-)
VII	A ₁	MNS	P+	R ₁ r	Le(a-)	Fy(a+)	K-	Lu(a+)	Hp 2-1	Gm(a-)
VIII	O	MNS	P+	R ₂ r	Le(a-b+)	Fy(a+)	K-	Lu(a-)	Hp 2-2	Gm(a-)
IX	O	MS	P+	R ₁ r	Le(a-)	Fy(a-)	K+	Lu(a-)	Hp 2-1	Gm(a+)
X	O	MS	P+	R ₁ r	Le(a-b+)	Fy(a+)	K-	Lu(a-)	Hp 2-2	Gm(a+)
XI	A ₂ B	NS	P+	rr	Le(a-)	Fy(a+)	K-	Lu(a-)	Hp 2-1	Gm(a-)
XII	O	Ms	P-	R ₁ r	Le(a-)	Fy(a+)	K-	Lu(a+)	Hp 2-1	Gm(a+)

TABLE B
Finger Print Values (I-VI)

Twin Pairs	Ridge counts										Total	Intra-pair Difference		
	r/l	1		2		3		4		5				
		R	U	R	U	R	U	R	U	R			U	
I	Palle.....	r	22	14	2	-	6	-	6	-	15	-	93	4
		l	9	18	-	1	-	4	-	4	-	15		
II	Peter.....	r	20	10	1	-	8	-	6	-	12	-	97	9
		l	13	18	10	-	-	-	-	9	-	15		
III	Olga.....	r	17	-	11	-	14	-	20	12	13	-	129	8
		l	-	13	-	2	-	10	-	18	-	11		
IV	Ingrid.....	r	16	-	2	-	12	-	21	13	15	-	138	3
		l	-	14	-	9	-	14	-	20	-	15		
V	Maren....	r	18	-	15	-	12	-	9	12	9	12	140	1
		l	-	16	-	15	-	12	8	16	-	12		
VI	Jensine....	r	17	-	9	11	13	-	16	-	11	-	132	18
		l	-	15	-	14	-	13	8	11	-	11		
VII	Ingegerd...	r	21	-	5	-	8	-	21	-	16	-	133	3
		l	-	11	-	11	-	6	-	18	-	16		
VIII	Monika....	r	14	6	5	6	9	-	16	11	18	7	130	1
		l	-	14	-	9	-	14	-	14	-	16		
IX	Kaj.....	r	17	-	-	8	-	-	13	-	11	-	94	1
		l	-	14	-	9	-	9	-	7	-	6		
X	Robert....	r	21	-	-	9	8	-	17	-	8	-	95	18
		l	-	-	-	6	-	8	-	8	-	10		
XI	Martha....	r	-	-	-	17	14	-	14	-	12	-	113	18
		l	-	-	8	-	-	13	-	16	-	19		
XII	Marie.....	r	-	-	-	17	11	-	13	-	9	-	95	18
		l	-	-	7	-	-	10	-	12	-	16		

r/l = right/left; R = radial, U = ulnar.

TABLE B
Finger Print Values (VII-XII)

Twin Pairs	Ridge counts											Total	Intra-pair Difference
	r/l	1		2		3		4		5			
		R	U	R	U	R	U	R	U	R	U		
VII	Kamma... r	6	2	-	12	6	-	16	-	19	-	105	5
	l	7	8	-	-	-	5	-	15	-	18		
VIII	Ella..... r	8	-	7	-	9	-	13	-	13	-	110	21
	l	13	10	-	8	-	10	-	13	-	16		
IX	Signe..... r	27	13	14	18	16	-	16	17	20	-	204	9
	l	20	12	22	25	18	-	25	-	18	-		
X	Hanne.... r	21	-	17	-	15	-	18	-	19	-	183	11
	l	21	-	16	15	20	-	18	-	18	-		
XI	Karin..... r	18	-	11	14	-	19	23	16	14	-	174	6
	l	-	15	21	9	-	13	13	23	-	14		
XII	Kristine... r	21	-	-	18	10	-	21	21	18	-	165	11
	l	-	11	18	12	15	16	16	17	-	15		
XIII	Petrine.... r	19	-	-	20	-	-	24	4	14	-	168	6
	l	-	16	16	9	-	17	-	23	-	19		
XIV	Dorthe.... r	22	-	-	19	13	-	23	15	14	-	179	6
	l	-	19	22	10	-	14	15	17	-	16		
XV	Astrid..... r	14	9	6	-	-	-	4	-	4	-	47	6
	l	-	-	-	-	-	7	-	5	-	7		
XVI	Edith..... r	5	-	2	-	-	6	-	-	9	-	41	1
	l	-	-	-	-	-	-	-	10	-	9		
XVII	Viggo..... r	21	10	-	7	14	-	10	-	8	-	123	1
	l	-	19	8	-	-	11	-	13	-	12		
XVIII	Oluf..... r	22	13	8	-	13	-	9	-	10	-	122	1
	l	3	16	4	-	-	15	-	11	-	14		

TABLE C

W-B Weighted Scores (WS), Points and IQ's for the First Testing (I) and the Retesting (II).

Twin Pairs	Information		Comprehension		Digit Span		Arithmetic		Similarities		Picture Arrangement		Picture Completion		Block Design		Object Assembly		Digit Symbol		Verbal Points		Performance Points		Total Points		Verbal IQ		Performance IQ		Total IQ	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II		
I Palle.....	12	13	12	12	7	7	16	13	12	12	11	14	12	13	16	15	12	13	15	14	59	57	66	69	125	126	114	112	121	125	119	120
Peter.....	13	17	14	17	9	10	16	17	12	14	11	13	10	13	14	16	12	14	16	16	64	75	63	72	127	147	120	133	117	129	121	135
II Olga.....	9	9	6	8	6	7	7	7	12	11	7	7	9	9	10	10	12	12	7	6	40	42	45	44	85	86	94	96	103	102	99	99
Ingrid.....	11	13	6	9	7	9	7	7	14	12	10	9	9	10	9	11	11	10	8	7	45	50	47	47	92	97	99	105	105	105	106	
III Maren....	10		13		6		6		14		8		12		10		11		(10)*		49		51		100		104		110		108	
Jensine....	10	10	8	9	4	4	9	10	11	11	7	8	7	10	7	9	12	9	8	9	42	44	41	45	83	89	96	98	98	103	97	101
IV Ingegerd..	9	9	6	6	3	3	10	7	6	9	4	10	10	10	7	7	10	14	6	7	34	34	37	48	71	82	88	88	97	110	91	98
Monika....	10	10	9	8	3	2	10	9	9	8	7	9	8	10	9	9	11	13	9	8	41	37	44	49	85	86	96	92	105	111	100	101
V Kaj.....	13		12		7		10		11		9		10		7		10		10		53		46		99		110		111		111	
Robert....	15	16	13	14	9	6	7	7	16	14	9	10	12	9	10	10	12	12	6	8	60	57	49	49	109	106	118	115	114	114	117	115
VI Martha....	8		6		7		6		10		9		7		10		13		10		37		49		86		95		116		105	
Marie.....	5		5		6		4		8		11		6		8		13		8		28		46		74		85		113		97	
VII Kamma....	7	8	12	9	7	10	3	4	9	11	10	12	9	12	8	9	11	14	6	6	38	42	44	53	82	95	94	98	109	120	100	110
Ella.....	6	7	9	9	7	7	4	6	11	12	7	10	9	10	7	7	5	12	6	5	37	41	34	44	71	85	93	99	98	109	94	104
VIII Signe....	7	9	7	8	3	3	6	4	6	9	4	7	9	8	6	5	8	9	6	6	29	33	33	35	62	68	86	92	100	102	91	96
Hanne....	8	8	10	10	4	3	4	6	8	8	7	6	9	9	8	8	7	12	7	7	34	35	38	42	72	77	93	94	105	110	98	101
IX Karin.....	8	8	9	10	9	6	4	6	11	5	9	7	6	8	5	6	11	12	6	6	41	35	37	39	78	74	101	96	108	112	104	102
Kristine....	9	9	10	7	7	7	4	7	11	11	6	7	8	9	4	4	9	11	7	8	41	41	35	39	76	80	101	101	106	112	103	105
X Petrine....	11	12	14	11	10	9	9	4	13	14	7	9	14	13	10	8	12	12	9	11	57	50	52	53	109	103	119	112	127	129	125	122
Dorthe....	11	11	8	9	7	7	9	9	12	11	8	8	10	12	5	7	10	12	6	7	47	47	39	46	86	93	109	109	115	124	111	116
XI Astrid.....	13	13	12	11	6	7	6	7	10	13	7	7	10	10	9	7	7	11	6	6	47	51	39	41	86	92	109	113	115	117	111	115
Edith.....	12	11	10	12	7	7	9	6	11	9	7	7	10	7	10	10	12	11	8	9	49	45	47	44	96	89	111	107	124	120	117	111
XII Viggo....	7	8	7	5	4	6	12	12	7	5	3	7	4	8	7	6	7	7	5	4	37	37	26	32	63	69	102	102	103	109	99	102
Oluf.....	11	11	10	10	7	4	9	9	10	8	7	7	8	10	8	8	10	12	5	5	47	42	38	42	85	84	110	105	116	121	112	112

* The twin in pair III who was not retested, was not given this sub-test at the 1st test either; in calculating the total scores, a value (10) corresponding to the average scores in the other four sub-tests in the performance section has been used.

TWIN PAIR INDEX

- Pair I: Pp. 40, 41, 43, 45, 46, 47, 52, 60, 62, 63, 68, 69, 71, 72, 73, 74, 75, 76, 77, 78, 79, 85, 90, 91, 92, 94, 96, 97, 98, 99, 102, 103, 110, 112, 118, 129, 149, 150, 152.
- Pair II: 40, 41, 43, 45, 46, 47, 52, 54, 60, 62, 63, 67, 68, 69, 70, 71, 72, 74, 75, 76, 78, 79, 85, 86, 90, 91, 92, 94, 95, 96, 97, 98, 99, 101, 102, 110, 112, 118, 120, 127, 129, 149, 150, 152.
- Pair III: 40, 41, 43, 46, 47, 63, 68, 69, 70, 71, 74, 76, 78, 79, 85, 86, 91, 92, 96, 97, 98, 99, 101, 103, 107, 109, 110, 112, 118, 120, 127, 129, 149, 150, 152.
- Pair IV: 40, 41, 43, 44, 45, 46, 47, 52, 54, 63, 68, 70, 72, 74, 75, 76, 79, 83, 90, 91, 92, 94, 97, 99, 101, 102, 103, 110, 112, 120, 129, 135, 149, 150, 152.
- Pair V: 40, 42, 43, 45, 46, 47, 52, 54, 62, 63, 68, 69, 71, 72, 73, 74, 75, 76, 78, 79, 80, 84, 86, 90, 91, 94, 96, 97, 98, 99, 100, 101, 102, 103, 110, 112, 118, 120, 129, 135, 149, 150, 152.
- Pair VI: 40, 42, 43, 46, 47, 53, 54, 63, 67, 71, 72, 74, 75, 76, 78, 79, 82, 84, 86, 90, 91, 94, 97, 98, 99, 100, 102, 103, 110, 112, 118, 120, 129, 149, 150, 152.
- Pair VII: 40, 43, 46, 47, 52, 63, 68, 69, 71, 74, 75, 76, 77, 78, 91, 92, 96, 97, 99, 100, 101, 103, 110, 112, 120, 129, 149, 151, 152.
- Pair VIII: 40, 42, 43, 45, 46, 47, 52, 63, 67, 68, 69, 71, 72, 74, 75, 76, 78, 79, 83, 84, 90, 91, 96, 97, 98, 99, 100, 101, 102, 110, 112, 120, 129, 135, 149, 151, 152.
- Pair IX: 40, 43, 45, 46, 47, 53, 54, 63, 67, 68, 69, 71, 72, 74, 76, 78, 91, 92, 97, 99, 100, 101, 102, 110, 112, 117, 118, 129, 149, 151, 152.
- Pair X: 40, 43, 46, 47, 63, 67, 68, 69, 72, 73, 74, 75, 76, 77, 78, 86, 90, 91, 92, 94, 96, 97, 98, 99, 101, 102, 103, 110, 112, 118, 120, 127, 129, 149, 151, 152.
- Pair XI: 40, 43, 46, 47, 60, 63, 68, 69, 72, 74, 76, 78, 86, 90, 91, 92, 96, 97, 98, 99, 101, 102, 110, 112, 120, 127, 129, 149, 151, 152.
- Pair XII: 40, 43, 45, 46, 47, 54, 62, 63, 66, 68, 69, 71, 74, 76, 77, 90, 91, 94, 97, 99, 101, 102, 103, 110, 112, 117, 120, 129, 149, 151, 152.

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PART II
CASE MATERIAL

TWIN CASES

I	Palle and Peter	1
II	Olga and Ingrid	36
III	Maren and Jensine	68
IV	Ingegerd and Monika	87
V	Kaj and Robert	115
VI	Martha and Marie	148
VII	Kamma and Ella	165
VIII	Signe and Hanne	185
IX	Karin and Kristine	216
X	Petrine and Dorthe	232
XI	Astrid and Edith	256
XII	Viggo and Oluf	276

CONTENTS

<p>I. <i>Palle and Peter</i> 1</p> <p style="padding-left: 20px;">The separation 3</p> <p style="padding-left: 20px;">Palle 3</p> <p style="padding-left: 20px;">Peter 10</p> <p style="padding-left: 20px;">The twin relationship 16</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 18</p> <p style="padding-left: 20px;">Clinical examinations 24</p> <p style="padding-left: 20px;">Psychometric examinations 26</p> <p style="padding-left: 20px;">Other special examinations 32</p> <p style="padding-left: 20px;">Epicrisis 32</p>	<p>Monika 101</p> <p style="padding-left: 20px;">The twin relationship 103</p> <p style="padding-left: 20px;">Clinical examinations 105</p> <p style="padding-left: 20px;">Psychometric examinations 107</p> <p style="padding-left: 20px;">Other special examinations 112</p> <p style="padding-left: 20px;">Epicrisis 112</p>
<p>II. <i>Olga and Ingrid</i> 36</p> <p style="padding-left: 20px;">The separation 37</p> <p style="padding-left: 20px;">Olga 37</p> <p style="padding-left: 20px;">Ingrid 45</p> <p style="padding-left: 20px;">The twin relationship 49</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 51</p> <p style="padding-left: 20px;">Clinical examinations 56</p> <p style="padding-left: 20px;">Psychometric examinations 58</p> <p style="padding-left: 20px;">Other special examinations 64</p> <p style="padding-left: 20px;">Epicrisis 64</p>	<p>V. <i>Kaj and Robert</i> 115</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 116</p> <p style="padding-left: 20px;">The separation 116</p> <p style="padding-left: 20px;">Kaj 117</p> <p style="padding-left: 20px;">Robert 123</p> <p style="padding-left: 20px;">The twin relationship 131</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 136</p> <p style="padding-left: 20px;">Clinical examinations 138</p> <p style="padding-left: 20px;">Psychometric examinations 140</p> <p style="padding-left: 20px;">Other special examinations 145</p> <p style="padding-left: 20px;">Epicrisis 145</p>
<p>III. <i>Maren and Jensine</i> 68</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 68</p> <p style="padding-left: 20px;">The separation 70</p> <p style="padding-left: 20px;">Maren 71</p> <p style="padding-left: 20px;">Jensine 72</p> <p style="padding-left: 20px;">The twin relationship 75</p> <p style="padding-left: 20px;">Clinical examinations 76</p> <p style="padding-left: 20px;">Psychometric examinations 78</p> <p style="padding-left: 20px;">Other special examinations 82</p> <p style="padding-left: 20px;">Epicrisis 84</p>	<p>VI. <i>Martha and Marie</i> 148</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 148</p> <p style="padding-left: 20px;">The separation 151</p> <p style="padding-left: 20px;">Martha 151</p> <p style="padding-left: 20px;">Marie 153</p> <p style="padding-left: 20px;">The twin relationship 157</p> <p style="padding-left: 20px;">Clinical examinations 157</p> <p style="padding-left: 20px;">Psychometric examinations 159</p> <p style="padding-left: 20px;">Other special examinations 162</p> <p style="padding-left: 20px;">Epicrisis 162</p>
<p>IV. <i>Ingegerd and Monika</i> 87</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 87</p> <p style="padding-left: 20px;">The separation 89</p> <p style="padding-left: 20px;">Ingegerd (case records) 90</p> <p style="padding-left: 20px;">Monika (case records) 95</p> <p style="padding-left: 20px;">Ingegerd 99</p>	<p>VII. <i>Kamma and Ella</i> 165</p> <p style="padding-left: 20px;">Supplementary information on the twins' biological family 165</p> <p style="padding-left: 20px;">The separation 168</p> <p style="padding-left: 20px;">Kamma 168</p> <p style="padding-left: 20px;">Ella 172</p> <p style="padding-left: 20px;">The twin relationship 176</p> <p style="padding-left: 20px;">Clinical examinations 177</p> <p style="padding-left: 20px;">Psychometric examinations 178</p> <p style="padding-left: 20px;">Other clinical examinations 182</p> <p style="padding-left: 20px;">Epicrisis 183</p>

VIII. <i>Signe and Hanne</i>	185	Petrine	235
Supplementary information on the		Dorthe	242
twins' biological family	185	The twin relationship	245
The separation	187	Clinical examinations	246
Signe (case records)	187	Psychometric examinations	253
Hanne (case records)	190	Epicrisis	253
Signe	193		
Hanne	198	XI. <i>Astrid and Edith</i>	256
The twin relationship	201	Supplementary information on the	
Supplementary information on the		twins' biological family	256
twins' biological family	202	The separation	260
Clinical Examinations	206	Astrid	261
Psychometric examinations	207	Edith	264
Other special examinations	212	The twin relationship	266
Epicrisis	213	Clinical examinations	267
		Psychometric examinations	268
IX. <i>Karin and Kristine</i>	216	Other special examinations	273
Supplementary information on the		Epicrisis	273
twins' biological family	216		
The separation	217	XII. <i>Viggo and Oluf</i>	276
Karin	218	Supplementary information on the	
Kristine	220	twins' biological family	277
The twin relationship	223	The separation	278
Psychometric examinations	224	Viggo	278
Other special examinations	229	Oluf	281
Epicrisis	229	The twin relationship	283
		Clinical examinations	284
X. <i>Petrine and Dorthe</i>	232	Psychometric examinations	285
Supplementary information on the		Other special examinations	290
twins' biological family	232	Epicrisis	290
The separation	234		

CASE I

PALLE AND PETER

Peter, a student, aged 22, approached us in 1956 at the Institute of Human Genetics in Copenhagen. He informed me that he had not known that he was a twin until three days previously. For some years, and particularly during the past few months, he had occasionally been mistaken for someone else by different people he met in the street. He had now met his "double", the meeting having been arranged by some common friends. Both were very much impressed by their striking resemblance to each other, and when they realized that they had been born on the same day and at the same clinic in Copenhagen, it lay near at hand to assume that they might be twins.

In the beginning Peter was not inclined to accept that they were twins. He had never doubted that he belonged to the home where he had been brought up, because he had always felt that he resembled his family. He asserted, therefore, that if they really were twins, then they must both be children of his parents, although he found it difficult to explain why they had been separated.

Palle, an office worker, had known for about six months that he was an adoptive child. He had not received this information from his adoptive parents or discussed the matter with them. He had thought of trying to find his natural parents, but had not made a serious attempt to do so prior to the meeting.

The day after their meeting, they went to the national registration office and to various public offices in an attempt to trace their antecedents. They discovered that they were twins, that they were born out of wedlock and also that they had been together at a children's home from where they had been adopted separately. When confronted with this information, their adoptive parents reluctantly admitted that such was the case.

The twins stated that due to the possible scientific interest of their case they were prepared to submit to detailed examination; they had, however, apparently also other reasons for approaching us. Thus, during the first interview, Peter obviously wanted to establish an emotional contact; he appeared almost bewildered, and expressed conflicting feelings about being in a situation which forced him to revise his previous ideas about himself and his

environment. He seemed to want to transfer his problems from emotional to intellectual spheres, and it also turned out that the day before he had, as a Roman Catholic, approached his Church for analogous reasons.

Our investigation, undoubtedly, came to represent a firm basis for the twins during a difficult life situation; both, perhaps especially Palle, wanted to try to contact their natural parents, but they accepted my general reason for not complying with their request, and apparently they gave up tracing their relatives.

THE SEPARATION

The twins were born at a university maternity clinic. The *case records* from the clinic state:

The mother was a 16-year-old, unmarried housemaid, admitted because of her socio-economical conditions. Previously she had been healthy. She had not been pregnant before. Apart from a slight, temporary tendency to crural oedema, the pregnancy had progressed normally. Examination disclosed: Uterus of elongated ovoid shape, approximately $1\frac{1}{2}$ " below the xiphoid process; upwards to the right a round, smooth part of a foetus, equal resistance on both sides, heart sounds clearest on the left side.

The presence of twins was first disclosed during delivery. It lasted $7\frac{1}{2}$ hours, and commenced with passage of amniotic fluid, following which effective labour pains developed quickly. Palle was born first, in a R.S.A. footling presentation following episiotomy and breech extraction under chloroform anaesthesia. Peter was born 20 minutes later, after renewed passage of amniotic fluid, in a L.O.A. cephalic presentation. The heart sounds were normal throughout birth, and neither twin showed signs of asphyxia.

Afterbirth: The total placenta weighed 970 g.; 480 g. for Palle and 470 g. for Peter. The umbilical cords were 48 cm. and 45 cm. long, respectively. The two placentas were easily separated and the twins were considered to be dichorionic.

The twins appeared to have been born two or three weeks prematurely, but both were fully developed, Palle: 2600 g./47 cm.; Peter: 2100 g./45 cm. Head/chest circumferences: 33.5/32.0 and 33.0/31.0 cm., respectively. Peter was examined by a dermatologist due to naevi teleangiectatici dispersed over the left side of the chest; radium treatment was recommended. Palle did not manifest any abnormality.

The mother presented slight, temporary albuminuria and hypertension (nephritis non sanata), and a plum-sized, distended cystic tumour (ovarium?) in the right side of the abdomen (however, an examination shortly before she was discharged failed to confirm the presence of this tumour).

During the 51 days the twins were at the clinic they developed favourably on the usual diet of mixed milk; they were breastfed occasionally. Their

weights increased gradually and in parallel, Palle always weighing 300 to 500 g. more than Peter; when discharged, Palle weighed 3700 g. and Peter 3300 g.

They were admitted to a children's home on the outskirts of Copenhagen on being discharged from the maternity clinic, and they remained there until they were separated from each other.

The *case records* from the children's home give the following information:

The father was a 25-year-old, unmarried labourer. He and the mother (who both had blonde hair and blue eyes) had known each other for about four years and were engaged. The mother hoped that they might later be married, but she was not able to take the children home with her, as her mother was in a mental hospital; her father, who was a cobbler, had only a small income, and she had to look after him and her younger brothers and sisters.

The twins remained together at the children's home until Peter was admitted to hospital when 10 months old.

The *case records* from the hospital state:

Retained for four months because he developed tussis convulsiva and bronchitis. Diagnosis: *Tumor angiomaticus thoracis, otitis bilateralis*.

Palle remained at the children's home, and does not appear to have been ill.

The regulations required that the twins had to be removed from the Children's Home when they were one year old. During this year, their mother lost contact with their father, and after having sought advice from her father and a maternal aunt, she decided to let the twins be adopted, and if necessary to let them be adopted separately.

When 14 months old, Palle was put into the care of a childless grocer and his wife in Copenhagen. He stayed in their home for only two weeks, as the foster-mother "did not really like him and could not develop a feeling of motherhood towards him". He then stayed a couple of weeks with the maternal aunt mentioned above, who seems to have thought of keeping him, but when 15 months he was given into the care of his present adoptive parents.

Peter proceeded directly from hospital to his present home when 14 months old.

Thus, the twins were separated when 10 months old, and they did not see each other again until they were 22 years and 4 months old. The twins were both formally adopted when 21 months old.

PALLE

The *adoption papers* state:

The adoptive parents were a 27-year-old bricklayer's labourer and his 27-year-old wife. They had been married for a little more than three years. They

had no children, but had previously acted as paid foster-parents. Their first foster-child, a girl, had been taken from them after six months because the child's mother would not let them adopt it. They then had another girl for a year; why they did not retain this child is unknown. They motivated their wish to have a third foster-child by stating that they had given up hope of having children themselves, and now wanted to adopt one instead.

The adoptive father came from a Copenhagen labourer's home. When young, he worked for some years digging peat; he then commenced an apprenticeship as a smith, but broke his contract and took a job as an errand-boy. When 19, he went to sea as a ship's boy; he became an ordinary seaman and remained at sea for eight years. He then returned to his parents' home. For some time he was dependent on unemployment benefit from his trade union, then worked as a lorrydriver, and later as a bricklayer's labourer or hodman. He became engaged and married two years later.

The adoptive mother was the daughter of a teacher of handicrafts and had grown up in North Slesvig which was then a German province. She had been employed as a domestic servant prior to her marriage, but was not employed outside her home since then.

They lived in a rather poor quarter of Copenhagen in a two-roomed flat, without any entrancehall and without toilet facilities. Their rooms were described as small, but exceptionally well kept and clean.

During *the interviews*, Palle stated that he had been brought up as an only child in "a typical working-class home". Seasonal variations in his adoptive father's work meant that income was always irregular and generally necessitated strict economy. During short periods the family's main source of income was unemployment benefit from the trade union. His adoptive parents had, however, always made it a point of honour to manage their affairs without resorting to public assistance. Throughout Palle's childhood, his adoptive mother contributed an important part of the family's income by working as a seamstress at home. They lived in the slum-like two-roomed flat mentioned above until Palle started school, when they moved to their present flat in a somewhat better district of Copenhagen. It was also rather small, consisting of a bedroom and a living-room where Palle slept on a couch, but the fittings were modern and the adoptive mother keeps it excellently. Palle still lived there when he met Peter, although he had for some time thought about moving into lodgings (which he has done since).

Palle started school when he was 7 $\frac{1}{2}$ years old and attended a municipal school until he was 14 years old (the obligatory elementary education in Denmark) without taking any form of schoolleaving examination. He did not encounter important problems while at school. He was usually "about average" in his class and did not find it difficult to keep up with classmates; his best subjects were arithmetic and writing, but he was not particularly brilliant

in any subject; German was the only foreign language he learned at school. He was well-liked by teachers and classmates, but he did not have close contact with any of them; he kept to himself and did not assert himself. Since leaving school, his only additional education had been a course at a commercial college, two years English at night-school, and a course in book-keeping.

On leaving school, he was employed by a large ladies' outfitter as an apprentice. He obtained this position through his adoptive mother, whose work as a seamstress had brought her into connection with the firm; she wanted him to have "a nice, clean work". He completed his training when 18, and then entered the infantry to serve the compulsory 18 months' period of conscription. He was mainly employed in the paymaster's office. When discharged he returned to his previous work at the same firm, and continued to live at home. At 21 he took a position as a book-keeper in a petrol and oil firm, and he was still employed there at the time of our investigation.

Apart from the effects of stringent economy, Palle's early home life had been influenced by his adoptive father's drinking habits which often led to scenes. Conditions had improved considerably in recent years, however, and there were now few conflicts or disagreements. Most of the family's acquaintance belonged to his adoptive father's family, and relationships between the family and his adoptive father were strained and quarrelsome.

Palle described the adoptive father as a small, slightly built, dark-haired man, who does not resemble Palle physically or mentally. He is the youngest of nine children from a disharmonious labourer's home. As a young man he found it difficult to adjust to his family and to his work. When at sea, he "tried a little of everything", and he began to drink. He was healthy and capable of normal work until about six months before the twins met, when he fell off a scaffolding; he sustained severe injuries and was in hospital for a long time. He had since been an invalid, and received a small pension. This aggravated the family's poor economy, and the adoptive mother, even more than previously, had to "keep things going". Palle said about the adoptive father: "We are completely different", and characterized him as reserved, pessimistic, and tending to depressive moods, which Palle thought might be due to "heredity" (one of his adoptive father's sisters committed suicide). "He has always been the little one . . . he has an "inferiority complex" . . . he is rather a querulous type of person". After his accident, the adoptive father was difficult to manage, demanded a lot of attention, was "nervous" and "ought really to have had psychiatric treatment", but he had always been hostile towards physicians and hospitals. He and Palle found it difficult to confide in each other, but he had never treated Palle severely and never resorted to corporal punishment; he was "a just and conscientious father". He attached importance to giving Palle a good material background so that

he "did not lack anything", and he frequently compared conditions during his own childhood to Palle's. He never attempted to encourage Palle to improve his social standing, and did not understand why Palle cultivated many interests outside the home. He had a strong feeling of solidarity with the working-class, and was a social-democrat; he was, however, not really interested in politics. He had never had any particular interests. "He only talks about what is in the newspaper". Since Palle's adoption became an admitted fact, and perhaps especially since Palle moved to lodgings, his relationship with the adoptive father changed somewhat. Palle now felt almost closer to him than to his adoptive mother, and thought that his adoptive father was "more genuine and not so exaggerated" in his emotional reactions.

The adoptive mother was an only child from a stable home. She was described by Palle as a slightly-built, dark-haired, apparently decidedly asthenic woman, who had manifested slight climacteric symptoms for some years. Otherwise, Palle stated, she had been healthy (but, as mentioned later, she is reported to have had pulmonary tuberculosis). Palle described her as a mild, reserved, anxious mother who had always been very worried by any form of illness. She was "exaggeratedly loving" towards Palle, "demanded an equal degree of love", over-protected him, fussed over him and "spoil" him by her over-attentiveness. In her passive, quiet way she seems to have been the main figure in the home and to have kept it together. Palle was much attached to her while a child, but during puberty he consciously attempted to escape her influence. This development never caused real dissension, his adoptive parents not only accepted that he wanted to move to lodgings, but also helped him to do so. He thought that his adoptive parent had, generally speaking, given him a "good home", although he had always felt that "something was lacking". He characterized his home as "neutral"; from a religious point of view "it has been without any significance at all". "We have only ever spoken about superficial things".

Physically, Palle never resembled his adoptive parents at all. Due to his fair hair and blue eyes, he had sometimes thought that he might be an adoptive child, and as mentioned he had discovered that he was an adoptive child shortly before the twins met; an older friend had pointed out that it was peculiar that Palle had first been christened a year after he was born. He could not give any reason for avoiding to discuss this with his adoptive parents, apart from feeling that they "would not be able to take it"; he preferred "to let things take their own course", and even did not raise the matter until a couple of days after he had met his twin brother; the discussion with the adoptive parents was far less unpleasant than he had feared.

Throughout his childhood, Palle was treated as a "weakling", perhaps because he had been "neglected" when in the children's home. He was often ill, and this worried his adoptive mother. Her anxiousness in this respect in-

creased when he contracted pulmonary tuberculosis when six years old and was hospitalized for nearly a year. He was thereafter treated as a "delicate" child, was given iron and other strengthening medicine. He thought that he had likely been "what one calls a nervous child". When 4-5 years old he suffered from nightmares and attacks of anxiousness; he believed that this was due to his adoptive father often coming home drunk during this period. Apart from this, he had "other nervous disturbances", which manifested themselves in pronounced restlessness, a tendency to bite his nails, and nose-picking. There was also nocturnal enuresis until he was 12-13 years old, about twice a week, but never during the daytime. He thought that his adoptive parents had treated his enuresis in a sensible way; he was never punished or reprimanded, they rarely mentioned it, and it terminated spontaneously.

He could not give details regarding his early psychomotor development, but had never heard that he was abnormally slow in learning to walk and talk. He had "always" had a slight tendency to stammer, especially when unsure of himself. He was a rather quiet boy, almost despirited and anxious, usually felt bashful, lacked self-confidence and withdrew into himself when together with others. "I have not been as carefree or as happy as other children could be". Since leaving school, his relationship with his adoptive parents underwent a change as did his attitude towards his environment in general. His work led him to developing various interests which gradually included him to spend most of his leisuretime away from home. He became an "open-air-type", spent his summer holidays in a camp school, was an enthusiastic hiker and rowed a lot. During winter, he took an active part in a youth organization, took up music, singing, literature, and amateur theatricals, joined a chess club, and went to dancing lessons. He began to feel more free and easy and also that he was accepted by his social circle. His "horizon" was influenced in important ways by an older friend whom he met when 16 years old, and who took him in hand; this man, an unmarried painter about 10 years older than Palle and chief of the camp school, was the one who helped Palle to investigate the question of adoption.

The time Palle spent in the Danish army played an important role in his development. This was the first time he was away from home for more than short periods. He was really happy, "it was the best time of my life". He liked the well-regulated conditions; he was almost solely concerned with office-work and felt strongly attracted to it. This was one of the reasons why he decided not to continue his former employment when he was demobilized. He had never liked trade, he "couldn't sell, found it difficult to establish the necessary contact with the customers, and couldn't palm things off on them". He enjoyed his present office work, where he sat all day and wrote and kept accounts. He was entrusted with confidential work, felt that he was doing

his bit in life, was "on the right shelf", and that he was respected by colleagues and superiors.

He had never taken any interest in politics or religion, "I never like to have a definite opinion about anything, I have been rather neutral in most things". He thought he characteristically avoided taking a definite stand in discussions or expressing his personal viewpoints. His attitude towards life in general was "tinged with pessimism". "I have always felt like a spectator in most things". He preferred to be passive, "to let things go their own way, rather than to be active". In certain respects, however, he felt he was more "mature" than the majority of boys of his own age; he was "less prejudiced", especially regarding sexual matters.

He had never been engaged. When 18-19, he had a couple of short-lived sexual affairs with girls of his own age, and had "been out" with several others. Sex had never occupied an important place in his mind; he felt that he was normally equipped and without conscious abnormal tendencies. He did not have any particular problems due to masturbation or other sexual matters during puberty. He liked female company, liked to dance, but was not inclined to frequent bars and restaurants.

He took a beer now and then when in company, but did not drink very much. He had smoked since he was 18. His consumption of tobacco was moderate, at one time he preferred cigarettes or a pipe, but now smoked cheroots. He was not dependent upon tobacco and had, e. g., stopped smoking for several weeks when training for sport competitions.

Palle was admitted to a children's hospital in Copenhagen when 16 months old. The *case records* state:

During the month he had been in his foster home, he had suffered almost constantly from coughing. Four days prior to admission, the following day, and on the day of admission he had several brief fits of "spasms in the arms and stiff eyes". The physician who admitted him to hospital thought the attacks might be "cold shivers", but there does not appear to have been any fever, and they were not accompanied by unconsciousness or cyanosis.

On examination he was found to be suitably well-fed (10.3 kg.), and well cared for. Dentition was irregular (6/4), upper molars appearing. No signs or rickets. Apart from phimosis, other conditions were normal. His psychomotor development was normal, he could stand without support and walk with a little help. As he failed to have an attack of the type described above, he was discharged four days later. Diagnosis: *Epilepsia, obs. pro.*

He was readmitted to the same hospital when 6 years old. The *case records* state:

His mental development had been normal; he walked and talked when 1½ years old, but still had regular nocturnal enuresis. When two and five years old, he had chicken-pox and measles without complications. When five

years old he had impetigo accompanied by a glandular abscess; he was subsequently ill for a long time, tired, irritable, sometimes catarrhal and feverish.

Two months before admission he had developed angina tonsillaris with "glands" and a fever which lasted for three weeks. Examination at a tuberculosis clinic disclosed a positive tuberculin reaction, a homogenous infiltration, about the size of a hand, in the hilus of the right lung, and cultures from gastric content showed colonies of bacilli. On admission he weighed 20.3 kg. and was 115 cm. tall. Apart from stethoscopic changes corresponding to the infiltration there were no somatic abnormalities. He was lively and bright. There was enuresis nocturna throughout his stay at hospital in spite of evening toilet and reduced consumption of liquids. He was vaccinated against whooping-cough. He was kept in hospital for five months. Diagnosis: *Tuberculosis pulmonum*.

As the pulmonary infiltration remained unaltered, he was transferred to a children's sanatorium. He remained there for nine months. The *case records* state:

His adoptive mother was admitted to a tuberculosis sanatorium when 20 years old, she has been regularly examined for several years, and is now cured.

During his stay at the sanatorium, he had febrile angina tonsillaris once more. He seemed to be happy in spite of continued enuresis nocturna. He weighed 25.5 kg. when discharged and was 125 cm. tall. The pulmonary infiltration had almost disappeared. A slight hypochromous anaemia was treated with iron. Diagnosis: *Tuberculosis pulmonum, anaemia*.

Palle had not been hospitalized during adulthood. Since his first admission when six months old he had never manifested symptoms indicating epilepsy.

Since puberty, he had suffered from vague mental symptoms resembling dysphoria or mild fluctuations in mood, lasting from hours to a few days. He described them as "a feeling of being partly dead"; he was tense, restless, but not really depressed, and felt best if he had something to do. During such periods he impressed his surroundings as "surly and moody", but he stressed that this description did not correspond exactly to his subjective state; he simply preferred to keep to himself. He did not consider that these attacks were provoked by external events, but when in exciting situations, he was apt to feel "nervous", uncertain of himself, and still stammered easily, but otherwise did not suffer from speech defect. Periodically, however, he was considerably inconvenienced by "sensations" around the larynx which felt "sore". His voice was "wrong"; he was often told that he mumbled and spoke indistinctly, but if he attempted to correct it, he only made it worse. He had not suffered from sleep disturbances, and had rarely dreamt.

He never had definite dyspeptic symptoms, although during the past few years there had occasionally been epigastric "tenderness and tingling". During

the same period he had now and then attacks of "lumbago" without known provocation; these attacks were never accompanied by ischias symptoms and always terminated spontaneously. He had never had subjective cardiac symptoms and did not experience any difficulties while in the army or when he participated in sports. He concluded that he had, generally speaking, been healthy.

PETER

From the *adoption papers* one learns:

The adoptive parents had been married for two years when they wanted to adopt a child because they did not believe that they were able to have children themselves.

The adoptive father was a 27-year-old newspaperseller. He was the oldest of five children, and had grown up in a Copenhagen labourer's home; after having worked as an errand-boy, he was apprenticed as a mechanic, but a few years after he had finished his apprenticeship he gave up this type of work, and for some time he had various jobs. He became engaged to Peter's adoptive mother when he was 25. As his parents-in-law died a short time afterwards leaving a newspaper-kiosk and a flat, he married.

The adoptive mother came from a Roman Catholic home and was a Catholic. Before marriage she had been employed as a domestic servant and as a shop assistant.

The adoptive parents had since managed the kiosk together. The flat had two rooms, and was described as "possibly not as clean as one might wish".

During *the interviews*, Peter stated that his adoptive parents later had two children of their own, a boy 3 years younger than Peter and a girl 12 years younger. His adoptive parents' only income was from the kiosk. Although they worked hard, they never managed to stabilize their economy. They obtained their present flat near their kiosk in one of the main streets of Copenhagen a year after they had adopted Peter. There were two fairly large rooms and one small room; it had always been too small for the family and always "neglected, dirty, untidy, and well-worn".

Peter entered a Catholic private school when 7 $\frac{1}{2}$ years old, and later a Catholic gymnasium. He was not particularly successful and when 19 he failed his matriculation examination (modern languages). His Church helped him to go to the U. S. A. where he attended a Catholic boarding-school for a year. He passed an examination said to correspond to the Danish university entrance standard, but when he returned to Denmark, he had to take a matriculation course lasting one year. He commenced studying biology when 21 years old.

When we came into contact with the twins, he had just failed a minor

examination in biochemistry, but had obtained first class honours in philosophy and logic (a compulsory examination for all students at the university, usually taken during the first year).

He had experienced great difficulties during his studies, mainly due to economic reasons. He did not receive any support or financial assistance from his adoptive parents, but had been given various small bursaries, mainly by his Church. He had been forced to work for his living during several periods.

After returning from the U. S. A., he had lived at home for a short time, and then went to live with an older friend with whom he shared a room, when he was taking the matriculation course. When he started to study biology, he returned home for financial reasons, but his relationship with his adoptive father deteriorated so much that after a short period he moved to a room in the centre of Copenhagen, where he had lived ever since in a Spartan way.

His adoptive parents were Roman Catholics and Peter had been brought up as a Roman Catholic. Both his adoptive parents came from families which Peter described as "degenerated"; one of his adoptive father's cousins had been imprisoned, another was said to be homosexual and had been imprisoned; two of his adoptive mother's sisters had been imprisoned; one of them, apparently a prostitute, had a mentally abnormal, epileptic daughter, and several other members of both of the adoptive parents' families had shown symptoms of social maladjustment.

When still ignorant of his adoption, Peter speculated a lot about these "taints" in his family, and he always definitely dissociated himself from his adoptive parents' families. Peter had never thought he might not be the natural child of his adoptive parents, in spite of the fact that a boy had once accused him of being an adoptive child, and in spite of one of his adoptive mother's relations once being on the verge of disclosing it. He mentioned that he told his adoptive parents that he was going to meet his "double" without their commenting upon it. He thought his adoptive parents had been "cowardly" or "abnormally jealous" and therefore tried to hide the facts from him as long as possible.

His adoptive father was a strongly-built man of medium height, pyknic and light-haired. He is the oldest of five children, who grew up under unfortunate circumstances with a severe, miserly, and mentally unbalanced (apparently psychopathic) father. The adoptive father started to drink when still a young man, and had continued to do so, increasing his consumption in later years. He was drunk about twice a week, and when drunk he was often malicious, quarrelled with his wife and almost resorted to brawling. He had, however, always been able to carry out his normal work, and apart from an operation for duodenal ulcer, since which he had had periodic dyspepsia, he had been healthy. He seems always to have been rather abnormal mentally, and when younger had repeated difficulties in adjusting to conditions at his

various places of work, presumably related to his alcoholic proclivities. Peter described him as “quarrelsome, misanthropic, and quick-tempered”, a self-righteous type of person who “can only see defects in others and who is negative and hostile towards everything and everybody” . . . “he has never been contented with his social position” . . . “ he is bitter”. He had, however, always been rather “just” in financial matters, but Peter thought that this trait tended towards miserliness. “He seems only to value life’s material aspects, and the climaxes in his life consist solely in family parties well supplied with food and spirits”. He completely lacked any form of “intellectual” interests. He was converted when he married, but, as opposite to his wife, had never been really religious.

The adoptive mother is the oldest of four children from a Roman Catholic, very orthodox home. The father of the adoptive mother is said to have been a very strict man “who actually chased his children out into the street”. Apart from the adoptive mother, none of the children remained Catholics.

I have seen the adoptive mother when I paid occasional visits to the newspaper-kiosk. She is of average height, relatively broadly built, blonde, and has blue eyes. When younger she was probably attractive, and her physical resemblance to Peter is obvious enough to explain why Peter remarked upon it.

According to Peter’s description of conditions in his home, the adoptive mother was the central, dominating figure, presumably because her own religious and economic background form the basis of the home. She is obviously the most active and “sthenic” of the adoptive parents. The relationship between the adoptive parents have apparently always been poor, and several times on the verge of divorce-proceedings.

As far as Peter knows, his adoptive mother never had any severe illness, although when she was a girl, she had a “dangerous” disease of some unspecified type, which it seems was perhaps the reason for her assuming that she was incapable of bearing children. She did, however, have a child when 29 and 38 years old, respectively.

The first pregnancy was unexpected. The delivery was difficult and the child, Peter’s step-brother, had a congenital left-sided total hare-lip and cleft palate, which led to repeated hospitalizations. He was at first thought to be retarded in development due to his somatic defects, but when he entered school, it was discovered that he was mentally deficient. His parents were not inclined to accept this diagnosis. Peter thought that they treated him in an unnecessarily harsh way and without any understanding; they hit him and scolded him, and resisted all attempts to influence their behaviour. After some years, however, he was placed in the care of the child welfare authorities, and partly due to Peter’s connection with the Catholic Church, admitted to a home for children near Copenhagen. Peter had always been attached

to him, and still visited him regularly. He said that the step-brother was "moderately mentally deficient with an IQ about 80".

Peter's step-sister was possibly also poorly intellectually equipped. She attended a Catholic school where she had difficulties; she was "nervous" and had apparently suffered from her environment. After starting to study biology, Peter tried to find a place for her outside her home. The adoptive parents were very indignant about these attempts, and reproached him for "also trying to take her from them". Peter had always been sympathetically inclined towards his step-siblings, whom he physically resembled so much that he found it difficult to accept that they were not his true siblings.

Peter said that his adoptive parents were undoubtedly pleased when they adopted him. He did not think that the birth of their own children affected their attitude towards him; he was more inclined to the opinion that his adoptive father gradually became negative in his attitude, and perhaps "ashamed of" his own "defective" children.

Peter did not know very much about his early development, but assumed that he learned to walk and talk and achieved bladder and bowel control at the normal age without any particular problems. He had always been "nervous"; this nervousness manifested itself especially in pronounced restlessness, excitement, and a tendency to "finger and fumble with everything". He bit his nails energetically until puberty, and had since habitually picked the roots of his nails so they "frayed". Before he started school, he often had nightmares, during which he repeatedly dreamt that he was forced towards a large hole or the edge of a precipice, and then woke up crying and anxious; his adoptive parents requested medical assistance, but he was unable to give further details. He believed that his nervousness was due to his home environment, especially disagreements between his adoptive parents.

During puberty, he felt tense, restless, and unable to tolerate noise, and life at home "got on the nerves". He thought that his difficulties while at the gymnasium were mainly due to conditions at home, and that they were the worst possible background for study. He had to read with his fingers literally in his ears. During this period, he had a girl friend who took up much of his time, and this likewise led him to neglecting his school-work. Because of the scenes between his adoptive parents, he did not dare invite friends home; instead he developed many widespread interests, including dancing, singing, classical music, literature, and rowing. He went to a Catholic youth camp in the summer and took up different kinds of social work for the Catholic Church. His adoptive father did not understand his difficulties during puberty, demanded that he should assist at the kiosk, "was down my neck all the time", accused him of having "fine feelings", called him "baron" or "count", and suggested that he was probably ashamed of his home and family.

The adoptive mother was at that time entering climacterium; she was very

labile, unreasonable, egoistic, quarrelled with Peter's adoptive father "even when there was no real reason to do so"; on the whole, Peter thought that she was unnecessarily severe about her husband's drinking. She tried to drag Peter into her quarrels and to keep him on her side. If he did not agree with her, both his adoptive parents often united in criticizing him. He had never been able to understand their many remarks about how grateful he ought to be, how he ought to thank them for all they had done for him, etc., as these remarks were made in such a way that he could not help feeling that they were "abnormally egoistic".

He particularly disliked his adoptive mother's rather immodest behaviour at home, for example wandering around their small flat in her underclothes, and on account of this he often criticized her. She on her side reproached him for not showing her sufficient signs of filial love, for not kissing or embracing her, and she found that it was "abnormal" for a son not to do so; during one interview, Peter mentioned that physical contact with his adoptive mother had often affected him violently, he felt disgust and loathing. He still found it difficult to understand his own reactions, thought a lot about them and felt that "something kept me back". He did not elaborate this point in later interviews.

On one occasion, Peter's adoptive mother had apparently suggested that he might be homosexual. When about 19, Peter met an eighty years old man, whom he still visited and regarded as his "mental father". This man, who was unmarried and was previously leader of a youth camp in the East, Peter considered had exerted considerable influence on his development. Peter described him as "a very fine person, cultivated, well-read, and deeply religious" (but not a Catholic). The adoptive mother had once said that a friend had told her that this man was a homosexual. On this occasion, Peter got very angry with her and intimated that if she had not been his mother, he would have left her for good, a remark which, when he later learned that he had been adopted, made him "think quite a lot". He would not deny that his friend might have been homosexual at one time, but he did not attach any importance to it, as the man had never made any approach whatsoever to him. With regard to sexual matters, Peter was frank. He considered that he was normally oriented. He had been "out with" 3-4 girls; one of them seems to have meant quite a lot to him, and he was still in contact with her. He had never been sexually intimate with girls, and said that his religious and ethical attitudes meant that he "respected women and matrimony" and therefore rejected casual sexual relationships. Apart from this, he did not want to form any permanent connection until he had completed his studies. He thought that his religious attitude enabled him to manage his sexual problems without undue difficulties, and he had never speculated very much about masturbation. He liked the company of people of his own age, was keen on

dancing, but despised "party-life" and the idea of spending his evening in bars and restaurants.

He did not like drinking, and only ever took more than a single beer. He started smoking moderately when he was 18, cigarettes to begin with, later mainly pipe, because it was less expensive.

Peter had "always" lacked self-confidence, and he previously must have been somewhat "immature". His trip to the U. S. A. changed him a lot in these respects, as he felt more independent and certain of himself when he compared himself to his rather "childish" American acquaintances. He got on well, was given prizes for his school-work. His increased self-confidence persisted when he came home again. His teachers were now completely satisfied with him, and he developed what he called "a fine examination technique". He had, however, still to fight against some lack of confidence in himself. He easily became nervous and tense, but forced himself to control his "inner restlessness", for example by putting one hand on the table in front of him and concentrating on "relaxing". He still tended to "fidget", however, and when preparing for examinations habitually plucked at his eyebrows or picked the roots of his nails. Otherwise he did not consider that he had symptoms of nervousness, he was "in any case far less confused than before". When he attempted to live with his adoptive parents again, the experiment had ended with a violent quarrel with his adoptive father, and he was more or less "thrown out". He continued to visit his adoptive mother, but his relationship with his home was still tense and full of conflict. He said, he would probably never again be able to be more than "neutral" in his attitude towards his adoptive parents; they had accepted the situation, but apparently still tried to reinstate the past.

He discussed his future plans in detail during the interviews. His adoptive mother had encouraged him to study because he wanted to deal with other people.

He would like to be a teacher, whereas he rejected most other jobs.

He hoped to complete his examinations at the normal time. On the other hand, he did not seem fully to realize the difficulties he would encounter.

After being discharged from the hospital when 14 months old, Peter was vaccinated against tuberculosis as several members of his adoptive parents' families had tuberculosis, and he never manifested any symptoms of this disease. Neither had he ever showed signs of epilepsy or enuresis, and he had had no important illness during childhood.

When 17 years old, he was admitted to hospital. The *case records* state: "Influenza" for two weeks, and then typically acute symptoms of pneumonia with concurrent bilateral otitis. Penicillin had good effects. He was described as "nervous", but without special peculiarities. Weight: 61.0 kg.; height: 172 cm. Discharged after 3 weeks. Diagnosis: *Pneumonia sinistra*.

Since puberty he had had "attacks". He described them as follows: he sometimes felt "dead", became reserved and impressed others as "sulky", felt that he "lacks the ability to control his facial expressions". These attacks lasted a few days and occurred without known provocation, "although you can perhaps always find some reason or other". Even though he still liked company during these periods, his behaviour and expression always led to comments, and he, therefore, usually kept to himself.

He had for some years had vague symptoms which he described as unpleasant—"like a lump", localized in his larynx. He felt that his voice was "pitched wrongly" and had been told that he mumbled and spoke indistinctly; others told him that he spoke with a slightly melodious accent and this led to him being "accused of coming from Jutland or Bornholm". At intervals during the last few years he had had attacks of "lumbago"; he had such an attack during our period of investigation. It lasted for a few days without concurrent objective neurological symptoms. He had never had dyspeptic symptoms. Athletics had never given rise to cardiac symptoms. He had not yet done military service.

THE TWIN RELATIONSHIP

The twins remained in close contact with each other ever since they were reunited. They met daily and acquired common friends, rowed in the same club, played chess together, and shared other interests. Both lived outside their adoptive home, but whereas Peter seemed to have improved his relationships with his adoptive parents, Palle drew more and more away from his home, so that when last seen they did not differ much in this respect.

During our two years' period of observation, the twins mostly stressed their resemblance to each other, and hesitated to attach importance to their differences; presumably they did not try very much to discover such differences. They immediately felt sympathetically inclined towards each other and their first meeting made a deep impression on both of them.

Thus, Peter said: "We saw something very familiar in each other", and this familiarity was almost "weird". They not only resembled each other physically, but also in movements, the way they walked and the way they spoke. They both felt that they "belonged together and had the same attitude"; each knew almost what the other one felt and thought; they had similar associations, their thoughts "merged into each other". They also felt that they resembled each other in their "nervousness"; both felt restless and tense, and both suffered from a pronounced lack of self-confidence and a certain degree of "immaturity".

Palle thought he in certain respects, especially regarding sexual matters, was "more mature and free", unprejudiced, and, because he early had to

support himself, was less "schoolboyish" than Peter, even though he admitted that he previously was probably more dependent on his environment.

Peter, on the other hand, thought he had a "wider horizon", especially after his trip to the U. S. A., and also stressed that, contrary to Palle, he was antagonistic towards his environment when still quite young.

While they both considered that their different educations and ways of life had not managed to make them particularly different from each other, they agreed that they differed in some important ways, especially with regard to religion. This difference remained unaltered during the period of observation. Palle completely lacked interest in religious matters, and, in spite of their many discussions, still could not understand Peter's religious attitude, and was fully convinced that he would never alter his own attitude. Peter, however, believed that Palle had always "sought after" what he himself had found in religion and that Palle would sometime spontaneously develop religious interests. He stated categorically that he had never attempted to entice Palle towards Catholicism.

Their religious differences decisively influenced their attitudes towards ethical and especially sexual problems; Peter expressed this by saying that they had "different scales of values". Whereas Palle mostly failed to understand Peter's sexually reserved behaviour, Peter thought Palle's attitude displayed insufficient realization of the responsibilities one incurs, and that it was "almost egoistic and inconsiderate". They preferred different types of girls: Peter was attracted to dark, and in his eyes "profound" girls, whereas Palle preferred light-haired, "lively" types. They mentioned that other people immediately classified Palle as "the more handsome, but also the naive and weak twin", whereas Peter was "more energetic, a little aggressive and perhaps rather cunning". Neither thought these descriptions were generally true, and as regards their sexual behaviour they were inclined to think the descriptions could be reversed. Both stressed that they had always been very tidy and conscientious, almost pedantic, and that they were both extremely economical in their habits. Palle believed he had "inherited" his "sense of order" from his meticulous home, whereas Peter thought his tidiness had developed because his home was always so untidy and disordered.

The twins were still mistaken for each other by their acquaintances and by distant "relatives". Their adoptive parents were not inclined to accept that they resembled each other particularly, but had not, on the other hand, been able to specify how they really differed, and the twins felt that their adoptive parents' attitude was primarily due to "jealousy". They agreed that their childhood environment had been, generally speaking, radically different, and that there were few points of resemblance, although there might be some superficial resemblances. This, for example, was true regarding their adoptive fathers, who were really very different seen from the twins' viewpoints. They

also thought their adoptive mothers were quite different, and they would really almost have preferred to have had the other's adoptive mother. Even as children, and especially since puberty, they had both experienced that they "disagreed" with their environments, but they stressed that although both dissociated themselves from their environments, they differed in the way they freed themselves.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The twins had never met their natural parents or any of their families. From various official records and files we have been able to collect a considerable amount of information concerning their family. This information is presented here because it was unknown to the twins.

The father

According to information from *the national registration office* at the time of our investigation, he was 49 years old, lived in a rather battered working-class quarter in Copenhagen, and called himself a semiskilled worker. He was married to a slightly older, divorced woman, who received a pension due to tuberculosis. According to present information, they had no children.

From the *official police records* one learns that the twins' father had been imprisoned. The *legal documents* state the following:

He was born and grew up in an East-Jutland sea-port as the youngest child of five. His parents were Swedish and immigrated to Denmark at the beginning of the present century; both died shortly afterwards. The twins' father was then 10 years old. He had an elementary education, and was cared for by an upholsterer, but a year later he was sent to the "poorhouse", and he seems to have supported himself from the age of 14. He was employed at a number of farms. When he was about 18 years old he came to Zealand. (He seems to have become acquainted with the twins' mother while he was in the Army). Since that time he had various short-lived jobs, mainly on farms in North Zealand. When he was 27, he obtained a job as a labourer at a rubber factory where he stayed for some years.

When 33, he was still unmarried. He was at that time sentenced to 12 months' imprisonment for a series of burglaries. During a routine investigation concerning arson at a boarding-house his room was searched by the police. The search disclosed various effects, and he admitted that he had committed several minor burglaries and other forms of theft during the past few years. The thefts had all occurred during the first years of the War during the blackout, after he had drunk.

The cases are reported as follows: 1) On his way home from a bar, he broke into a mansion and took a large quantity of silver from an unlocked

cupboard. He kept the silver in a suitcase in his room, and had not made any attempt to sell it. 2) Stole an unlocked bicycle parked in the street during the blackout, used it for a couple of days, and then returned it after having removed certain parts. 3) Stole two suitcases (empty) from a doorway. 4) Took a woman's red umbrella which had been left in the train; he was on his way home after visiting a bar. 5) Stole a package (containing various advertisement-films and a copy of "Snow White") from a platform-wagon, likewise after having visited a bar. 6) and 7) Broke into the unlocked kitchen of the boarding-house mentioned above on two occasions and removed various foodstuffs and kitchen utensils; on a third occasion he was seen in the kitchen, and this led to the police taking an interest in him. 8) During the period he was employed at the rubber factory, he stole bicycle tires, pieces of rubber, etc.

The report indicates that he described his actions in a rather naive manner, and did not try to hide anything. He asserted that he committed all the thefts when he was drunk. His "resistance was broken down by spirits". After committing a theft, he could not understand why he had done so, but he did not suffer from amnesia. He only drank at intervals, but then for several days at a time without restraint, an average of 15-20 beers or a similar amount of spirits, and usually wandered from bar to bar alone. Even when he was drunk, indeed few people would notice it. He had always been able to carry out his work, and he had only once been seen drunk at his work. Otherwise his mentality is not described in detail. He was not submitted to medical or psychiatric examination. Most of his former employers stated that he was a quiet, decent, and well-liked, perhaps somewhat reserved, person. A few thought he was probably below average intelligence and not a particularly clever man. All agreed, however, that he had never previously shown signs of being untrustworthy or dishonest.

Little is known about the twins' father after he was released (subject to probation for 2 years). He had not been sentenced since, although he was charged with theft a couple of years after his first case, but the case did not come to court.

The father's siblings. The twins' father had four brothers and one sister who were 50-60 years old, all married. The *official police records* state: The oldest brother, a brush-maker, married twice, had 8 children. One of his children, an unmarried rope-maker, 41 years old, was sentenced to 10 days' imprisonment for embezzlement when 16, and was put on probation; he was later arrested in connection with fraud and theft at a hotel. Another of the father's brothers, a 56-year-old labourer, was cautioned for begging when a young man. One of this man's five children, a 27-year-old labourer, was involved in a case of theft when 17, but the case did not go to court. He was fined two years later for being an accessory to theft (fellow-workers took a bale of rice from a ship), and later involved in yet another case of theft. There is no information available suggesting that anyone in the father's family was addicted to alcohol.

We made no attempt to contact the twins' father or the family.

The mother

From *the national registration office* the following information has been gathered:

She married at 26 and was a social-worker in a province town. She had two children, a girl and a boy, about whom no information is available. She is the 6th of 8, grew up in a cobbler's home in a village in North Zealand, and left school at 14. Her mother was admitted to a mental hospital when the twins' mother was still a child. She lived with her father when the twins were born, and remained with him until she was 20 when she started to train as a social-worker.

While investigating the official records regarding the twins' families, I realized that I knew their mother who had been occupied at a hospital. I did not attempt to contact her again, and the following description has been reconstructed from my recollections of her: She was a strongly built woman of medium height, moderately obese, pyknic. She resembled the twins, but not particularly (Palle's adoptive parents had told him that the twins resembled their father closely). She was probably of average intelligence, rather neurotic, perhaps she lacked self-confidence, sought emotional contact. She talked quite a lot and was rather loath to terminate a conversation, but she seemed very conscientious indeed, painstaking and interested in her work. She was apparently healthy, but was supposed to suffer from attacks of headache, probably migraine.

The mother's siblings. 1) *Brother*, 47 years old, married transport-worker. 2) *Sister*, stillborn. 3) *Brother*, (twin), 43 years old, married chauffeur. 4) *Brother* (twin), died in infancy. 5) *Brother*, 35 years old, married postman. 7) *Sister*, 38 years old, married to a factory labourer. 8) *Sister*, 33 years old, married to a labourer. Admitted to a mental hospital when 21. The *case records* from the hospital state: Several of the siblings are said to have been "nervous". Attended a normal village school, kept house for her father, and later obtained a position as a switchboard operator. Premorbidly: quiet, somewhat melancholic, almost apathetic. When 19 her mentality altered, she became depressed. During treatment by "a natural healer" she became erotically excited and had intercourse with any and everyone. When 21 she had an abrasio mucosae uteri performed; at that time she had for about 6 months incessantly changed in mood, varying from deep despondency or slight depression to unnatural excitement with sexual hyperactivity. She was transferred to a mental hospital because she threatened to commit suicide due to a broken engagement. During this admission, which lasted 3 months, she was treated with insulin coma. On discharge well-balanced and mentally normal. Diagnosis: Exaltatio mentis transitoria, psychopathia constitutionalis? Nine months later she was admitted to a general hospital, according to the *case records*, with abdominal pains. She said she expected to have a miscarriage, but examination showed that she was not pregnant. She alternated between a sluggish, apathetic, peculiar, unselfconfident mood and erotic excitement; she was thought to be a psychotic, and was transferred to a mental sanatorium, where she remained for 3 months. In the *case records* she is described as infantile, disingenuous, dramatizing, hysterical, prolix about matters of no importance; she wrote naive, manic-type letters to several young men, her mood was elated, she smiled a lot, was full of initiative, "behaved like a naughty child". Gradually she became less excited, but she seemed to be somewhat

paranoid and apparently misinterpreted what she read in the newspapers. When admission to a mental hospital was ventilated, she "took herself in hand" and was discharged to her home. Diagnosis: psychoinfantilismus, psychopathia. At the age of 23 she was again admitted to a mental hospital. *Case records*: The clinical picture was now a typical endogenous depression. She was treated with ECT and discharged as recovered 3 months later. Diagnosis: psychosis manio-depressiva. She had not been hospitalized since then, but according to statements made by the twins' mother (recorded in the case records mentioned below) she is habitually rather depressed.

The maternal grandmother and family

The grandmother is a 69-year-old, chronic patient in a mental hospital. The *case records* state: Her father was "a drunkard", during the later years of his life "mad", and he was reported to have been sentenced to 8 years' imprisonment for a "sexual crime"; his father was also said to have been "mentally deranged".

The grandmother was the third of four children from a labourer's home on Zealand, spent her childhood in a country village, and later was employed as a domestic servant. She married a cobbler when she was 21; there were eight children, including one pair of twins. Premorbidly: moderately intelligent, quite clever, somewhat "nervous".

Her mental illness commenced when she was about 29 following her many births and a severe attack of "influenza"; she changed, became confused and bewildered, agitated, anxious, afraid of dying and of losing her husband. She was admitted to a general hospital, but shortly afterwards transferred to a mental hospital, where she remained for 10 months. She was agitated, manic, fiddled with things continuously, tore things to bits, could not speak coherently, was only partially oriented, obviously suffering from auditory and olfactory hallucinations, deluded, thought she was being persecuted, and said she was influenced by electricity. She had to be restrained occasionally, and sometimes threw cockery at people. Her mood was labile, mainly elevated and "frisky". She gradually became quieter without special therapy. Diagnosis: confusion. Apparently she did not manifest abnormal features again until she was 34 years old when she was admitted to a general hospital for uncharacteristic abdominal symptoms, which were taken to be "psychogenic". When she returned home, she became manically excited, sang loudly, and was readmitted. Shortly afterwards she was transferred to a mental hospital. She was "foolish", had auditory hallucinations, talked to voices. No manifest delusions. During her 10 months' stay here she was excited, sang loudly, mixed herself up in whatever was going on, was easily angered. Her behaviour was queer, she used her handkerchief as toilet-paper. During this period she had an epileptic fit lasting two minutes. She gradually subsided. Diagnosis: schizophrenia. During the next 8 years she remained at home. She seems to have been melancholic, but otherwise without remarkable features. When about 42 years old she suddenly developed a "restless mind" and changed rapidly in mood; sometimes depressed, quiet and reserved, sometimes excited and singing, talking incoherently to herself. She was again admitted to a mental hospital and has since been a chronic patient. On admission she was quite calm, apparently oriented in time and place, but clearly in an elevated mood, and she misidentified persons. Her speech was richly flecked with neologisms. This state continued, although it was characterized by pronounced periodicity; sometimes she was uninterested in any type of occupation and could be violent, at other times she was quiet and could be occupied. She gradually became increasingly apathetic, but at the same time more unpredictable and aggressive. Due to her fragmented incoherent thoughts and imagination, her lively hallucinations, autism, threatening and abusive behaviour, she was regarded to be schizophrenic, and bilateral lobotomy was performed at the age of 55. Her state afterwards perhaps became worse; she was more confused, her periodic alternations in mood remained unchanged, she continued to be hallucinated, was perhaps more aggressive than prior to the operation, and her calmer periods became shorter. Her husband obtained a divorce without her seeming to understand its implications. In an attempt to alleviate her periods of aggressiveness and complete inactivity,

she was treated with serpasil at the age of 65; she improved somewhat, could be occupied, seemed to be calmer, ceased to be aggressive, but still behaved peculiarly: refused to partake in the social life of the ward, had "ideas" demanded that the chairs be placed with their backs to the table, that the cups should be placed differently, etc. It was still difficult to obtain verbal and emotional contact. At the age of 67 she was transferred to a mental hospital in Jutland; her behaviour has remained unchanged. She does not appear to be oriented, chatters unintelligibly when addressed, apparently finds it difficult to understand what is said to her. There seems to be a reduction in auditory acuity of unknown cause. Diagnosis: schizophrenia (?).

The grandmother's siblings: 1) *Sister*, married to an innkeeper, died childless at the age of 72 from diabetes mellitus. (She is the one who helped the twins' mother with the adoption, and looked after Palle for a couple of weeks). 2) *Brother*, a married labourer. Five children. He died when 32 years old from "influenza". (1) *A son* was peculiar, reserved and with various hypochondriacal ideas, as well as ideas of persecution following an attack of "influenza" at the age of 21. He was admitted to a mental hospital. According to the *case records*: Diagnosis: dementia paranoides. Discharged seven months later. Three years afterwards admitted to a psychiatric department in Copenhagen. He was torpid, apathetic, stuporous, apparently suffering from auditory hallucinations, incontinent, masturbating. Diagnosis: dementia praecox. Transferred to a mental hospital where he stayed for 5 months. There was severe psychomotor retardation. He fumbled a lot with things, was perplexed, heard distant voices. Diagnosis: schizophrenia. He then stayed with his parents during the next years. His state alternated; for periods of months he was "normal", could be occupied; during some periods he seemed "to come to a stop", and during one of these latter periods he was admitted to a psychiatric clinic at the age of 45. Diagnosis: schizophrenia. Transferred to a mental hospital where he has remained ever since. He is monstrously fat (114 kg.)—"stands like a massive mountain, looking out of the window", without initiative, difficult to contact. There was some improvement when he was treated with chlorpromazine. Diagnosis: schizophrenia. (2) *A daughter* is an invalid, and has been repeatedly admitted to a neurological clinic because of chronic polyneuritis-encephalomyelitis. 4) *Brother*. No information is available.

The maternal grandfather and family

The maternal grandfather and several members of his family are either *propositi* or in other ways registered in the studies made on the island of Bornholm by *Strömngren* (1938) and *Fremming* (1947).

The grandfather. Former cobbler, 75 years old, living on Bornholm. According to the files of *Fremming*, he was regarded to be mentally normal. In connection with another investigation, I interviewed one of his sisters (see below) who confirmed that he was "normal, energetic, and very just and conscientious". After the divorce from the twins' grandmother, he does not appear to have kept in contact with the twins' mother. *His father*, a gamekeeper, apparently did not present signs of mental abnormality. He married twice and had several children in both marriages. *His mother* died at the age of 34, following the birth of twins. She is said to have been "melancholic", *her father* is said to have been "a periodically mad drunkard", and he is reported to have been imprisoned.

The grandfather's siblings. 1) *Brother*. No information. 2) *Sister*. According to the files of *Strömngren* and *Fremming*, she was "moody", but as far as known, she was never psychotic. She married a store-foreman and had eight children: (1) *Daughter*, 59 years old, unmarried, invalid. When 19 admitted to a psychiatric clinic in Copenhagen. Diagnosis: hypomania? Transferred to a mental hospital where she remained for two years. Diagnosis: psychosis manio-depressiva. The state was alternating between mania and depressive stupor. Shortly after being discharged, she was readmitted to a psychiatric clinic. Diagnosis: degeneratio psychopathia. Transferred to the mental hospital. Diagnosis: psychosis manio-depressiva, debilitas intellectualis. From 23 to 46

years of age she stayed at home, and was then again admitted to a psychiatric clinic. Diagnosis: debilitas intellectualis. She did not manifest clear psychotic features but was, nevertheless, transferred to a mental hospital, where she has remained ever since. She is described as habitually naive, childish, influenced by her intellectual defect; periodically depressive, periodically erethic with hallucinations and aggressive behaviour. (2) *Son*, 57 years old, married factory worker. He is a propositus in a "normal-material" collected by *Bartels* (1941). According to these files he was classified as "only moderately intelligent, but otherwise not deviating mentally". (3) *Daughter*, 41 years old, married. Mentally normal. (5) *Son*, 48 years old. Since the age of 12 cared for at a hospital for mental defectives; classified as an idiot. (Judging from the brief *case records*, however, he seems rather to belong to the upper group of the imbeciles). He is habitually exceptionally labile in mood, periodically quiet and reserved, periodically excited, argumentative, and aggressive. During puberty he was for some time in a special guarded ward. (6) and (7) *Twins (boys)*, died at birth. (8) *Son*, 47 years old, mentally normal. 3) *Sister*, married, died at the age of 36. According to *Fremming's* and *Strömgen's* files she was melancholic" even when a child. At intervals of some years she had hallucinatory depressions and exaltations. Hospitalized several times, but never admitted to a psychiatric ward. Died following an operation (cholecystitis?). 5) *Sister*, died unmarried at the age of 34 in a mental hospital. Propositus in *Fremming's* material. From the age of 21, following an unfortunate engagement, melancholic, and suffered from depressive delusions, "guilty until I die". She was admitted to a general hospital where she was in an exalted mood, very noisy and had to be fed. She was transferred to a mental hospital, where she was incontinent, noisy, talkative in an incoherent, paralogical manner and apt to divest her bed of clothing. She had various delusions of grandeur, "was senior physician, king, emperor", complained that there was poison in the food and that she was given "human flesh" to eat. During the 12 years she was at this hospital, she continued to be periodically agitated, aggressive, noisy, and singing. She lost weight, contracted pulmonary tuberculosis. She declined, developed haemoptysis, and died. Diagnosis: schizophrenia (hebephrenic-catatonic). 6) *Sister*, 72 years old, married to a labourer. Propositus in *Fremming's* material. As mentioned, I have seen this sister in connection with another investigation on Bornholm. Mentally she appeared to be hypochondriac, mildly demented, but otherwise not abnormal. Three adult children; all of them are well. 7) *Sister*, 70 years old, said to be mentally normal. 8) *Sister*, died in infancy. 9) *Sister*, died in infancy. 10) and 11) *Brothers (twins)*, died in infancy.

The grandfather's half-siblings. There were several children in the second marriage of the grandfather's father. At least seven of these, from 53 to 67 years old, are still alive and all seem to be mentally normal.

Summary of the supplementary information

There is a heterogeneous psychiatric disposition in the twins' natural family.

Several members of the twins' paternal family, which immigrated from Sweden, have come into conflict with society on account of minor offences of the law. The twins' father has been sentenced to a year's imprisonment for a number of minor burglaries and other forms of theft. He appears to be mentally somewhat deviating and was probably a dipsomaniac; he drank at intervals and only ever committed thefts in connection to periodic alcoholic excesses and he had no amnesia for the thefts. The paucity of information makes it difficult to pursue the matter. A paternal uncle and two cousins of the twins have also come into conflict with the law. There is no information available suggesting that any of the father's siblings or other relatives were addicted to alcohol.

The case material concerning the maternal family presents various differential diagnostic problems and has, therefore, been reported in great detail. The available data concerning the mental state of the twins' mother, especially during youth, are sparse. There does not appear to be any reason to assume that she, apart from slight and uncharacteristic neurotic symptoms, is psychopathological in any way; especially, no signs indicating periods of even mild psychosis have been disclosed. Several other of the mother's siblings are said to have been "nervous", and one of her sisters manifested an undoubtedly manic-depressive psychosis. The twins' grandmother has been diagnosed as schizophrenic. Even though the course of her illness, particularly at the beginning, was characterized by periodical alterations in mood and subsequent remissions, it seems reasonable to accept the diagnosis in view of the subsequent course of the illness. There is a case of what is undoubtedly schizophrenia in the family of the twins' grandmother, her nephew, and the father and grandfather of the twins' grandmother appear to have been mentally deviant. The twins' grandfather did not manifest psychopathological symptoms, but his mother, who died when still young, was "melancholic" and one of his sisters was labile in mood. A daughter of this sister was mentally deficient and had a manic-depressive psychosis, and a son was also mentally deficient and possibly subject to mild periodic alterations in mood. Another sister of the twins' grandfather was habitually melancholic and suffered from periodic depressions and exaltations with hallucinations; she was admitted to hospital at one occasion in a presumably psychotic state. A third sister died in a mental hospital. She was diagnosed as a case of hebephrenic-catatonic schizophrenia; the course of her illness, at least at the beginning, was typified by alterations in mood and one cannot exclude the possibility that she suffered from an atypical manic-depressive psychosis.

As there is at least one, possibly more than one, case of manic-depressive psychosis in the family of the twins' grandfather, the otherwise remarkable occurrence of a manic-depressive psychosis (the twins' aunt) in a child of a schizophrenic woman (the twins' grandmother) might be explained by this disposition.

Several cases of twins were recorded in the maternal family.

CLINICAL EXAMINATIONS

Palle was interviewed 10 and Peter 12 times and they were interviewed together three times. I did not visit their homes, and I had no contact with their adoptive families.

The twins were almost the same height, Palle: 174 cm., Peter: 173 cm., of the same stature, slim, but strongly built, athletic-leptosome, with regular, rather handsome features. Palle weighed 72.2 kg., and Peter 73.6 kg. They

were dark-blond, and their hair was exactly the same texture and shade, brushed straight back. Palle, who, on the whole, seemed to be more interested in his appearance and dressing than did Peter, had shallow artificial waves in this hair. The hair whorls in both cases were anticlockwise. Both had bushy eyebrows which tended to meet. Their eye colour was dark blue. Magnification failed to disclose pronounced differences in the pigment pattern of the iris. Their heads and faces differed slightly in shape. Palle's skull was longer, somewhat "egg-shaped". Peter's was, so to speak, more "pressed together" and appeared to be shorter than Palle's, so that when seen in profile, his nose seemed a little more prominent; these slight differences probably explain why Palle appeared more "handsome and weak", and Peter more "energetic and aggressive". They closely resembled each other with regard to the position, shape and details of their ears, their high foreheads, their relatively deep-sunken eyes (the left eye of each twin lying a little deeper than the right) and their chin and cheek configuration and the teeth.

Routine medial examination did not disclose abnormal features; in particular there were no signs suggesting neurological or cardiac disease. Blood-pressure was normal in both cases. Peter had a reddish naevus roughly as large as a shilling on his left breast and a café-au-lait coloured one of the same size on his right calf. His cuticles were fissured and he lacked the nail on the third finger of his right hand (due to an accident). Otherwise there were no differences between the twins. Both were right-handed.

Their behaviour was strikingly similar. Their outer calm clearly veiled controlled tenseness. They both appeared placid, somewhat "mask-like", serious, almost sulky in appearance and rarely smiled. They rarely gesticulated when speaking, but their few movements were almost identical. Both spoke with a monotonous low-pitched, slightly mumbling voice; they also resembled each other in their gait, and I was repeatedly struck by the resemblances in their general behaviour and attitude during the interviews—for example the identical way in which they both took out a little diary and carefully noted the time and date of their next interview.

They were both exceptionally cooperative. During the interviews, they usually remained passive and expectant in their attitude, but were occasionally quite free and easy and informative in an instructive way. Both seemed reliable. They both seemed to seek emotional contact and both undoubtedly had a considerable need for such contact, though it was perhaps more pronounced in Peter. He was also usually easier to obtain contact with but, on the other hand, the more superficial relationship with Palle often seemed to be more natural and genuine. When together they never tried to dominate each other, and they both expressed their considerable feelings of mutual sympathy and only ever indirectly intimated criticism or dissociated themselves from each other.

Both appeared to be above average intelligence, and equally well endowed. It was impressive how little their different educations seemed to have influenced their intellects and behaviour, and it was clear that the twins themselves did not notice differences of importance; Palle in particular never expressed anything indicating a feeling of intellectual inferiority.

As regards personality they both appeared to be rather insecure, constrained, repressed, lacking in self-confidence, tense, and slightly obsessive-compulsive.

Palle seemed to be less unbalanced and more harmonious emotionally, but also more "impersonal". Peter seemed to be more disharmonious, complex, and reacted more immediately. He seemed to be rather ambitious in a slightly naive, boastful, assertive, immature, all-knowing way, and was more apt than Palle to express aggressiveness and simultaneously stressed the high moral ideas which he expected himself and others to live up to. Their insight into their own minds was rather superficial, especially in Palle's case. Their train of thought was characteristically "heavy" and inelastic. They were both very painstaking, almost pedantic about details, apt to cling to the same line of thought for a long time, and manifested a pronounced tendency to perseveration, just as they also manifested a characteristically "empty" mood of indifference with only slight emotional variations and reactions. Both expressed hypochondriacal tendencies, and their descriptions of their various symptoms were strikingly similar.

They thus displayed some differences in personality but, on the whole, these differences appeared to be differences in degree rather than kind. Even though the immediate impression was that the twins represented normal personological variations, the more detailed acquaintance during the observation disclosed that they were both to some degree deviant personalities, Peter a little more so than Palle.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Palle

Solved 57 matrices in 52 minutes. (Matrices E_{10-12} were excluded). He worked slowly and steadily, asked only a few questions. Score: $12+11+10+11+8=52$. The distribution was normal; discrepancies: 2. Group: 75-90 percentile. Conclusion: intelligent, thorough, effective, but slow.

Peter

Solved 56 matrices in 44 minutes. (Matrices E_{9-12} were excluded). Worked quickly, but independently, "thought aloud" occasionally, enquired whether the psychologist "was interested in comments". Score: $12+10+12+10+7=51$. Normal distribution; discrepancies: 2. Group: 75-90 percentile. Conclusion: intelligent, thorough and effective.

Wechsler-Bellevue

	Palle				Peter			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	17	12	18	13	18	13	24	17
Comprehension	14	12	14	12	16	14	19	17
Digit Span	5+5 ¹) = 10	7	6+4 = 10	7	6+5 = 11	9	6+6 = 12	10
Arithmetic	10+2 ²) = 12	16	9+1 = 10	13	10+2 = 12	16	10+3 = 13	17
Similarities	15	12	15	12	15	12	17	14
Vocabulary	(30)	(13)			(33)	(16)		
Verbal Points		59		57		64		75
Picture Arrangement	12	11	17	14	13	11	15	13
Picture Completion	12	12	13	13	11	10	13	13
Block Design	21+15 ²) = 36	16	21+13 = 34	15	21+10 = 31	14	21+14 = 35	16
Object Assembly	18+3 ²) = 21	12	18+4 = 22	13	18+2 = 20	12	18+5 = 23	14
Digit Symbol	62/62 ³)	15	61/61	14	66/67	16	67/67	16
Performance Points		66		69		63		72
Total Points		125		126		127		147
Verbal IQ		114		112		120		133
Performance IQ		121		125		117		129
Total IQ		119		120		121		135

¹) Digits forwards and backwards. ²) Accuracy and time credits. ³) Correct/passed items.

Palle

Cooperated well and accepted the problems satisfactorily. Worked painstakingly, but in a very tense manner. Seemed to be less tense on *retesting* (9 months later). The most remarkable result is perhaps his relatively poor Digit Span and a slight difference between the forward and backward span. Conclusion: intelligent.

Peter

Confident with a high level of aspiration. On *retesting* (10 months later) he mentioned that he had thought a little about the test, and this probably explains his improved score on Information, but his scores improved on nearly all the other subjects, too. Qualitatively, he manifested almost the same features as Palle on Digit Span, but not to quite the same degree. The relationship between his Verbal IQ and Performance IQ was the opposite of the relationship between Palle's scores. Conclusion: intelligent (well-informed, intellectually ambitious).

Rorschach

		Palle			
12 W	9 F+	1 H	5 P. 3 Orig (+/-)		
11 D	7 F+/-	12 A	F+ 75 (extended 66)		
1 Ds	2 F-	3 Ad	F = 100 - L = 69		
1 Dd	2 FC	3 Obj	A = 58		
1 Dds	2 CF	2 Bt	Affective ratio: 31		
Total: 26	2 FY	1 Blood	RT: 1.2 min. (I - VII)		
	2 YF	2 Ls	1.2 min. (VIII - X)		
		2 others	Seq.: orderly-reserved		
			Ap: W! - (D) - Ds - Dds		
			Exp. 0/3		
			Colour shock (+ shock VII, sex?)		

Tendency to perseveration: criticism of shapes and symmetry, questions and appeal, white as colour and colour as Y ("Verschmelzung").

He displayed uneasiness, uncertainty, and a tendency to appeal to and ask questions of the psychologist. He used quite a long time on the test (about half an hour), seemed to find it difficult to proceed from one card to the next, and his answers similarly indicated a tendency to perseverate and perhaps also a rather low consciousness of the perceptual/conceptual processes (Deutungsbewusstsein).

Psychogram: He is intelligent and has a definite desire to assert himself, but his attitude is rigid and tense to a considerable degree. He frequently did not achieve much in spite of considerable efforts, is speculative in an unproductive and humourless way. His perceptual mode is "synthetic", sometimes he seems to be "blurred", confused, and "oppositional". His personal contacts are characterized by repression, lack of freedom, and a tendency to demand a lot of himself and others, as well as by lack of plasticity and by "narcissistic" traits. There is presumably a marked tendency for not only sexual, but also other emotions to provoke anxiety and start off his defence mechanisms. His aggressive impulses are probably those which are expressed in the most satisfactory way, although somewhat indirectly. He is unlikely to be able to control his anxiousness satisfactorily (apprehensive fantasies? apprehensive dreams?). His controlled and externally adjusted traits exist concurrently with impulses and moods, which presumably may manifest themselves abruptly. His general mood seems to be unfree, unhappy, "flat", and possibly he may experience a certain "emptiness". He must be classified in the schizoiothymic group, with manifest neurotic traits developed on the background of a character-neurosis. ("Emotional deficit" in childhood, especially with reference to the "mother-figure"?)

Double-blind test

Man, young or youthful. Probably above average intelligence, but does not seem to use his abilities particularly effectively, as he appears to be lacking in independence, irresolute, apt to cling to things, vainly trying to achieve better results. His attitude towards the task seems to be tense and fatiguing. He is presumably without much initiative, but would be more productive if given restricted tasks which he felt certain he was capable of carrying out satisfactorily. Emotionally he appears to be fundamentally immature, easily touched, disharmonious, and with greater need of personal contact than ability to achieve it. He probably feels isolated, functions as a spectator and avoids engaging himself emotionally. He seems to be apt to be weary of others and does not appear to trust either himself or others very much. There are signs of strong aggressiveness, but the way he manages these tendencies is not clearly manifested in this test. Presumably they most frequently manifest themselves indirectly in a passive, rather surly manner. There are also signs of superficial obsessive-compulsive mechanisms which do not appear to be a sufficient defence against anxiousness and impulsivity and the latter might very well manifest themselves in his behaviour. Habitually dysphoric mood?

Retest (after 9 months)

8 W	4 F+	4 A	4 P. 3 Orig (-/—)
6 D (+ 2 after Rej.)	4 F+/- (+ 1)	4 Ad	F+ 60 (extended 63)
1 Ds	2 F-	1 Obj	F = 100 - L = 63.
1 Dds	2 FC	2 Bt (+ 1)	A = 50
	1 CF (+ 1)	2 Ls	Affective ratio: 19
	2 FY	3 othra	RT: 0.6 min. (I—III)
<hr/> Total: 16	1 YF	(+ 1)	1.3 min. (VIII—X)
	+ V		Seq.: irregular?
			+ reversed.

Ap.: W! (D) Ds Dds
 Exp.: 0/2
 colour shock
 Shock V+VII
 Rej. (1st round)IX.

Tendency to perseveration and symmetry-perception.

His behaviour was more coherent, and he presumably exerted more control over himself. Without actually being uncooperative, he restricted himself to almost solely attempting to remember what he said during the first test, and 12 of his 16 (+2 supplementary) answers are direct repetitions, and to some degree several of the others resemble his original answers.

Psychogram: Although this behaviour may purely be a "test phenomenon", his change in attitude, nevertheless, seems to agree with the structure of his personality. He appears to avoid provocation at the cost of his intellectual productivity and emotional and perceptual potentialities (Erlebnismöglichkeiten) shading into blocking (Versagen). There is, however, probably no important alteration in his personality structure. His presumably manifest neurotic features have not been reduced, and his ability to compensate for these features still appears to be problematic. He seems to be dysphoric, tense, repressed, and sensitive with egocentric features, immature and exacting.

Peter

3 W	17 F+	1 H	5 P. 8 Orig? (+/-)
1 Ds W	6 F-	12 Hd	F+ 74 (extended 75)
13 D	1 FM+	7 A	F = 100 - L = 72
1 DdD	1 FM-	3 Ad	A = 31
2 Do	1 FC	1 Obj	Affective ratio: 50
12 Dd	3 V	3 Anat	RT: 1.1 min. (I - VII)
Total: 32	1 Min Hd	4 others	Seq.: irregular-confused
			Ap.: (W) (D) Dd.
			Exp.: O-1/1/2
			Colour shock, shading shock.

Some perseveration; appeal and questions; perceived symmetry; use of edge-areas.

Although he fully accepted the task, he did not work easily or freely. He undoubtedly has a considerable desire to be productive, but his behaviour often seemed immature and self-assertive; he keeps on even when he does not achieve very much by doing so. He frequently gives supplementary, detailed descriptions which tend towards being rather far-fetched.

Psychogram: He is obviously intelligent, with a tendency to stress the unusual, especially by giving detailed descriptions, but he lacks a general view of the situation, and his behaviour as a whole is rather "artificial". There are undoubtedly functional difficulties derived from an emotional, neurotic basis. He seems to try to compensate for them, and often gives immediate, conscious, but badly adjusted responses. He is very repressed emotionally, his ability to contact others is poor, and there is probably little manifest desire to contact other people. His controlled, intellectualized way of keeping himself at a distance seems to be a defence against emotional impressions from his environment and emotional impulses in himself. He is very unsure of himself when dealing with others, in fact suspicious of others, and presumably this is the reason for his attempts at "overinterpretation". Due to his inability to survey the whole situation and his poor ability to emphasize, he is apt to give obviously maladjusted responses, bounding on "paranoia-form" thoughts. It appears that his sense of humour is able to remedy this situation, but even this humour seems to be of a rather twisted type. He does not appear to be openly aggressive. He demands a lot of himself, and

probably also a lot of others. In fact, he seems generally to be rather demanding, egocentric, "narcissistic", and has some difficulty in adjusting sexually. There is little immediacy, trust or contact, and there are manifest neurotic features, and presumably emotional disturbances in his previous and present environments. He is clearly schizothymic.

Double-blind test

Man, young. Well endowed intellectually, but he probably has difficulties in making full use of his abilities. He seems to be unsure of himself, retires behind a rather childish, boastful type of behaviour, and his pretensions are perfectionistic, but unfertile; he takes far too much interest in unimportant details, loses his general understanding of the situation by doing so, and thus also loses grip on the situational context. He tries to keep to formal aspects, appears to be careful, rigid, and rational to such an extent that his initiative must be crippled; he probably prefers to be a spectator, but at the same time has a tendency to overestimate himself. When together with other people, he will presumably be correct but rather cool, and he does not seem to have the necessary background to enable himself to obtain a warmer and more spontaneous rapport. He is unlikely to dare to use his imaginative resources, and appears to be intolerant towards impulsiveness, afraid of emotionality, and probably has difficulties in expressing his own feelings. Neither does he seem able to express his aggressive impulses adequately; they presumably manifest themselves indirectly, possibly in a passive, provocative attitude. He is self-referring and uses projection as a defence mechanism. His general mood is lowered, he seems restless, and the test is marked by obsessive-compulsive features.

Retest (after 10 months)

5 W (2 cut offs)	25 F+	3 Hd	6 P. 8? Orig (+/-)
	3 F+/-	12 A	V+ 81 (extended 74)
29 D	4 F-	9 Ad	F = 100 - L = 79
2 Ds	1 FM+	3 Obj	A = 49
1 Do	1 FM-	2 Bt	Affective ratio: 44
6 Dd	1 FC	5 Anat	RT: 0.9 min. (I-VII)
	2 CF	1 Ls	0.7 min. (VIII-X)
Total: 43	1 C	1 Cg	Seq.: irregular-indeterminable
	3 V	3 "empty"	Ap.: (W) D! - Dd! - Ds - Dd
	2 FY	4 others	Exp.: 0/4
			Colour shock (+ compensation)
			Shading shock?

Tendency to perseveration and criticism of blots and shapes, perceiving the symmetry, questions.

His behaviour resembles that during the first test considerably; he gives more responses. There are relatively few repetitions of previous responses.

Psychogram: Unchanged in all important respects. His attitude must be interpreted as an expression of his high level of aspiration. His reactions to the stimuli are apparently not only stiff and restricted, but also alter due to "inner" causes (presumably mostly due to uncertainty and dissatisfaction with himself). His emotional reactions still seem peculiar and impersonal. His ability to obtain a general view of a situation is poor. His original productions are of limited range or concern more details.

Word Association Test (a. m. Rapaport)

Palle

Began by giving many definitions and was asked to associate more freely, but continued to give definitions to a considerable extent. He was obviously emotionally

touched by the test material. His mode of action is restricted and yet his compensation is not quite convincing. Results: His reaction times are generally short during the first presentation of the word list, and difficulties mainly occur when he is given definitely "sexual" words. One cannot but remark upon his compensatory attempts and his defence mechanisms (intellectualization, emotional repression, and "dilution"). Apart from sexual problems, he also seems to have difficulties regarding his parents and his role as a male. When the list is presented the second time, most of the short reaction times are retained, but there are more increased than decreased reaction times. The repetition-percentage is normal or slightly above normal (75 per cent).

Peter

Tense, seems to exert control and to "diffuse" when presented with emotional provoking words. His compensation is generally adequate. Results: All reaction times are short, most of the responses neutral, a few remarkable because they disclose both his emotional provocation and his defensive reactions (intellectualization, and control). There are undoubtedly considerable difficulties with regard to sexual and interpersonal problems. When the list is presented the second time most of the reaction times remain unchanged, and the repetition-percentage is presumably normal (68 per cent). It is remarkable how the degree of provocation appears to be the same for both (cf. the Rorschach results).

Summary and comparison of the test results

The twins are undoubtedly well endowed intellectually. They work thoroughly and independently, Peter, who is more generally well-informed, a little more quickly than Palle. Both are intellectually ambitious, Peter more than Palle. Peter seems to be rather "exaggerated" and tense in his attitude and behaviour; this is also true of Palle, and the difference between them is only slight. They are both emotionally repressed, somewhat immature, and both are characteristically unmodulated, persevere in their reactions, corresponding to their "dry, intellectual" form of contact with others. Their ability to obtain contact with others is, however, not particularly poor, but they both possess a considerable desire for such contact. They are characterized by a demanding attitude, approaching narcissism, which means that their emotional reactions often seem to be egocentric. Both are undoubtedly neurotic. Palle is probably better able to compensate than Peter, who seems to have greater difficulties in surveying a situation, and to be less effective, as well as more apt to ruminate about things, whereas Palle seems better able to realize and satisfy his aggressive emotions and impulses. Both seems to have a large number of possibilities for complex-determined experiences and actions. Both seem to lack "distance" between themselves and their experiences, indicating a poor ability to neutralize their experiences. Their defence consists mainly in reaction-formation, isolation, dissociation of emotions and sublimation, and there is no difference between them except perhaps as regard the latter mechanism, which is most pronounced in Peter's case. The test results especially give one the impression that both have been subjected to an emotional deficit during childhood with lack of contact

with their environment; this trait is perhaps more pronounced in Peter than in Palle, but also here it is merely a matter of degree. Ixoid/schizothymic personalities. (Character neurosis? early deprivation?).

OTHER SPECIAL EXAMINATIONS

EEG. The results are remarkably similar. Alpha-rhythm for both is 11 hz, amplitude 10–50 μ v, and the distribution in time of the dominant activity calculated as a percentage of the total period was 50–60 per cent for Palle and 33 per cent for Peter. There are abnormal potentials in both cases: 5 hz-runs occipitally. No change during hyperventilation and flicker. Conclusion: Palle's EEG is slightly abnormal, Peter's slightly to moderately abnormal. In both cases there is too much slow occipital activity (immaturity?).

ECG. Palle: Slightly depressed S-T segments but upright T waves in lead I, tending more towards "bajonet-shape" in lead II. Peter: "Bajonet-shaped" T waves in lead I, upright T waves in leads II and III. Apart from low T waves which are not definitely pathological, the precordial potentials are normal in both cases. Both display clear although not definitely pathological Q waves in leads I and II. Conclusion: It is remarkable that there is the same slight deviation from the normal in both (not least in view of the fact that neither subject manifest clinical symptoms of a cardiac defect).

Roentgenological examination. In both cases the heart is of normal size and shape, quite similar. Thorax is normal in Palle's case, whereas Peter shows signs of a previous left-sided pleurisy. In both cases there are costae cervicales bilaterales, most pronounced in Palle's case, rudimentary (and first discovered on re-examination of the roentgenograms) in Peter's case.

Otological examination. Both complained of having "a feeling like a lump in the throat". Nothing abnormal in Palle's case. In Peter's case: white vocal cords with a slight paralysis of labium internum.

EPICRISIS

Palle and Peter were born out of wedlock. Their birth was normal. They developed normally, were breastfed occasionally, and they stayed together with their mother at a maternity clinic until they were nearly two months old. Their mother left them and they were referred to a children's home where they were together until they were nearly 10 months old. No information concerning the similarities and dissimilarities in environmental influences during their stay at the home is available.

Palle remained at the children's home and does not appear to have been ill although he might to some degree have been marked by the institutional care. He was put into the care of a childless couple when 14 months old,

but was rejected and stayed with a maternal relative until he was given into the care of his adoptive parents at the age of 15 months.

Peter was admitted to hospital due to a congenital naevus and retained there for four months because he developed otitis, tussis, and bronchitis. He proceeded from the hospital to his adoptive parents when 14 months old.

The twins were thus separated at the age of 10 months and the separation was complete until chance circumstances led to events in which the twins were mistaken for each other and finally to a meeting between them at the age of 22. Our investigation started a few days later and the observation period lasted for a little more than two years.

Both grew up as adoptive children in Copenhagen in somewhat different quarters of the city. In both cases they were adopted by childless couples. Their homes do not seem to have differed particularly as regards social and economic status, housing conditions or general cultural influences, but their childhood environments were otherwise very different:

Palle was the only child in his home, whereas Peter was brought up together with two younger step-siblings. Palle received ordinary elementary school education; he left school at fourteen, became a shop assistant, received some theoretical education in commerce, and later took up work in an office. Peter left school at 21 after having spent a year at an American boarding school, and matriculated in modern languages; at the time of our investigation he was studying biology. Palle's home was rather neutral in matters of religion, whereas Peter's adoptive parents were Roman Catholics, and he himself became a deeply devoted Roman Catholic.

In both cases the homes were influenced by conflicts between the adoptive parents, but Peter's home was decidedly less harmonious than was Palle's. The twins are probably correct in considering that the resemblances between their adoptive fathers, especially their drinking habits and their general attitude towards the surroundings, were merely apparent and superficial resemblances. Similarly, it seems convincing that the twins' adoptive mothers were also very different personalities, who mainly resembled each other in that they were both the central figure of the family; although their roles were almost diametrically opposite. At least there seems no reason to doubt that the twins experienced that they had been brought up in very different surroundings. In fact, the different personalities of the adoptive mothers meant that the twins' environments differed as regards religion, social ambitions, domestic order and cleanliness and as regards other aspects of the psychological atmosphere in general. Both twins probably suffered from lack of emotional contact with their family, and both established contacts with persons outside their homes during puberty, and they developed strikingly similar interests.

Both of them presented slight nervous symptoms or behaviour disturbances

during childhood; both suffered from nightmares, pronounced tendencies to nail-biting, restlessness, and Palle also presented nocturnal enuresis and a slight tendency to stammer. They were both closely attached to their adoptive mothers and both of them later gradually attempted to free themselves from this influence and dissociated themselves from their environments. This did not lead to a manifest conflict in Palle's case, whereas there was open conflict in Peter's, which resulted in his more or less breaking off relationships with his adoptive home. After they left their home, and perhaps especially since their adoption was openly admitted, the twins' relationships to their adoptive families became more similar.

It is reasonable to assert that the twins were perhaps placed in environments below their potential level of developments as regards emotional and intellectual possibilities. Theoretically at least, they could have been introduced to more "suitable" homes, but on the other hand, one should not forget that the twins were also clearly favoured by their environments in various respects, especially if one tries to compare these environments with the conditions the twins would have met if they had been brought up together with their natural family.

Although their education, particularly their formal schooling, differed considerably, the clinical as well as the psychometric examinations failed to demonstrate clear intellectual differences between the twins. Peter's improved results when retested with the Wechsler-Bellevue Scale undoubtedly express a characterological difference between the twins rather than an intellectual difference; he is far more ambitious than Palle and, furthermore, due to his educational training, he is clearly better able to exploit his intellectual abilities, even though neither of the twins did so efficiently.

The clinical and psychometric examinations also disclosed that the twins vary as regards the development and the present structure of their personalities. Their dissimilarity seems to be clearly conditioned, and can reasonably be explained, by some of the above mentioned differences in their childhood environments. However, the differences in personality manifested clinically and in the test results can be looked upon as differences in degree rather than differences in type and are most apparent from the immediate comparison of the twins, whereas the prolonged observation and a detailed analysis and comparison of the case histories and the test results tend to reduce the weight which can be laid upon some of these differences.

The main differences are clearly centered around their different attitude towards religion and sexual problems, but compared to the pronounced dissimilarity of their childhood environments, the dissimilarity between the twins must be said to be moderate. The differences are perhaps no more than variations within a basic personality structure which is rather resistant to modification by environmental influences.

Even though it is thus justifiable to assume that environmental differences clearly influenced the twins' intellectual, characterological and emotional development, the similarity in their personality structure is outstanding and perhaps prevailing. Their general behaviour and attitude during the investigation, their gestures, gait, and particularly their voices were strikingly similar. Both appeared to be introspective, lacked self-confidence and found it difficult to achieve emotional contact with others, whereas they expressed considerable feelings of mutual sympathy. Both appeared to be "immature" with obsessive-compulsive, psychosomatic, hypochondriacal and perhaps ixothymic features. Generally speaking, their personalities must be classified either as normal or slightly deviating from the average, Peter's on the whole, more than Palle's.

Their medical histories differed. Palle had uncharacteristic fits in early childhood and suffered from nocturnal enuresis. Peter, who presented naevi teleangiectici, had no symptoms of this kind. Palle contracted pulmonary tuberculosis, Peter did not. One may assume that Palle's tuberculosis was probably due to infection from his adoptive mother, together with the poor conditions in which he lived in a slum-like quarter. Peter was vaccinated against tuberculosis at an early age, due to the occurrence of tuberculosis in his adoptive-family—at least a convincing demonstration of the importance of environmental differences. Both twins presented slight psychosomatic symptoms of almost identical kind.

The striking similarity disclosed by some of the special examinations, the electrocardiographic, the roentgenological and particularly the electroencephalographic findings, seems of special interest. It is reasonable to relate the EEG-abnormalities to the twins perhaps ixothymic personalities, and perhaps also to Palle's childhood fits and enuresis. In this connection the information concerning the twins' father might be relevant, but the data concerning his personality and assumed dipsomania are few and hardly permit definite opinions.

It is even more difficult to evaluate the psychiatric disposition in the twins' natural family. Although both twins presented rather unusual and perhaps deviating personalities, it is hardly reasonable to predict whether they have an increased risk of developing similar psychiatric aberrations; they are still so young that most of the psychiatric illnesses occurring in the mother's family have had little chance to manifest themselves.

At the present they must be classified as: Normal or slightly deviating personalities.

CASE II

OLGA AND INGRID

This was the first pair of twins we examined. In 1954, a journalist approached us and described some unusual events which had led to their being mentioned in the newspapers.

The twins were born out of wedlock. Shortly after birth they had been put into the care of foster-parents who lived in different parts of Jutland. They first saw each other again when chance circumstances led to a meeting between them at the age of 35.

Ingrid had been brought up on a farm in North-West Jutland. She was married to a baker and lived in a market-town in the same area. She had known for some years that she had a twin sister somewhere in Jutland but had made no attempt to find her. One of her friends was visiting a market-town in South-East Jutland and there, accidentally, saw a woman in a shop who resembled *Ingrid* so closely that she did not hesitate to ask her whether she had any relatives or perhaps a sister in Northern Jutland.

Olga, who was married to a labourer and lived in the town concerned, answered that she knew nothing about her natural family; she was a foster-child and had been brought up partly by foster-parents, partly in a children's home.

Their exceptional likeness led to an investigation of their birth-certificates and other documents, and it was proved that they were twins. They were illegitimate children of a young maid, and when foster-parents were found for them, they had been separated.

The twins first met in *Ingrid's* home. Their next meeting took place a week later at a newspaper office where we met them for the first time. The twins, especially *Ingrid*, were rather worried by the publicity surrounding their case, but they were cooperative and it was possible to carry out our plan of investigation. We were able to follow them for the next three years.

When the twins met each other they knew nothing about their natural family apart from what has been mentioned above. As will be described later, the twins' mother contacted *Olga* after having read about the case in the newspaper. Neither of the twins, however, knew anything about the details which our later investigations disclosed concerning their family.

THE SEPARATION

The twins were born at a maternity clinic in Jutland. The *case records* from the clinic state:

The mother was a 17-year-old, unmarried housemaid, admitted due to her socio-economic circumstances. She was healthy, had menstruated regularly since the age of 13. She was only 145 cm. high. Pregnancy had been normal except for severe vomiting in the beginning, and birth occurred at the predicted time. Examination immediately prior to parturition disclosed: Uterus of elongated ovoid shape, approximately 1" below xiphoid process, upwards to the left a smooth, round resistance, heart sounds clearest in the mid-line. Parturition was introduced by spontaneous delivery of amniotic fluid. Labour commenced 2½ hours later, and four hours later Olga was born in a L. S. A. footling presentation. Then the presence of another foetus was discovered. The membranes of the foetus were penetrated and amniotic fluid delivered again. The heart sound was still normal. As labour did not commence, pitupartin was administered. An hour later Ingrid was born in a R. O. A. cephalic presentation. Both girls were alive and fully developed. Olga: 2,700 g./47 cm.; Ingrid: 3,000 g./51 cm.; head/chest circumferences: 33.0/31.0 and 33.0/32.0 cm., respectively.

Afterbirth: The two placentas were easily separated and the twins were considered to be dichorionic.

The twins were not breast-fed but thrived on artificial foods. Their weights increased in parallel, Ingrid always weighing 3–400 g. more than Olga. Ingrid was discharged when 8 weeks old and weighed 4,300 g. (Olga 3,500 g.). Olga was discharged at the age of 6 months and weighed 6,500 g. The case-records gave no details concerning their foster-parents.

Thus, the twins were separated when two months old, and they were 35 years and 6 months old when they next saw each other.

OLGA

During *the interviews* Olga remembered but little of her early childhood. Her foster-father, a former railway-worker, was 22 years old and her foster-mother 24 when she was given into their care at the age of six months. They lived in a market-town in North Jutland and were in poor circumstances until the father became rag and waste dealer. They had no children of their own and had approached a private institution in order to adopt a girl. At this time they seem to have been in contact with the twins' mother, who contributed to Olga's keep for some time.

Olga stayed with her foster-parents until she was transferred to a children's home at the age of seven. She did not know why she was transferred; per-

haps neighbours had complained because they considered that her foster-mother did not look after her properly. The foster-parents had children of their own (3, 5, and 6 years younger than Olga). Olga did not get along very well with her step-siblings and felt that she was an "outsider".

The relationship between the foster-parents was always very disharmonious. Generally speaking, Olga was unhappy because her foster-mother clearly did not like her.

According to Olga's description her foster-father was blond, relatively tall, slim, and apparently somewhat asthenic. He had been almost deaf since childhood and because of this he had been poorly educated and throughout his life he had great difficulty in reading and writing. He was very religious, very conscientious, and he took considerable care of Olga. Olga characterized him as "kind and good enough, in fact the only father I have had", but he was completely dominated by his wife and had little influence upon conditions in the home. Olga returned to her foster-parents for a short time at the age of 10, but her foster-mother forced the foster-father to send her back to the children's home. After Olga became an adult, she continued to keep in contact with the foster-father, and he once told her that he had often regretted that he had not stopped Olga's transfer to the children's home. He also stated that the foster-mother, who in later life was suffering from "poor nerves and biliary colic", and her children had only ever given him trouble.

Her foster-mother was a small, delicate, dark-haired, "choleric and hysterical" woman. She was, said Olga, unfaithful to her husband and two of her children were said to be illegitimate.

According to the files of the Institute of Human Genetics the foster-mother was admitted to a mental hospital when 42 years old. From the *case-records* the following information concerning her mental state might elucidate the conditions in Olga's foster-home:

Olga's foster-mother was brought up by her grandmother because her mother had died of tuberculosis. She married when young, had one abortion and three children. She was admitted to the mental hospital after an argument with her family because she declared a hunger-strike and threatened to leave the home or commit suicide by means of gas. Her husband was deaf and consequently very little fond of company. The family's life had been more or less normal until the German occupation of Denmark. There were three adult children, two daughters and a son, and the daughters began to fraternize with the German troupes. In the beginning, the patient found this so exciting and entertaining that she gave her daughters and their partners the run of the house, but when the girls exchanged their partners with new German soldiers, this gave rise to dissension and argument.

On being admitted, the patient was exalted, very talkative, criticized her husband and her children, but asserted that she only intended to frighten them. She presented no other definite psychopathological traits and was discharged after two weeks. Diagnosis: erethismus emotionalis.

With regard to Olga's step-siblings, *official records* contained the following information:

The oldest step-sister had a child by a German soldier and has been married several

times. She was known to be addicted to drugs. She was mainly supported by public relief and she had been sentenced to imprisonment because of embezzlement. The other step-sister, who was married to a musician, was said to be addicted to alcohol. No information was available concerning the step-brother.

Olga was in a children's home in South-East Jutland from the age of seven until she was 15. She was placed under supervision of the Child Welfare authorities. The *official documents* state:

Up to the age of 14 she was educated at the children's home. After this she was employed in domestic situations at two farms for six months at each place. Her employers were dissatisfied and described her as "dense, indifferent and lazy and instead of being paid wages she ought really to pay for her board and lodging".

Due to this, the head of the children's home reported to the Child Welfare authorities: "She has always been somewhat backward, almost afraid of work, but we hoped that she would learn to manage on her own. Instead she has deteriorated; she is now indifferent, will not work, and private homes cannot use her. For example, one may mention that one Sunday she left her new bicycle somewhere on the road and did not even know where she had left it. It took several days before it was found, and it was not she who found it. When asked about this she merely replied that she had not taken it home with her "because it was too exhausting to ride it" and she had therefore left it in a field. If she is not under constant supervision, she does nothing at all. Her behaviour is such that it is recommended that she be examined with regard to whether she ought to be placed under special care as a mentally defective".

She was examined by a psychiatrist, who stated: "Intelligence test (Brejning III) gives an IQ of 88.6. She is quiet, perhaps rather shy, but works well and with interest. She shows no imagination and is not apt to talk. Most mistakes occur in tasks which demand some cooperation from her, occasionally because she overlooks the point. She manages the practical tests well, but fails suddenly on a couple of them; when encouraged she pulls herself together but fails again later. Conclusion: With reservation because of the few data about her, one must regard her to be backward, but almost on the normal level. Her disability in practical life seems to be characterological; she has not been able to manage the transition from institutional discipline to normal life".

On this basis the Child Welfare authorities decided to return her to the children's home until she could be placed in a suitable private home. She was then 16 years old. At this juncture, due to the economic problems raised, the head of the home attempted to obtain information concerning her true parents: Her mother, who was still single, had been sentenced for vagrancy. When approached with regard to contributing to her daughter's keep she

suggested that the authorities instead placed the child in the maternal grandparents' home, but this solution was not considered to be satisfactory. Olga's father, who had married, did not pay maintenance for her. He had denied paternity, although her mother had stated that she had not had sexual intercourse with others during the period involved. (The documents do not mention that Olga had a twin sister).

When Olga had been at the home for six months she had behaved satisfactorily enough for her to be given employment at a farm. She was there for six months and at another farm for a year. As she carried out her work satisfactorily it was decided that she no longer needed supervision, and everyone seemed to have been quite optimistic about her ability to manage independently.

During *the interviews* Olga said that she was happy at the children's home. The conditions were good in all respects. There were 30 children. The head of the home and his wife took considerable care of each child, and Olga was much attached to them both, also in later life. She experienced no difficulty in school, although reading and writing did not come easily; she was quite good at arithmetic.

Olga gave a detailed description of her puberty. Her employers were not particularly satisfied with her, but in her opinion she had been placed in unsatisfactory jobs. Her first position was with a 60-year-old widower, a former farmer. She was at that time 15 years old. "He was bad, misused me, ought really to have been put into prison". Judging by her description there was sexual intercourse, and she asserted that she was at that time not fully aware that it was criminal.—"I had not been told about anything at all". In her next position she kept house for two unmarried brothers and their elderly parents. She managed quite well, but she was returned to the children's home because she had "lost her bicycle". She said that she had been frightened by a dog and ran home. Shortly afterwards she had been examined by a "psychologist" who had found that she was "mentally normal".

She remembered, although vaguely, that she had been in contact with her mother when 16 years old, when her mother visited the home. Her mother was about to marry, but did not dare tell her coming husband that she had a child. It was suggested that Olga might be cared for by her mother's parents, but Olga's maternal grandfather was addicted to alcohol and conditions in the home were poor. Olga disliked her mother and preferred to stay at the children's home, and the leaders supported this decision.

In her later employment as a maid, first at a farm and then at a recreational home, she had got on well, although she still felt that she was a "child from an orphanage"—thus, she was often suspected if something was lost, and had once been charged with theft and examined by the police.

After she was released from supervision at the age of 18 she had never

been in conflict with the law and had managed on her own. She obtained a job as a maid at a hotel in a sea-port on Fünen where she became acquainted with her future husband. He was a porter at the hotel, 13 years older than Olga, and had never been married before. They were married when Olga was 19 years old, mainly because she thought she was pregnant. She menstruated spontaneously shortly before the wedding was scheduled, but her partner "insisted" that they should marry. After a year they had a daughter and moved to her husband's home county in West Jutland. During the next few years they moved about and led an uncertain life. Denmark was occupied and her husband worked as a labourer at German aerodromes in Jutland and on Funen. Olga was consequently often left alone with her child in poor housing and with inadequate funds. At times they existed on unemployment relief, but they never accepted public assistance—"We have always been too proud to do so". They bought a small house but were "cheated" and got into debt.

When they married Olga had not realized that her husband was addicted to alcohol. His alcoholism progressed and made it impossible for them to stabilize their economy. After the War her husband had been employed as a labourer in the State Railways and finally obtained a post at a brickworks on the outskirts of a market-town in South-Eastern Jutland, and they had lived there since. They continued to live in poor circumstances; they had a small two-roomed flat in an old, damp farm-building near the brickworks, and had themselves constructed a small room for their daughter.

When visiting Olga's home I had the opportunity of speaking with her husband several times. He was a small man, hardly more than 150 cm. tall. He seemed to be primitive and taciturn, but not unintelligent, though unambitious and vacillating.

During the interviews Olga often criticized her husband. She stressed that they had married more or less by chance, probably because he was considerably older than she was and because they had both felt lonely. She "would really have preferred to marry someone else". She thought that their marital difficulties were mainly due to her husband, as he had been brought up in a poor home; he was the youngest of 15 children, his father and several of his older brothers drank, and his mother had "spoiled" him so he had grown used to expensive habits. He had never been brutal or violent, but he could be very unpleasant when he was drunk, they quarrelled daily, and she often thought of obtaining a divorce. He was careless with money, never paid his taxes or bills, and it was always difficult to extract money from him for clothing and housekeeping expenses. Because of this Olga had periodically had to find work, partly at the brickworks, partly at a textile-factory, although she had always preferred to stay at home and look after the daughter. Her husband did not want more children and therefore employed coitus in-

terruptus which Olga thought was to blame for her rarely obtaining sexual satisfaction. He had never been particularly active sexually, whereas Olga thought she was definitely above average in this respect. She admitted that, generally speaking, he was "as good as gold", fond of company, a skilled accordion player, fond of dancing and singing and exceptionally fond of animals, and they had some of these interests in common, but the main tie between them was their daughter.

Olga did not remember anything definite about her childhood diseases, but believed that she had had parotitis. She was a healthy child but perhaps rather "nervous", and, like most of the children at the home, she had nocturnal enuresis and periodically diurnal enuresis. Her enuresis terminated spontaneously when she was 8-9 years old, but she continued to have a pronounced "nervous" wetting, when cold or under mental stress. At the age of 10 she started to show a tendency to acne and boils, mostly localized to her back and face. Gradually she developed a permanent, itching and very embarrassing "eczema", which remained constant except for slight fluctuations dependent upon her mental state. She had consulted a dermatologist (who diagnosed a prurigo), as well as a natural healer. She had had a brief, though severe attack of urticaria with large, "burning" blisters, but otherwise no signs of allergic reactions.

She menstruated at the age of 12 and was prematurely developed sexually. Menstruation was rather irregular the first years but otherwise normal. When 13 she was admitted to the local hospital. The *case records* state:

Three weeks prior to admission knocked the groin against the handlebars of a bicycle. There was hypertrophy of the labii minoris; a tumor about the size of a nut was extirpated. Diagnosis: *deformatio labii minoris*.

When 18 there was menostasis lasting some months. She gave birth to her child when 19. Apart from pronounced "moodiness" due to loneliness her pregnancy was normal. She breast-fed the child for nine months without particular difficulty.

When 23 she was admitted again, as she believed that she had had a miscarriage. The *case records* state:

After parturition 4 years ago, copious, bad-smelling vaginal discharge. During the week prior to admission also abdominal pains, nausea and fever. (Husband recently treated for "infection of the urinal passage"). Objectively: tenderness of both ligaments, uterus retroflected, does not appear to be enlarged. Positive GR. Treatment: vaginal flushing and chemosept. Diagnosis: *gonorrhoea*.

She had not been hospitalized since and had, generally speaking, been healthy. Since puberty she had been overweight, a tendency that had increased since, and for some years she had been clearly obese. She was used to eating a lot since childhood. She did not appear to have thought that her obesity

was in any way pathological and had never thought of trying to reduce weight. She had smoked cigarettes ever since childhood. She had never liked alcoholic drinks. During recent years she felt "nervous" with a tendency to "headaches and tremor of the hands", but she had not consulted a physician about it. She did not take medicine.

I interviewed Olga's physician, who had known her for 6-7 years. He stated that she had consulted him when 29 years old for salpingitis-symptoms. She was at that time very obese (80 kg.) and he advised diet, but she did not adhere to it. Her basal metabolism was measured at the age of 32 (105-97 per cent). Menstruation was irregular, and she had a pronounced "prurigo" on her back and face, as well as hyperhidrosis and a slight masculinity in the form of increased growth of hair in the face, on her back and limbs. She was given carbon arc light, but this failed to give much improvement of her skin-disease. He described her as "a robust, somewhat primitive, but kindly person, living in disharmony with a manikin apt to drink whom she could get along without".

Olga's daughter. She was 16 years old at the time of our investigation. I also talked with her several times. She resembled Olga closely when compared with pictures of Olga when young. She was comparatively small, rather plump, premature in her physique. She appeared to be rather below average in intelligence, but otherwise normal. Ever since childhood she had been in Olga's confidence and appeared to be well-acquainted with the domestic problems. When an infant she had been "very nervous, restless and cried often", but later she developed normally both physically and mentally; in particular she was said never to have shown enuresis. When 12-13 years old she was admitted to the local hospital. The *case records* state: Only child, normal birth, 3,500 g., breast-fed for nine months. Developed normally, managed well at school, "nervous like her mother". Menstruated from the age of 12. About three months prior to admission scarlet fever; since then she has felt tired with oedema around her eyes. Objectively: well-nourished, early sexual development, probably not more than average in intelligence, rather shy. Pronounced lordosis. *Blood-pressure* 145/105, 135/85. Apart from intermittent albuminuria, routine laboratory tests showed nothing abnormal. Diagnosis: albuminuria orthostatica.

Olga stressed that she had always felt it important that her daughter should learn to work, keep her economic affairs in order and look after herself. Olga also stressed that it had rarely been necessary to punish her daughter corporally, and she may well have been "spoiled" as Olga gave her many presents, because she was often alone at home while her parents were at work. She had long wanted to be a nurse, but first she was to go into domestic training; this raised several problems as the daughter had since childhood suffered from a skin-disease localized to the palm of one hand, she was examined

by a dermatologist (diagnosis: *eczema toxicum e lavatione*) who advised against domestic work.

Addendum: After our investigation proper had been completed and approximately 4 years after the twins had met each other, Olga once again approached me.

She was at that time deeply depressed and said that she had left her husband some months previously and had moved to Copenhagen where she worked as a housekeeper. Her daughter had been forced to give up the idea of training as a nurse and had married a young mechanic. They had been married for some months and lived in Copenhagen, and this had been one of the reasons for Olga's decision to move there. Some days before her daughter had been admitted to a neurosurgical department, unconscious. She died two weeks later. (Diagnosis: *angioma arteriovenosum ruptura*).

For a few weeks I was in contact with Olga and during several long conversations she attempted an account of her life. She reproached herself vaguely because she felt that she—and especially her husband—had neglected their daughter's illness. In particular she was affected by the fact that the illness commenced just after coitus. Her mourning for her daughter seemed to be deep and genuine but at the same time well-controlled and realistic.

Olga and the twins' mother

The twins' mother approached Olga shortly after the newspapers had reported that the twins had met. During the next year Olga continued to keep in contact with her.

According to Olga's description and various photographs, the mother, who was now 52 year old, had a pronounced resemblance to the twins. She was relatively small, obese, had "the same cheek-bones" as the twins, and the same colour of the hair and eyes. She lived in the market-town in South-Eastern Jutland where she had been born, and said she was housekeeper for an elderly man. She received invalidity pension and had often been hospitalized during recent years.

She only gave Olga sporadic information about her life. Her mother had died when she was 14, her father married again and her stepmother did not like her. When she became pregnant at the age of 15, her family forced her to send the twins to fosterparents. She provided only vague and varying information about the twins' father; the only certain facts appear to be that he left her immediately. Olga's mother mentioned that she had been in love with a waiter who had died of tuberculosis, and this together with the conditions in her childhood home led to the various difficulties in her life. It was impossible for Olga to obtain information about her mother's life from the time she gave birth to the twins and until she married a glazier at the age of 36. Her husband was "a nasty chap" and she obtained a divorce after a few years. She had no children apart from the twins.

Olga gradually gave up the contact with her mother. She had hoped they would grow to like each other, but her mother was very different from what she had expected. Olga felt that they had little in common and mentally

they were, in fact, very different and "never on the same wave-length". Among other things Olga was offended by the fact that her mother never expressed regret at having been separated from the twins and that she had not particularly been interested in how they had got on. "I simply do not like my mother". She thought that her mother was emotionally blunted; Olga and her husband were rather shocked by her mother's vulgar behaviour when they once were with her at a restaurant; they got the impression that "when younger she must have been in contact with the lowest levels of society".

Olga was given some sporadic information by her mother about the twins' natural family. Olga's grandfather, who, judging by photographs, was a pyknic with moustache and pronounced cheek-bones, was a drunkard employed as a labourer and carter. Her grandmother, who died when still relatively young, was a small, slim, and asthenic woman who, according to photographs, looked tired and ill. Through her mother Olga established contact with a few of her mother's many siblings and their children, but apart from one aunt (after whom Olga had been named) she did not like any of them, and she was very disappointed indeed.

INGRID

Ingrid's foster-father was 45 and her foster-mother 43 when she entered their home at the age of two months. They were well-to-do farmers in North-West Jutland. They had been married for almost 10 years but had no children, probably because the foster-mother had had "chronic abdominal inflammation". Their desire to act as foster-parents was no doubt due to their being deeply religious, they were members of "Indre-Mission" (an evangelical branch of the Church of Denmark) and wished "to give an orphan a good home".

At the clinic where the twins had been born the foster-parents were urged to take both children, but as they had previously decided to take only one child they were allowed to choose. The twins had been christened, and "as they looked exactly alike they chose the one with the nicest name". About six months later they regretted that they had not taken both twins, but then Olga already had been placed with her foster-parents.

Ingrid grew up as an only child. She was never officially adopted but was in fact treated as an adopted child or "even as if I had been their own child". When she was 6-7 years old, she was told that she was not their child. Friends of her foster-parents mentioned it in her presence "out of pure spite", and her foster-mother admitted it. Ingrid clearly remembered that she became very unhappy, cried and "really never accepted it". At school and in later life she never mentioned that she was a foster-child, and it gave rise to various problems—among other things because her foster-mother hinted that her mother had led a "loose life". Ingrid did not know she had a twin sister until she was adult.

When Ingrid was three years old her foster-father died suddenly from "appendicitis". He was said to have been very fond of her. After some months her foster-mother sold the farm and bought a house in the market-town nearby. She had sufficient money so that she did not have to work.

Ingrid was closely attached to her foster-mother from early childhood and her foster-mother's religious attitude and independent means came to play a considerable role not only for Ingrid's mental development but also for her whole life. Ingrid characterized her childhood home as "a good home where I never lacked anything . . . it could not have been better if they had been my real parents". She was rather lonely as a child, without close friends, was always together with her foster-mother, who "spoiled" her and was also apt to take too much care of her and to be too afraid of illness. She was brought up relatively strictly and had been "trained religiously since a child". Due to this she was lacking in independence, very subordinated to her foster-mother, and a "nervous" child, anxious and quiet, with a pronounced fear of the dark.

She attended the local municipal school from seven to 14 years of age. She liked school, attached importance to doing well, as did her foster-mother. She was very good at arithmetic and also above average in other subjects. Her foster-mother wanted her to study, perhaps become a teacher, but Ingrid preferred to leave school; she often regretted it later. "I must have been clever enough and we had the money".

She continued to live at home for the first few years and was employed in domestic service at various places in the mornings, mostly in the homes of acquaintances. At the age of 15 she was away from home for 3 months at a continuation school in the neighbourhood. She had some problems during puberty because she made a conscious attempt to free herself from her foster-mother's influence. She was sexually developed at an early age and showed considerable interest in the opposite sex, but her foster-mother strongly opposed her participation in such activities as dance and visits to the cinema. She would have liked to learn domestic science, but her foster-mother obtained a job for her as shop-assistant at a bakery. When 17, she here met her husband. He was three years older than Ingrid, and an apprenticed baker at the time. They had sexual intercourse and married when she was 18, because she thought she was pregnant, but menstruation occurred spontaneously some months later.

Her foster-mother did not condemn her behaviour too severely: "She merely said that we ought to have a bad conscience and she helped us to get married". They moved into a flat on the first floor of her foster-mother's house but did not stay there long as very considerable opposition arose between her foster-mother and her husband's family. Their way of life differed radically and her foster-mother felt she had been "pushed to one side" and

dissociated herself from their "wordly life, cardplaying and such-like". Ingrid and her husband therefore took over a bakery in a remote village in the same county. They had economic difficulties, however, and also felt that they were "too young to let themselves be buried out on the moors". After about 6 months they had to move back to Ingrid's foster-mother, and they lived there for a year, while Ingrid's husband tried to manage a bakery in the town.

Economic difficulties arose again, and they decided quite suddenly to move to Copenhagen where the husband obtained a post as pastry-cook at a large restaurant in the centre of the city. Ingrid, who was 20 years old, worked as a shop-assistant. They lived under rather poor conditions. To begin with they shared a room and later shared a two-roomed flat with another childless couple. When they had been married for five years, they had their first child and at the same time took over the whole flat. They remained in Copenhagen for seven years. Ingrid stressed that for the first few years she was very happy and she liked the "free life of Copenhagen". "We had a lovely time, until we had children". The German occupation was in force and during the later part of the occupation Ingrid was very much affected by the black-out, the sabotage and street-fighting; she felt "nervous" and her husband, who had always wanted to return to the provinces, persuaded her to move back to her home town.

The relationship between Ingrid and her foster-mother and husband improved considerably. They arranged to take over Ingrid's foster-mother's house, let the first floor and lived on the ground floor, and the foster-mother moved into an old-age-pensioner's house nearby. Their flat consists of three rooms, they have a garden and good general conditions. They have four children. Ingrid's foster-mother has looked after the children and has been in daily contact with Ingrid. Ingrid's husband has a bakery which has prospered. Family life, on the whole, became harmonious and centered around Ingrid's children.

Ingrid said that her husband had always been rather "nervous" and had had "stomach ulcers". She characterized their marital relationships as "normal" but let one understand that previously there had been problems, especially in the sexual sphere. Otherwise she only made indefinite and tangential statements about her husband apart from stressing their many common interests, primarily music and literature; he played the violin, she the piano and both liked "good music, also classic music"; Ingrid read light novels and popular science; her husband was politically active, a social-democrat, and took part in study-groups.

When on a visit to their home I had the opportunity to talk with her husband. He was a man of medium height, strongly built, wore glasses and appeared to be a typically class-conscious, skilled worker, apt to overcompensate

sate with regard to being "a man of the people and from Jutland". He seemed intelligent, rather neurotic, but otherwise without remarkable traits.

I also had the opportunity of seeing Ingrid's foster-mother on one occasion. She was a sympathetic, well-preserved and undoubtedly intelligent woman, who very instructively informed me about Ingrid's upbringing. Ingrid's early psychomotor development had been normal but in many respects she was "precocious" particularly as regards walking and talking. She had never suffered from enuresis but had always had a pronounced tendency to frequent urination when she was exposed to cold or mental stress. Prior to school-age she had had parotitis, tussis convulsiva and morbilli—the latter was a severe attack that "retarded" her development. Apart from this there were no important illnesses until she at the age of 10 was treated as an out-patient for what appears to have been a severe maxillary sinusitis complicated by a fistula. She was given "electric" treatment and was advised "to take her holidays near the sea". At the same time she began to have "boils", localized especially to face and back, where there later was severe squamation and "eczema". This had persevered unaltered since and had been very itching and embarrassing. It varied with her mental state and her physician had said that it "probably was nervous". At the age of 16 she had an eczema-like disease localized to the one palm (apparently of exactly the same type as Olga's daughter's). Since adulthood she also had a tendency to urticaria, which manifested itself by reddish, itching skin eruptions occurring without known cause. She had never been examined by a dermatologist.

Menstruation commenced at the age of 12 and was always rather irregular but without molimina. At the age of 18 she had menostasis which lasted several months. Her four pregnancies and births, from 23 to 34 years of age, were quite normal. No still-births. She was able to breast-feed her first child for six months but after the next three births there was hypogalactia.

Ingrid had always been very anxious about her children, apt to be over-protective and afraid that something would happen to them, especially when they had the usual childhood diseases. Since she had had children, she felt unbalanced, "nervous", "my hands shake, I have headaches, feel tired and I am sometimes depressed and difficult to be together with". She had always found it difficult to be together with others, felt uncertain of herself, became glum, reserved and stiff and was consequently accused of being "sour". During later years she had been afraid that her nervousness might become worse when she entered her climacterium and result in "hysterical madness". She stressed that she had never consulted her physician about these symptoms and that she had always been very afraid of physicians and hospitals.

She had always had a large appetite, and since puberty she had had a tendency to be overweight but had attached great importance to keeping slim. She had smoked quite a lot ever since she was young, at one time

cigarettes, but now only cheroots. She had never liked alcoholic drinks. She occasionally took tablets against her headaches but no other drugs.

Ingrid's children. 1) *Daughter*, 12 years old when our investigation commenced. She suffered from enuresis nocturna and this worried Ingrid quite a lot. Ingrid felt that it was "hereditary" as her husband had also had enuresis when a child, and she would not accept her physician's assertion that it was "a nervous disorder". I talked with the daughter a couple of times. She resembled Ingrid when young (according to photographs), was precocious in her physical development, plump and had a pronounced acne. She appeared to be above average in intelligence; otherwise without remarkable traits. She entered the secondary school to study modern languages with the aim of later matriculating and studying pharmacy. 2) *Daughter*, 10 years old. 3) *Son*, 4 years old. 4) *Daughter*, 1 year old. All in good health and mentally without remarkable features.

THE TWIN RELATIONSHIP

Whereas Olga first discovered that she had a twin sister when the twins met at the age of 35, Ingrid had known about the existence of Olga since the age of 22, when told about it by her foster-mother during one of their few talks about the twins' family. Ingrid originally thought that the twinship might be the reason why she had no children after five years of marriage ("only one of a pair of twins could have children"), and when the twins met they were both surprised that the twin partner also had children.

Ingrid had often thought of trying to find her sister but had not done so partly out of consideration for her foster-mother, partly because she "did not know what it might lead to". Her attitude was ambivalent throughout in this respect; the night before their first meeting she could not sleep and would really have preferred not to have gone, and it was, in fact, her foster-mother who finally persuaded her to meet Olga.

During the interviews Ingrid often returned to her first impression of Olga. "I was immediately sure it was Olga and it was a peculiar feeling seeing "myself" get out of the train and come towards me". She realized that they resembled each other in many important respects both in their behaviour and mentality, but felt, nevertheless, that they differed, too. "I am more reserved, selfsufficient, Olga is more "experienced", is used to meeting strangers, but even so we are both emotional types . . . as regards the differences between us I rather think that I don't particularly like them".

She thought that these differences must be primarily due to their different upbringing, and that they would probably have resembled each other more if they had been brought up together, "so we could have helped each other and educated each other". The differences were also, she thought, partly due

to Olga being "an institution child who had never had a proper home". In her opinion they resembled each other particularly when young. "I think that when young we both liked to get about, but I was lucky as I was not allowed to go my own way too much. We were both interested in men early, but Olga was unlucky"; she did not doubt that Olga had been "more loose" sexually. She also stressed that their husbands were very different both in appearance and mentality. She failed completely to understand how Olga could have married "a man of that type"; she would never have done so herself and disliked his drinking and vacillation. She also criticized him for having worked for the Germans during the Occupation and stressed that her own husband had been "neutral". She only visited Olga's home once and did not like it; she considered that they lived in wretched conditions, and she abhorred their way of life and particularly Olga's husband who "threw himself down on the couch and used horrible language". Contrary to Olga she did not wish to meet her mother and said so immediately: "I am not interested at all".

Olga's attitude, on the other hand, was to begin with positive and she met Ingrid full of happy expectations. She had always very much wanted to have "a family". She thought at first that they "resembled each other in everything", although she realized that there were some differences in mentality and particularly speech—"I have always been able to play a triumph and say what I think, but she never does". She felt that they adopted the same attitude towards nearly everything, reacted emotionally in the same way and "were the same at heart". "I think that when we were young we were very much alike at bottom, for example about wanting to have a good time, but Ingrid was never allowed to do so and I never had the opportunity, but we both wanted to".

Olga first mentioned differences between them after some time, primarily that Ingrid had always lived in good circumstances and had been "spoiled" whereas Olga had been forced to manage on her own without help—"Everything we have we have bought ourselves". When comparing their homes she mentioned that she had always been an orderly person and thought it important that her child helped in the home as soon as possible, whereas Ingrid's home was very untidy and dirty because her children were allowed to do what they liked and never helped in the house. She thought their attitudes towards children were quite different, and that Ingrid "spoiled" her children, fussed over them and was far too anxious about them. Without hiding the failings of her own husband she nevertheless criticized Ingrid's whom she thought was boring, particularly because he was not very sociable and did not like to dance. She summed up by saying: "I certainly do not want to change with her".

At first Olga's attitude was so positive that she thought of moving to Ing-

rid's town, whereas Ingrid gradually withdrew from her sister. After about a year they had no contact with each other apart from sporadic letters. Among the reasons was their different attitude towards their natural mother and that Ingrid in various ways showed that she did not intend to accept Olga as "a full member of her family", for example by not inviting Olga to family parties. Whereas they at first conversed easily and when together had a feeling of solidarity, they gradually began to irritate each other, and finally even Olga admitted that their meeting had been very disappointing. Olga said: "It's not my place to say anything bad about Ingrid, but she resembles our natural mother to some extent".

When our investigation terminated three years after they first met, they no longer were in contact with each other. Both said outright that they wished they had never met, both felt that they lacked common childhood experiences and that the conditions under which they had been brought up had been "far too different".

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

While the twins through Olga's contact with their mother had some, although far from complete, knowledge of their mother's family, they knew nothing about their father's. A systematic search for information in various official registrations and documents, however, made it possible to construct a relatively detailed picture of the twins' natural parents and their family.

The father

According to information from *the national registration office* at the time of our investigation, he was 55 years old, married (for the second time), lived in a large market-town in Eastern-Jutland, and said his profession was that of a brushmaker. From the official records one learns that he had been sentenced several times. The *legal documents* state:

He was the 8th of 11 children from a labourer's home. His mother, who was early left a widow, had few means and could not manage the upbringing of her many children. No information was available on his father.

After leaving school the twins' father worked as an errand-boy, had brief jobs as a farm worker, later worked as a labourer, but was out of work for long periods, during which he earned his living by playing music and as "composer of verses and amateur actor". (He was 19 when the twins were born).

When 25, he was given a conditional sentence of 60 days due to burglary; he stole cigarettes and a banjo from a tobacconist. When 32, he was sentenced to 20 days for having sold a radio bought on hire-purchase. When 43, he

was given 60 days for theft of cigarettes and money, and when 44 he was charged with theft of a bicycle, but was not sentenced. He had three children by his first marriage, was divorced when 51; he had no children in his second marriage. No information was available concerning his state of health, apart from the fact that he was rejected for military service due to "poor sight and squint".

The twins' paternal half-siblings. 1) *Half-brother*, 30 years old, married, labourer, sentenced several times. The *legal documents* state: Poor home environment and no support from the home. Left school at the age of 14 and worked as an errand-boy and labourer. Sentenced to three months' imprisonment at the age of 20 for theft and fraud (ration-cards) but put on probation. He was put under supervision, but two years later committed another theft (money and a watch) and was given 4 months. When 26 sentenced to 60 days (sold a radio obtained by hire-purchase) and two years later he was fined for having sold tools obtained from his place of work. The police describe him as a "thin, light blond man with wide, thick lips and a broad nose", quite good-natured, but unstable, easily influenced, vacillating, untrustworthy and lazy". He was out of work for various periods and received public assistance. After having married he seems to have become more stabilized. No information concerning his state of health was available. 2) *Half-brother*, 26 years old, unmarried, cook's assistant. When 14 years old he was placed under the supervision of the authorities due to mental deficiency. The *case records* state: A paternal uncle was "backward", but otherwise there is no known predisposition. His parents were divorced. Birth and early somatic development normal, but quite early he showed signs of being of poor intelligence and from the age of nine he was in a class for backward children. He was teased by his school-mates but was good-humoured and pleasant. His father had him examined at the age of 14 with regard to whether it was possible to have him apprenticed. He was then described as a small, thin child, adenoidal and with a poor stance, very childish and of poor intellect. His IQ (Brejnings test III) was 67. He was placed in a home for mentally deficient and later with a foster-family. He had several jobs which he left without notice. When 16 he was again examined with the same test (IQ 61-65). Gradually he became more vacillating and peculiar in his behaviour, "very ladylike with fine feelings". When 26, his IQ according to Binet's test was 77. Score on Raven's Progressive Matrices: $9 + 5 + 2 + 1 = 17$. He had since managed well, but continued under supervision. 3) *Half-sister*, 24 years old, married to a labourer. Had been in a special school for backward children and was probably slightly mentally deficient. No other information available.

The mother

According to *the national registration office* she lived in the town where she was born—an East Jutland seaport. She was 52 years old, divorced and called herself "an unpaid housekeeper" for an older man. She had had disablement-pension since the age of 45, and had been hospitalized numerous times during the past years. When younger she had repeatedly been in conflict with the law. *Various official records* (legal documents, papers concerning invalidity pension and hospital case-records) provide the following information:

Her father, who grew up in a day-labourer's home and was one of many children, originally was a docker, but later worked as a brewer's driver. He drank a good deal, but was otherwise healthy until he died at the age of 69. The *case records* from the hospital describe him as "a fat man with a short, thick neck and a plethoric appearance"

(*death certificate*: cerebral apoplexia). Her mother came from a small-holder's who had many children. She married the twins' maternal grandfather when still young, had nine children, and died when only 42 years old (*death certificate*: cancer uteri).

The twins' mother was the 4th of 9 siblings. She attended a municipal school where she is said to have managed average standards. She was 15 years old when her mother died, and she helped her father look after the younger children. Shortly afterwards her father married a 22 years old domestic servant. The twins' mother, at the age of 16, started training as a domestic servant at a hotel in her home town, but stayed there only half a year as she became pregnant. After she had born (the twins) she stayed with her father and step-mother for a time, but did not have harmonious relationships with the latter. When nearly 19 years old she was admitted to the local hospital. Diagnosis: syphilis (she had had coitus with a chance acquaintance from the street).

Immediately after this she left home and went to a large town in Jutland, where she worked as a domestic servant and started to live as a prostitute. When 20 she left for Copenhagen. When 21 she was given 100 days' imprisonment for having spread venereal disease, was again admitted to hospital and several times given forced labour. She, nevertheless, avoided both medical and police control and finally her trace was lost until she at the age of 24 was found living in a slum in a large town on Funen with the official status of housekeeper. She was admitted to the local hospital for observation for venereal disease (WR -). During the same year she was twice sentenced to 30 days' imprisonment for vagrancy and theft. The theft had been committed when she and a friend had been on board a ship; while her friend had sexual relations with the cook, she had stolen money from him.

When 28, she was again in Copenhagen in "Vesterbro", a slum quarter frequented by street prostitutes. The morality-police had her under observation for some time: "a small, fat woman in a long, black silk-coat, who is in company with various men and apparently earns her living by prostitution". She lived with a waiter who presumably functioned as her pimp, and she was arrested at her door immediately after having finished with one of her customers. She denied all charges and even after her identity had been decided by means of fingerprints, she still asserted that she was not the person concerned but was called "Olga" (the name of an elder sister). When asked directly when she had last had coitus, she answered sharply: "I do not care to answer such a question". She was sentenced to 30 days' imprisonment.

Having completed the sentence she stayed a short time with her father and then returned to the town in Jutland mentioned above. The morality-police here soon came to know her well—the reports call her "Fatty". She maintained that she was a seamstress, but was believed to earn her living by walking

on the streets and serving customers after closing time in various illicit drink-shops. Between 31 and 34 years of age she was several times arrested or taken to a police-station, once because she had argued with a customer about the amount that was due. On another occasion she had after a drinking-bout at her home gone home with a cattle-dealer in his car and during coitus in a wood had taken his money. She was fined further four times and at the age of 34 she was charged with theft and with illicit sale of alcohol.

At the age of 35 she married a 29 year old glazier. They lived in a market-town in Jutland. Her husband had never been in conflict with the law, he periodically lived on public assistance. A year later they both were charged with theft. In company with her husband's unmarried sister she had been to a restaurant and here had met a labourer; she took his money during coitus at a drinking party in her home. She was fined 300 kroner but her husband was acquitted. They were divorced after five years (no children), and since then she had lived in her home town.

Since the age of 38 she had been repeatedly admitted to hospital. The *case-records* state:

- 1) Admitted when 38 years old. Menstruation from the age of 13, always irregular with premenstrual molimina. Gave birth (gemelli) when 17. Syphilis when 19, treated with mercurial and bismuth compounds. A cyst, which weighed 4 kg., was extirpated (microscopy:?). Diagnosis: cystis ovarii dextra.
- 2) Again hospitalized when 39. Weight: 96 kg., height: 159 cm. Diagnosis fibroma uteri, adipositas.
- 3) 43 years old. Explorative laparotomy was performed: "The left ovary was about the size of a child's head, nodous and adherent to the surroundings". Extirpation was considered impossible and X-ray therapy was given. Diagnosis: fibromyoma uteri.
- 4) 46 years old. Had lost weight and had slight dyspeptic complaints and epigastric pain. Menopause following X-ray castration when 43. The tumour had grown and there was obstipation, frequent urination and sometimes involuntary release of urine. She also complained of precordial pain, palpitations, dyspnoe, and "smoker's cough" (smoked a lot of cigarettes). For periods of up to six months injections of morphine, three times daily, as well as opium in drops. She was cancrophobic to a pronounced degree and wanted to be operated upon. Diagnosis: tumor abdominis inoperabilis, gastritis.
- 5) When 47, again admitted to hospital. No treatment was given. Diagnose: same.
- 6) 49 years old. The tumour now the size of a man's head. Laparotomia cum oophorectomia sinistra was performed. Microscopy: multilocular, papillary, malignant cyst of serous-pseudomucinous type. A macroscopical resemblance to a dermoid cyst could not be verified. X-ray therapy was instituted. Diagnosis: cystadenoma malignum.
- 7) 50 years old. Abrasio mucosae uteri was performed. Diagnosis: fibrosis uteri.
- 8) 51 years old. Diagnosis: hernia ventralis (following the laparotomy).
- WR: -. 9) 54 years old. On admission she was inebriated. She

was given blood-transfusions (blood-type: B, rh -). Diagnosis: fractura malleoli. During her later hospitalizations she was described in the case records as: "aged, apathetic, dull, sluggish, dysmnesic, probably a narcomaniac".

The mother's siblings. 1) *Sister*, 59 years old, married to a labourer. No further information available. 2) *Sister*, died at the age of 57, was married to a beer-vendor in good circumstances, three children. Hospital case records state: Admitted when 57: No serious illness until menopause at the age of 44, then climacteric complaints and "nervousness". At the same time she became overweight. For some years intermittent and later chronic abdominal pains. Took a considerable amount of medicine (opiopapaverin and allypropynal), was depressed, presumably because of conditions at home. She was full of complaints, prolix and gave very imprecise information. Diagnosis: colitis chronica. Readmitted three months later because of a "nervous break-down", was depressed, weeping, and stated herself that she was a narcomaniac. Diagnosis: abusus medicamentalis. About eight months later readmitted due to jaundice. The examinations showed hepatic insufficiency. Her state deteriorated gradually and she finally died. Clinical diagnosis: cholelithiasis, complicated by chronic cholangitis and secondary cirrhosis. (*Death certificate*: cancer abdominalis (pancreatitis?)). (Obduction was not performed as the family would not admit it). 3) *Brother*, 55 years old, unmarried labourer. According to *legal documents* he was fined when 26 for having driven a car without a license and for the car not having number plates; three years later warrant for canvassing. No information was available about his health. 5) *Brother*, 50 years old. No information available. 6) *Brother*, 46 years old, unmarried stoker. Apart from malaria apparently no serious illnesses. *Legal documents* state: Wanted by the police when 28 years old because of failure to pay maintenance to an illegitimate child. When 46 arrested when inebriated and during the same year fined for having deserted his ship. 7) *Brother*, 43 years old, married, labourer. On public relief for some time when 33 years old. No information concerning his health. 8) *Sister*, 42 years old, married to a labourer, a widow when 40, remarried, divorced and working as a shop-assistant. No other information available. 9) *Brother*, 40 years old, married labourer. *Legal documents* state: Brought up by his father and stepmother. Normal education, after this a farm labourer, later a tent-man in a travelling circus and for some years "contortionist" in Copenhagen restaurants. Married when 24, four children. When 19, warned twice for canvassing. At the age of 38 put on probation for theft and receiving stolen goods. (He and two of his friends had stolen metal from various firms). At 41 charged with having smuggled a large number of cigarettes. A police officer, who knew him well, stated in the report: "He is the youngest of nine children. His father, who was a docker, was drunken in his younger years, and the home suffered greatly from this. His mother died when he was three years old. He has never been able to get on well with his stepmother. As opposed to most of his brothers and sisters, who have managed quite well, he has wandered around ever since he was confirmed and first when he married started to lead a quiet life. He does not seem to be particularly intelligent, but although he is rather dull and sluggish, he is sensible and not without a sense of humour. He has had various jobs, and when out of work got a job with a group who practice theft of metal. It is my impression that these factors have played an important role, and it is therefore recommended that the case be finished with probation and that he is put under supervision". He was fined. No information available concerning his state of health.

Summary of the supplementary information

The father, who was brought up in a poor environment by a mother who was an early widow with 11 children, had no proper education and experienced great difficulties in managing his life. He was father of the twins when

19. He later married and had three children, was divorced when 51 and had no children in his second marriage. He seems to have been rather vacillating, and between the age of 25 and 43 he was often in conflict with the law because of petty theft and other slight offences. One of the twins' paternal half-brothers was sentenced several times for petty crimes and also seems to have been a social misfit, easily influenced, lazy and vacillating. Another half-brother was placed under supervision of authorities due to mental deficiency. A half-sister seems to be slightly mentally deficient, and one of the twins' paternal uncles is also said to have been backward.

The mother was also brought up in poor circumstances. She was one of nine children and her mother died when the twins' mother was only 15 years old. Her father, a presumably alcoholic docker, married again and her stepmother was far from fond of her. During puberty she seems to have had little support from her home. At the age of 16 she became pregnant and had twins who were sent to fosterhomes. At the age of 19 she contracted syphilis and shortly afterwards she left home. When 21, she was imprisoned for having spread venereal disease; she became a prostitute and up to the age of 35 she was almost constantly in conflict with the law. She married at the age of 35 but was divorced after five years. She had been repeatedly admitted to hospital mainly due to cystes of the ovary and she finally became an invalid, mentally blunted and was probably a narcomaniac. Three of her brothers had been punished for petty thefts and other minor offences when young. There seems to be a pronounced predisposition to obesity in the twins' maternal family.

To summarize briefly, thus both parents of the twins were socially maladjusted and could be classified as probably psychopathic personalities.

CLINICAL EXAMINATIONS

Olga was interviewed 9 times, Ingrid 6 and both twins together twice. I visited each of their homes three times and had interviews with their husbands and daughters, Olga's physician and Ingrid's foster-mother.

The twins resembled each other closely; they looked about five years older than their age and had a rather "matronly" appearance. They were relatively short, Olga 155 cm. and Ingrid 154,5 cm., and both were rather obese, Olga (78.5 kg) clearly more pronounced than Ingrid (70.0 kg.). The distribution of fat was mainly of truncular type, the difference in panniculus adiposus was most pronounced in the face, whereas the limbs were relatively thin and short. Their hair was dark blonde, identical in colour and consistency, straight without any tendency to wave. The hairlines were identical, both had their hair parted on the left and the hair whorls were anti-clockwise. Their eyes

were greyish-blue and similar (cf. the ophthalmological report). The shape and size of their heads, the position of their ears, the free lobes and the details of the ears, the surroundings of the eyes and their noses were very similar, indeed; both had characteristically slightly protuberant cheekbones. There was a slight difference between their mouths clearly due to Olga's total upper denture which fitted badly, whereas Ingrid had an excellent partial upper denture; both had defective teeth in the lower jaw and many fillings.

Both twins had more than the normal amount of hair on the crura, fore-arms and face; usually Olga had slight barbae, whereas Ingrid, obviously, shaved frequently. There were no signs of masculine tendencies otherwise and the pubic hair was normal. Both twins had a typical, widespread acne seborrhoica, most pronounced on the back and somewhat more pronounced in Olga than Ingrid. The other somatic examinations disclosed nothing abnormal. Blood-pressure was normal. Both were right-handed.

They resembled each other very closely in their behaviour during the interviews, particular their posture, gait and gestures, and their voices. Their facial expressions differed when relaxed, Olga looking more "jovial", Ingrid rather "glum", but they were very similar when they smiled. Their clothing was not particularly similar although influenced by fashion and their type. Neither used cosmetics.

During the interviews they were both very cooperative. They manifested obvious differences regarding their interest in and ability to establish emotional contact.

Olga seemed to be the one who was most interested and easiest to establish rapport with, but the contact often was only transient. She seemed to be open and at ease, uninhibited, simple, impulsive, almost primitive, and she was much more talkative than Ingrid. She expressed her opinions quite, made many spontaneous remarks which were sometimes very naive, direct and almost "shameless". She made no secret of her interests in the material aspects of life and did not attempt to give an impression that she was in any way exceptional.

Ingrid was far more reserved; critical and controlled, even though she also was interested in establishing emotional contact, which sometimes was very genuine. She seemed far more uncertain of herself than Olga, hesitant and sometimes definitely evasive. She usually answered first after having considered the question for some time, and she made relatively few spontaneous remarks. Sometimes she suddenly retreated, looked directly negative or "insulted". To some extent she appeared to realize the impression she gave other and later often tried to stress her cooperative attitude or give her speech particular warmth. It was undoubtedly also characteristic that while Olga was very interested in the newspaper reports about them, Ingrid was rather

disturbed. On the other hand, she was very interested in the aims of our investigation, whereas Olga never commented on this matter.

Their attitude towards each other was ambivalent. Whereas Olga at first always referred to herself and Ingrid as "we" and stressed their likeness to each other, Ingrid often let it be known—sometimes by a pregnant silence—that she did not always share and did not feel responsible for her sister's opinions. Later, Olga expressed herself very critically about Ingrid, whereas Ingrid's criticism on Olga continued to be subdued. When together, they both were sometimes very assertive, argued a little, but never allowed the other to domineer.

They both appeared to be of normal intelligence, but there was an obvious difference in ability, Olga appearing to be rather under average, whereas Ingrid seemed to be above average. This difference seemed primarily to be due to their different attitudes; Olga was rather indifferent and Ingrid obviously ambitious and better informed. This impression of their intellectual capacity was perhaps less determined by what Ingrid actually said than by what she, contrary to Olga, did not say.

Although they manifested obvious differences both in intellectual capacity, character, and in their emotional reactions they, nevertheless, resembled each other closely in various facets of their personalities, particularly as one came to know them: Both were mainly extroverted, emotionally labile and impulsive but at the same time very self-asserting and "sthenic"; neither manifested obvious neurotic symptoms, but both had mild anxiety reactions and hysterical traits which were most pronounced in Ingrid. Neither could be said to be mentally abnormal.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Olga

Tried to solve 60 matrices in 25 minutes. She was jovial and continued to be in good spirits although she did not manage the last part of the matrices. Score: $12+9+6+6+1=34$. The distribution was normal; discrepancies: 4. Group: 25-50 percentile. Conclusion: normal intelligence.

Ingrid

Attempted 53 matrices in 26 minutes (Matrices E_{6-12} were not attempted). Rather sulky, seemed tired, complained of pain in her eyes about the middle of the test, but could be persuaded to continue. Her explanations of her solutions were often rather vague and inadequate. Score: $11+8+7+3+2=31$. The distribution was normal; discrepancies: 4. Group: 25-50 percentile. Conclusion: normal intelligence.

Wechsler-Bellevue

	Olga				Ingrid			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	12	9	12	9	15	11	19	13
Comprehension	7	6	9	8	7	6	10	9
Digit Span	5+4 = 9	6	5+5 = 10	7	6+4 = 10	7	7+4 = 11	9
Arithmetic	6	7	6	7	6	7	6	7
Similarities	15	12	13	11	17	14	15	12
Vocabulary	(22)	(10)			(28)	(12)		
Verbal Points		40		42		45		50
Picture Arrangement	8	7	8	7	11	10	10	9
Picture Completion	10	9	10	9	10	9	11	10
Block Design	18+3 = 21	10	18+2 = 20	10	18+1 = 19	9	21+2 = 23	11
Object Assembly	18+2 = 20	12	18+2 = 20	12	18+1 = 19	11	17+1 = 18	10
Digit Symbol	30/30	7	27/27	6	35/36	8	32/32	7
Performance Points		45		44		47		47
Total Points		85		86		92		97
Verbal IQ		94		96		99		105
Performance IQ		103		102		105		105
Total IQ		99		99		103		106

Olga

Her behaviour was in the main as described for Raven's Matrices. She was relatively cooperative, but did not work particularly energetically. Her performances on the verbal tests varied; the low scores on Arithmetic and Comprehension are especially remarkable. Her general level of Information is poor throughout, but the results for Similarities as well as other tests show that she is undoubtedly of normal intelligence. Her results on the performance tests also fluctuate, and perhaps the most interesting result is the low score on Picture Arrangement. On *retesting* (31 months later) nearly all the scores remained unaltered. Conclusion: normal intelligence (marked by primitiveness).

Ingrid

She cooperated better than on Raven's Matrices and seemed to attach some importance to how well she did; her performance was best when the task appealed to her, but it seemed that there was considerable latent impulsiveness and she was sometimes uncompromising and negative, particularly toward Arithmetic. Her results on the verbal tests fluctuate considerably, and her low scores on Comprehension and Arithmetic are noteworthy. She did best on Similarities and quite well on Information. The fluctuations on the performance tests are slight. On *retesting* (22 months later) she scored somewhat better on Information and Comprehension but otherwise the differences between the two tests, also on performance tests, are slight. Conclusion: normal intelligence (marked by tenseness and intellectual ambitiousness).

Rorschach

Olga			
9 W	16 F+	1 H	8 P. 3 Orig (—/+)
23 D	1 F+/-	0 Hd	F+ 70 (extended 70)
2 DdD	6 F-	25 A	F = 100 - L = 66

1 Do	2 M	4 Ad	A = 76
3 Dd	1 M in Dd	1 Anat	Affective ratio: 37
<hr/> Total: 38	1 FM	1 Bt	RT: 0.7 min. (I-VII)
	1 FM—	3 Ls	0.4 min. (VIII-X)
	3 FC	1 Obj	Seq.: orderly-reversed
	4 CF	1 Scene	Ap.: W—D!
	3 FY		Exp. 2—3/5½
			Colour shock? Shading shock

Tendency to self-criticism, perseveration, and low "experience-awareness"; denied and question-like answers, descriptions of card-symmetry; pseudo-selfreference. Achromatic Colour? Card-turning.

Cooperative and positive in her attitude even when she found the task difficult. She showed her uncertainty openly, asked questions and was apt to think that it was her fault when she did not manage well. She seemed rather naive and concrete.

Psychogram: Presumably of normal intelligence, rather desirous of demonstrating her ability, particularly if this can be accomplished in a rather childish, imaginative and emotional manner. The frequent stereotypes and perseveration are probably largely due to mixture of uncertainty and desire to manifest her ability, as is also true of her occasional interest in details. On the other hand, she did not always maintain her self-critical attitude and her reactions to emotional subjects were sometimes maladapted. Emotionally one finds the same attempt and desire to adjust and, on the other hand, considerable susceptibility, affective reactions and liability. She thus seems to be rather primitive and egocentric, but also lively and naive. The underlying uncertainty and special identification problems will, however, leave their mark on her ability and wish to contact others. One must expect that there can arise the desire to keep people at a distance and possibly there are signs of anxiety. Her defences appear to consist especially in repression and projection. Compensation appears to be generally good and in daily life she ought to show that she is an able woman. It seems that the variations in her defence mechanisms, her ambivalence and neurotic traits make it difficult for her to obtain fully effective and lasting adjustment. One must expect moderate depressions but apart from this she is probably more sthenic than asthenic. It seems likely that she has problems in her relationships with parent-figures and sexual matters.

Double-blind test

Woman, probably elderly, difficult to evaluate from the test. Presuming she is elderly it seems that she is of normal intelligence. She is probably liable to express herself vaguely and there is possibly difficulty in mobilizing word-symbols (probably not due to intellectual reduction?) rather than a (characterological) tendency to avoid definite opinions and engage herself. Her way of thinking seems too naive to make use constructively of the resources her imagination provides her with. At the most she stops at childish day-dreams. She seems to seek contact with others, but superficially and talkatively. She is presumably too infantile and self-centred to be able to establish less superficial, more mature relationships. She appears to be emotionally susceptible, labile and suggestible. The test structure is rather hysterioform.

Retest (31 months later)

8 W	16 F+	8 H	8-9 P. 10? Orig (+ + / -)
19 D	2 F+/-	7 Hd	F+ 75 (extended 75)
1 DdD	4 F-	10 A	F = 100 - L = 63
1 Do	3 M	10 Ad	A = 50
11 Dd	1 M—	1 Cl	Affective ratio: 30
<hr/> Total: 40	3 M in Dd	1 Fire	RT: 0.5 min. (I-VII)
	1 M— in Dd	2 Ls	0.7 min. (VIII-X)

2 FM	1 Obj.	Seq.: orderly-reversed
1 FM—		Ap.: W—D—Dd!
2 FC		Exp.: 3-6/3
2 CF		Colour shock? Shading
3 FY		shock.

Tendency to self-criticism and perplexity?, denied answers; "localization"—"perseveration". Achromatic colour? Excessive card-turning.

The number of responses is the same as before; very few answers (8-11) are repeats. Her behaviour appeared more moderated, she was more confident.

Psychogram: The results differ in various respects from the first test. Probably this is due to a change in her attitude or in the test situation. As in the first test she seems to be of normal intelligence, but the more imaginative aspects as well as her more infantile aspects are more manifest. She is now able to give rather unusual and original responses, but is apt to be too far so they become stereotyped and very detailed. This does not appear to be pathological, as it corresponds to her naive and immediate personality. As before, one must presume that she is apt to project, but otherwise she now seems more introverted than before. There are, however, still many signs of extroversion and emotional susceptibility. Her tendency to react impulsively is almost clearer now than in the first test and her interest in establishing contact with others seems to be more pronounced. Basically, however, there is still lack of confidence and the latent feeling of insecurity, but her compensation appears to be slightly better than in the first test and probably her state has altered somewhat during the interval between the tests.

Ingrid

8 W	9 F+	2 H	6 P. 3 Orig (+ +/—)
+ Ws	4 F+/-	3 Hd	F+ 79 (extended 78)
9 D	1 F—	3 A	F = 100 — L = 61
2 Ds	1 M	3 Ad	A = 26
4 Dd	1 M in Dd	1 Arch	Affective ratio: 26
Total: 23	4 V	1 Art	RT: 0.7 min. (I-VII)
	2 FY	1 Cl	1.0 min. (VIII-X)
	1 YF	2 Cg	Seq.: orderly?
		3 Ls	Ap.: W — (D) — Ds — Dd
		1 Obj	Exp.: 1-2/0
		2 "Water"	Colour shock, shading shock
		1 Other	

Tendency to exclamations, forced laughter, dejections, object-criticism, and rejection-reactions; aggressive pseudo-appeal; preference of central areas and naming areas without giving interpretations.

Quite cooperative, but she undoubtedly attempted to retain control over the situation. When in difficulties she was occasionally obviously aggressive, although she superficially appealed.

Psychogram: Of normal intelligence, rather more likely to be above than below average, with a varied although rather "impersonal content". Her level of aspiration (Anspruchsniveau) is high and she will often be critical, not only toward others but also about herself. She is then capable of being downright contrary in her attitude and opinions; at the same time, however, her most remarkable responses occur in connection with her intellectualization.

One must assume that there was considerable, latent anxiety in the test situation.

Emotionally she also manifests strong defensive mechanisms toward impulses and affect. Whereas her emotional life is marked by inhibition, her basic mood appears to be quite varied and there may be regular, though moderate, depressions. Her contact with others is affected by efforts at control and desire to keep at a distance. Behind her certain degree of efficiency and superficial adjustment there appears to be insecurity and latent anxiety, probably especially in connection with the feminine and sexual role. She will react mainly sthenically toward the problems she has in establishing contact with others and will adopt a critical, "hard and sharp" attitude. It thus appears that she has both sexual problems and problems in her relationships with others.

Double-blind test

Probably a woman, middle-aged? Presumably of normal intelligence, but very unsure of herself and evasive, probably tries to avoid situations that demand much of her both intellectually and in her contact with others. When anxiety is provoked she is likely to give up completely. She has particular difficulty in concentrating on her task and in mobilizing word-symbols when provoked. More deeply she appears to be emotionally inhibited, but probably manifests a certain degree of superficial emotion. She seems very susceptible to emotional stimuli and tense. There are tendencies toward opposition in the test, but her aggressiveness probably does not show itself openly—will more likely manifest itself in defiance and passive provocation. She is probably superficially interested in others but has hardly much ability to comprehend their situation; her contact with others will presumably be marked by a conscious, superficial manner, whereas she presumably finds it more difficult to establish immediate, cordial, emotional rapport. Discrete hysterioform traits?

Retest (22 months later)

4+1 W	8 F+	1 H	5+1 P. 0 Orig?
1 WDs	1 F+/-	1 Hd	F+ 85 (extended 82)
9 D	1 F-	6 A	F = 100 - L = 72
<hr/>	2 M	1+1 Ad	A = 50
Total: 14+1	1 CF	1 Bt	Affective ratio: 43
	1+1 FY	2 Cg	RT: 0.9 min. (I-VII)
		2 Ge	0.6 min. (VIII-X)
			Seq.: indeterminable
			Exp.: 2/1
			Colour shock, shading shock.

Tendency to object-criticism, rejection-reactions, preference of central areas.

Her behaviour had altered somewhat as she now seemed more sulky and reserved, sighed, looked out of the window, pushed the cards away after an average of one response and asked "Have you got the heart to keep on?"

Psychogram: Due to the lower number of responses and the quite common number of repetitions (6-7 answers) one cannot expect to find important new aspects. Particularly the unusual, detailed, oppositional and intellectualized processes appear now to be either less pronounced or completely absent. This is probably due to a more negative attitude toward the test as she still appeared to be provoked by the material. On one of the cards she blocked completely the first time. Her affect, which previously was mainly presumed, now appears clearly, although in only one response. Otherwise she still tries to inhibit and control her emotions. She will also react strongly to external impulses that threaten her forced attitude and position, averting and compensating, perhaps really because they in some cases correspond to her own latent impulses; her defence-mechanisms seem to be more or less efficient. If this compensation fails, one must expect pronounced reactions.

*Word Association Test (a. m. Rapaport)**Olga*

Her behaviour resembled that during the Rorschach test. She is easily provoked but manages by combining her desire to express herself with a certain degree of "disinterestedness".

Results: Most reaction-times were short or average, and only one was over 10 seconds ("husband"). The longest reaction-times were otherwise 6-9 seconds ("Stomach", "intercourse", "hunger"). Most reactions were simple and manifested her rather primitive and emotional, but also her realistic, attitude. There was, however, clearly interpersonal-sexual problems, ambivalence. Her defensive mechanisms were rather primitive (flight, posing and reaction-formation).

When the list was presented the second time, more reaction-times were prolonged than shortened. The percentage of repetitions was low (50 per cent). The long reaction-times disappeared. It seemed that, in spite of being provoked, she could not help "engaging herself", and this is probably why she did not compensate and neutralize her emotions, so that all her problems are as manifest as they were before. From a qualitative point of view there is no reason to alter the previous description of her personality.

Ingrid

She was rather provoked. Her reactions alternated between a tendency toward blocking (repetition of the stimulus-words) and a rather "posing" fork of agitation and "joking" and forced laughter; the latter reaction, however, almost only occurred at the beginning, and she responded to all words.

Results: The reaction-times were usually short or average. The longest reaction-times were 5-8 seconds ("men", "wound", "bite", "gun", and "husband"). As described for the Rorschach test she showed a rigid, controlled attitude and made attempts to adopt an intellectual attitude. It seemed obvious that she was "fighting" against the more immediate (emotional and extrovert) reactions.

When the list was presented again, more of the reaction-times were prolonged than were shortened. The repetition percentage was low (9-10 per cent). The longest reaction-times were 6-10 seconds and in response to quite new words ("accident", "fight", "woman", and "friend"). Her problems were as manifest as previously, but apparently she had been forced to use more affected and peculiar reactions.

Summary and comparison of the test results

The twins are of normal intelligence with a basic resemblance in intellectual pattern. Olga's ability is probably a little below, Ingrid's a little above, average. The differences between the results for the psychological tests correspond to manifest differences in ability, and are presumably due to their different attitudes towards the testing and to different environmental factors. Thus, Ingrid seems to be better informed and also more ambitious and tense, reacted emotionally when she encountered difficulties and was rejected and pseudo-appealing, whereas Olga was more indifferent, less tense and seemed to be more labile and less inhibited, more immediate, naive, and determined by fantasy in her reactions. Nevertheless, she seemed to have encountered various difficulties, and she also to some degree lacked self-confidence. Ingrid obviously tried to retain control of a situation and to keep things at a distance. She manifested her emotions less obviously and if her defence and

status are threatened, she will probably be provoked easily and try hard to regain her equilibrium.

The way in which they seek contact with other people is thus different, and their latent desire for contact is presumably also different; Olga's need for contact is presumable more pronounced than Ingrid's. To a large extent these differences are due to differences between their defensive mechanisms. Olga's consist mainly in repression, projection, and "posing", whereas Ingrid's are mainly reaction-formation, denial, isolation, and intellectualization. Ingrid has probably had greater possibilities for identification and introjection than Olga.

The results of the tests, nevertheless, resemble each other considerably as regards the personality structure. Both are mainly extroverted, sthenic, and repressive. It is difficult to classify them definitely as regards their personality, but it seems doubtful whether either is psychopathological. Olga has manifest problems and conflicts but they have, however, not given rise to obvious neurotic reactions, and although Ingrid seems to be more neurotic, she has also compensated effectively.

OTHER SPECIAL EXAMINATIONS

EEG. The results are remarkably similar. Both have an alpha-rhythm of 9.5 hz; amplitude 35–75 μ v and the distribution in time of dominant activity calculated as a percentage of the total period was 80–90 per cent. In both cases the alpha-amplitude and diffusion increased during hyperventilation and activity was inhibited during flicker. Olga had no abnormal potentials, whereas Ingrid had occasional trains of 6 hz potentials frontally. Conclusion: Normal in both cases.

ECG. Considerable resemblance in all details. Conclusion: normal results in both cases.

Ophthalmological examination (Summary of report). Normal conditions. Iris: greyish-blue. Great resemblance between the twins in all details, especially striking is the presence of three pigmented dots in the left iris in both twins, the only difference being that the dots are more distinct in Olga, more blurred in Ingrid. Ophthalmoscopy shows in both in the right eye a peculiar little vessel crossing the nasal part of the disc and running far in temporal direction. Conclusion: Normal conditions in both cases.

EPICRISIS

Olga and Ingrid were born out of wedlock. Their birth and early development was normal; they were not breast-fed. They stayed together with their

mother at a maternity clinic until they were two months old. While Olga remained another four months at the clinic, Ingrid was given into the care of foster-parents.

The twins were thus separated when two months old, and the separation was complete until chance circumstances led to an event in which they were misidentified and to a meeting between them at the age of 35. Our investigation of them commenced a week later, and the observation period lasted for a little more than three years.

Both grew up in Jutland, in different districts. As regards social, economic and general cultural influences, their childhood environments differed, and the interpersonal relationships and the psychological atmosphere in the environments as well as the twins' later life histories were very different.

Olga was a foster-child from the age of six months until the age of seven years. Her foster-home was a rather poor and disharmonious labourer's home. She was emotionally attached to her foster-father, a well-intentioned religious man, who was socially handicapped due to an almost complete deafness and domineered by Olga's foster-mother, a hysterical, presumably psychopathic woman, who openly rejected Olga when the foster-parents had children of their own. Olga came under supervision of the Child Welfare and was transferred to a children's home. Thus, in her later childhood she was an "orphan-age-child" with rather limited possibilities for establishing more lasting personal relationships with other persons. As regards formal education, Olga's school training was probably rather poor. After she had left school at the age of 14, she continued to be under supervision of the Child Welfare until the age of 18, and during this period she experienced some difficulty in adjusting socially. She married when 19.

Ingrid entered her foster-home at the age of two months. Her foster-parents were well-situated, deeply religious farmers. They had no children of their own and Ingrid, who was never officially adopted, thus grew up as an only child. When she was three years old, her foster-father died, they moved to the nearby market-town and she, consequently, became closely attached to her foster-mother, who probably overprotected Ingrid and played a considerable role not only for Ingrid's childhood development but also for her later life. Ingrid's school training was probably average. After the age of 14, she had various jobs, but continued to live together with her foster-mother, until Ingrid married when 18.

Corresponding to the differences in the twins' childhood environments, the twins differed in their personality development, primarily in their attitude and mode of reactions towards their environments. They agreed that they had been brought up in very different environments.

Both developed slight but different neurotic mechanisms in childhood. Olga was more primitive, more impulsive, indifferent, careless, and independent,

and she suffered from enuresis. Ingrid was more inhibited, anxious, dependent, conscientious, and probably more ambitious.

Puberty seems to have been a decisive period in their personality development. Both matured sexually at a relatively early age, both were married in young age (19/18 years) because they thought they were pregnant. This similarity was hardly due to chance, but finds a reasonable explanation in the fact that both at that time knew that they were an illegitimate child of a young maid and thus they had special reasons for trying to avoid getting into an analogous situation. Their different choice of sexual partners and consequently mates became of decisive importance for the environmental differences which have influenced their later life and personality structure. The difference in personality already present between the twins in childhood seems to have remained unchanged during their later life.

Olga married a man who was considerably older than herself. Her husband was a labourer, unstable in social respect, addicted to alcohol, and her marriage was disharmonious, marked by pronounced domestic and economic troubles. She later divorced and to this came the death of the daughter and the very great disappointment she felt when she met her natural mother and her twin sister. All in all, Olga's life had been troublesome and full of presumably psycho-traumatic events.

Ingrid married a man a few years older than herself. He was a baker and they came to live in stable economic and domestic conditions. On the whole, her family life was without open conflicts. Although she gradually freed herself from the influence of her foster-mother, she continued to feel attached to her foster-home, whereas she avoided a contact with her natural mother and also disengaged herself from a close contact with her twin sister.

On the clinical investigation and the psychometric examinations, they were found to be of normal intelligence with a slight difference in ability, Olga appearing to be under average, whereas Ingrid seemed to be above average. This difference seems primarily to be due to their different attitudes during the examinations and corresponded to the difference in their formal school training and general conditions.

As regards personality, they manifested similarities as well as dissimilarities. Both appeared to be mainly extroverted, emotionally labile, impulsive, self-asserting with mild neurotic traits, anxiety and hysterical mechanisms, which were most pronounced in Ingrid. The differences in personality are reasonably explained by the differences in their childhood environments; both seem to be to a high degree susceptible to environmental influences. Olga was the more talkative and impulsive, the more primitive and independent, and at the same time the more indifferent, whereas Ingrid was the more taciturn and reserved, the more complex and dependant, and she also lacked self-confidence. Neither of them could be said to be mentally abnormal.

Also regarding physical health and illness they for the most part presented similarities. The main difference seems to be that Olga, contrary to Ingrid, had contracted a gonorrhoea. Both had, on the whole, been physically healthy. Both had from puberty developed a moderate obesity, a bit more pronounced in Olga than in Ingrid. Both manifested a probably hereditary conditioned skin disorder; both had slight symptoms of allergy, and both presented subtle psycho-somatic symptoms in the form of tendency to headaches and hand shaking. Both had given birth to children, but they differed in their attitudes towards principles of upbringing.

When one compares the information which has been collected concerning the twins' natural parents, who grew up under unstable conditions and became social misfits in young age, with the information which is available concerning the twins' upbringing, it is near at hand to presume that the environments for both twins and perhaps more obviously for Ingrid, have been able to counteract tendencies presumably present in both twins towards a development in directions analogous to the life history of their natural parents. It is noteworthy that it was Ingrid who presented the more pronounced neurotic traits, but it is also noteworthy that both of them succeeded in developing within a normal personality variation despite their different childhood environments. On the other hand the differences in personality were responsible for the twins' failure in keeping together after they met again as adults.

They are classified as: Normal personalities with only slight neurotic traits.

CASE III

MAREN AND JENSINE

Our attention was drawn to this pair of twins in 1956 by the Institute of Human Genetics in Copenhagen.

Jensine, a 37-year-old nurse at a Copenhagen hospital, had told a physician connected with the institute that she and her twin sister had been brought up separately.

Maren, who also was a nurse, lived in Germany (South Slesvig). This gave rise to some practical difficulties in arranging an intensive investigation but, thanks to the twins' cooperative attitude, it was possible during a period of 2½ years to carry out our examinations to such an extent that the results in the main can be compared with the data from the other twin pairs.

The twins were born in Northern Jutland. Their parents were well-to-do farmers who had four children already. The twins were separated at the age of six weeks because their mother died. They were put into the care of two of their paternal aunts, who were both married to farmers and lived in the twins' home county, about 10 kilometres apart from each other.

Even though the twins grew up in the same area and knew in early childhood that they were sisters, they had had little contact with each other.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The information comes mainly from the twins themselves, who, however, knew only a little. Some supplementary information was collected from various official records.

The father

He was 42 years old when the twins were born, and came from a religious ("Indre-Mission") family of farmers who had lived in the same area for generations. He was the next-youngest of five children from a small-holder's family. He bought a medium-sized farm without assistance from his family and married for the first time when 25. His wife, an 18-year-old maid, died

10 years later leaving him four children. Shortly afterwards he married his housekeeper, with whom he had six children, among them the twins.

After the twins' mother's death all children were put into the care of foster-parents. The farm was sold, and two years later the father died (according to *the death certificate* he committed suicide by hanging).

The twins could give but little information about their father's reasons for taking his life. They had never even seen a picture of their father, but according to descriptions they knew that he was rather slim, apparently asthenic, darkhaired and with greyish-blue eyes. He was physically healthy but mentally reserved, depressive and very concerned with religious speculations, periodically lacking in initiative, and despairing. Apparently his family and friends regarded his depression as a reaction to the deaths of his two wives and he had never sought medical advice. The family was surprised when he committed suicide, and felt shameful about his apparently irresponsible act, which led to accentuation of their strong feeling of family unity and their religious attitude. These years had always been completely "censored" and the twins had never been able to obtain detailed information about them.

The father's siblings. 1) *Brother*, died as a child due to unknown causes. 2) *Sister*, 84 years old, unmarried, previously headnurse at a provincial hospital. A religious woman, who left her profession in order to bring up the twins' four siblings. She is said to have been physically and mentally healthy. 3) *Sister (Maren's foster-mother)*, died at the age of 74 from "cardiac disease", having previously been in good health. She had six daughters and five sons, who at the time of the investigation, were 46-60 years old, all healthy. By Maren they were described as "all very reserved and somewhat melancholic", but none had shown definite signs of mental illness. 5) *Sister (Jensine's foster-mother)*, died when 78 from "cardiac disease"; had been operated on for cholelithiasis, but had otherwise been healthy. She had two daughters and three sons, 48-55 years. According to Jensine, they were all "melancholic", *one daughter* had been admitted to a mental hospital for four months at the age of 25. *The case record* gives the following brief information: A maternal uncle (the twins' father) committed suicide and a great-grandmother of the patient is said have to been "mad". Diagnosis: psychosis manio-depressiva (depression). Another daughter had been operated on for a benignant cerebral tumour.

The twins' paternal half-siblings. They had four half-brothers. One was said to have died in adulthood of "paralysis". The three others, aged 50-52, were farmers in Jutland, and all said to resemble their father in their "melancholic" nature. None of them seem to have been hospitalized. The twins never had close contact with their half-siblings, for example, Jensine mentioned that at a large party near her childhood home she once met a man who was a complete stranger to her, until he turned out to be one of her half-brothers.

The mother

Very little information could be gathered about her. According to the twins' information she died from "Spanish Fever" at the age of 39, about six weeks after giving birth to the twins. The twins, who had never seen a picture of

their mother, could provide no information about her physical or mental state. They had never had contact with any of their maternal family.

According to various *official records* the twins' mother was a twin herself, but nothing could be traced about her twin brother. The twins' mother was the illegitimate child of an 18-year-old labourer and a 25-year-old maid, both from small holdings on the island of Samsø. The parents married later, and had yet another girl and a boy. No information was available.

The twins' siblings

As mentioned they were taken care of by the oldest aunt and the twins never came into close contact with them. They resembled the twins physically and were like the twins slim, relatively weakly-built with medium to dark blonde hair and grey or greyish-blue eyes: 1) *Sister*, 45 years old, married to a clergyman, six children. When young she had tuberculosis, had always been thin, became gradually "worn out", but was mentally "active, happy and very religious". 2) *Brother*, 44 years old, married, farmer. Physically healthy, but "melancholic, reserved, living in a dismal, childless marriage, dominated by his wife and her child from a previous marriage". 3) *Brother*, 42 years old, grocer, married, four children. In good health; also "melancholic". 4) *Brother*, 41 years old, married, teacher, four children. Healthy, but "melancholic".

Summary of the supplementary information

There is predisposition to mental illness in the twins' paternal family: their great-grandmother is said to have been "mad", one of the twins' cousins (a daughter of a paternal aunt) has been hospitalized due to a manic-depressive psychosis, the twins' father, who had periodic depressions, committed suicide and the majority of the twins' siblings and half-siblings are described as habitually "melancholic".

There is little information about the twins' maternal family: the twins' mother was a twin herself (opposite-sexed pair). No information as to possible predisposition towards mental illness in the maternal family.

THE SEPARATION

The twins' birth took place in the home and is said to have been normal. There is no information available concerning the afterbirth.

Maren was born first and, probably, weighed a little less than Jensine. They did not know whether their mother breast-fed them, and nothing else is known about their development until they were separated six weeks later.

MAREN

During *the interviews*, Maren described her foster-home in very warm terms. Her aunt was 45 years old and her foster-father 47 when Maren was placed in their care. The youngest of her foster-siblings left home a few years later, and Maren therefore to all intents and purposes grew up as an only child. As the farm, which was relatively large (about 200 acres), was very isolated, she had a lonely childhood and rarely saw people of her own age.

She attended the local country school from the age of seven until she was 14. She had no serious problems while at school, apart from the fact that the instruction was poor and her teacher contented himself primarily with maintaining discipline.

Maren was a shy, very sensitive, reserved and somewhat "difficult" child, among other things she was incapable of playing with other children when she on rare occasions came into contact with any.

Her home was much influenced by her foster-father, who, according to her description, was a decidedly active pyknic, "a great personality" with political interests, especially concerned with South Slesvig. Contrary to the local population, which Maren described as "the blackest Indre-Mission", her foster-father was a Grundtvigian with the corresponding "more gay and happy" attitude towards life.

Shortly before Maren was to go to school, her foster-father told her that she was a foster-child. She did not think that she was much affected by this information.

Her foster-mother was a quiet, hard-working woman who made little impression on the home, and Maren mentioned her only occasionally during the interviews.

After leaving school she lived at home for a couple of years while working as a maid at farms nearby. She left home when 18, when she took a job as a children's nurse in a large market-town in Jutland. During the next few years she worked at a private maternity home in another town in Jutland, at a similar home on Funen, and finally for three years at an orphanage on Zealand. From 24 to 27 she trained as a nurse and for some years worked in hospitals in Copenhagen and the provinces. Between her various jobs she stayed at home, and among other things tended her foster-mother during her final illness up to her death. When 35, she became district nurse in South Slesvig, at first under the Red Cross, later under the Danish health authorities. She had continued to work there and, like her foster-father, had become very interested in the political problems of this area. She had kept in contact with her childhood surroundings and frequently visited her foster-father who had entered an old-age home.

Maren said that she had always been regarded as "a little peculiar", and she had always found it difficult to establish emotional contact with others.

She had never been engaged and she still seemed to be lonely. Even though no attempt was made to explore her sexual life, it seemed that she had never had sexual intercourse (an impression confirmed by statements made by Jensine).

Concerning her medical history Maren stated that as a child she was "weakly, ailing and had glands". She did not remember whether she had had the usual childhood diseases. Mentruation commenced when she was 14 years old, had always been regular and normal, but with almost constant, slight molimina menstrualis. Apart from the latter, however, she had never had gynaecological symptoms.

From her earliest childhood, she suffered from dental caries and when still young had to have crowns on her upper and lower front teeth.

From the age of 16 she had periodic herpes labialis, apparently occurring without external cause, but sometimes perhaps provoked by mental stress. (During the period of our investigation she had a single, brief attack which seemed to affect her quite seriously, especially mentally).

When 24, while a trainee-nurse and forced to read quite excessively, she suffered from pronounced visual disturbances of an asthenopic nature. An ophthalmologist had said that she was "long-sighted" and prescribed spectacles which she used for some years until she felt that she could manage without them.

As an adult she was very susceptible to infection and had frequently had bronchitis, angina tonsillaris and pneumonia.

She had only been admitted to hospital once, at the age of 26. *Case records:* A neuropsychiatric examination was carried out but nothing abnormal was found apart from a sinusitis. Diagnosis: *sinusitis acuta bilaterales*.

According to her own statements she perhaps had shown signs of "nervous" disturbances, and she had in particular always been very tense and insecure in strange situations, but she had never thought of seeking medical advice. Apart from her mild illnesses she considered that she had generally been in good health.

JENSINE

According to *the interviews* her paternal aunt was 40 and her foster-father 46 when Jensine was given into their care. Her foster-parents' farm was of medium size (about 100 acres), and they were well-to-do. The home was religious ("Indre-Mission") and influenced by her foster-mother, a hard-working, domineering and severe woman who apparently cowed Jensine's reserved and taciturn foster-father. Jensine was apt to think that her foster-mother took even greater care of her than of her own children, and she had always felt very closely attached to her foster-mother. Due to the religious attitude

of her foster-parents, however, the atmosphere in the home was always "melancholy and sombre", and there were many prohibitions; until she became an adult Jensine was never allowed to go to the cinema or take part in similar amusements.

She attended a village school from the age of 7 to 14 without difficulties. She did not have close relationships with her foster-siblings because of the considerable difference in age, and she therefore grew up as an only child; however, she had many playmates and had always found it easy to establish contact with others.

All in all, Jensine thought she had had a good home, but she did not attempt to conceal that she had been a "problem-child". As a child she was rather "nervous", anxious, very afraid of the dark and had nightmares. She developed "a lively imagination and quick temper" and could react "hysterically".

When she commenced school, her foster-mother told her about her true family relationships, but she never felt able to accept the facts. "I was confused and strangled by all this talk of family"; particularly she remembered that she reacted exceptionally violently when, as a child, she was solemnly presented with some silver spoons, which had belonged to her mother, and threw them on the floor. Also on other occasions she protested strongly against being told that she was not the child of her foster-parents. On the other hand, she later found it very difficult to free herself from the influence of her home.

After leaving school she remained at home until 18 while engaged as a maid for short times at various farms nearby. After leaving home she was a children's nurse for some years in the home of a veterinary surgeon, and then stayed six months at a high-school. From 21 to 24 years of age she trained as a nurse in a large provincial town in Jutland. She continued to work at this hospital until 27 when she went to Zealand where she worked for a year at a mental hospital. During this time she became acquainted with a journalist; they married when she was 29 and settled in Copenhagen. They had no children, and she continued to work as a nurse, primarily as a night-nurse.

Occasionally, Jensine was rather reserved during the interviews, especially concerning her early youth. She mentioned that she had been "engaged" while training to be a nurse (but never, as other information disclosed, that she had a child with the man concerned). Nevertheless, she talked freely about her current problems, especially the marital and sexual problems. Both she and her husband had been examined for sterility. The husband's fertility was considered reduced (probably due to orchitis following parotitis) and they had given up hope of having a child but had thought of adopting one or perhaps attempting artificial insemination. Jensine appeared to be ambivalent as regards her marital childlessness and often contradicted herself. Oc-

asionally she said that she would wait a little, occasionally that she was too old to have a child and that she was afraid of it restricting her activities too much. She was satisfied with her present life, felt independent and thus her husband's "equal". She also said that she did not at all like the idea of adopting a child as "it might be of poor stock", even though both she and her husband had arrived at the conclusion that "environment means everything". She had always been interested in her husband's work, although she at first found it difficult to accept his "unprejudiced" ideas about political and religious questions.

She retained her close contact with her childhood home, and when her foster-mother fell ill and died, she looked after her. She stressed that her upbringing had perhaps led to her "choosing the opposite band" when young and that she had had many problems since her childhood and had been "what one generally call nervous"; she emphasized in this connection that she was much averse to psychiatrists and that she would never seek psychiatric assistance.

During the single interview I had with her husband, who was intelligent, presumably rather neurotic, he confirmed that there had been marital problems and conflicts, especially in their sexual relationships. He did not think that the twins were more alike than average siblings.

Jensine gave the following information about her medical history: After having been placed in the care of her aunt she was breast-fed by "a big, buxom woman". She was apt to believe that this was why she developed more quickly than Maren and as a child was taller and stronger, as well as why she was not so susceptible to infection.

She did not remember anything about the usual childhood diseases. When she commenced school, she had a pronounced tendency to use her left hand for writing and drawing but this was quickly corrected by her teacher, and since then she had felt naturally right-handed.

Menstruation commenced at the age of 14 and had previously been regular and natural apart from mild molimina menstrualis.

She had severe dental caries when a child and already had to use a denture in the upper jaw when 18. When 21 she had uncomplicated scarlet fever.

While a trainee-nurse she suffered from frequent but slight headaches and was examined by an ophthalmologist who diagnosed "long-sightedness"; she used spectacles for some years after this. Three years ago, when she began to work as a night nurse, her headaches started again and she had since worn spectacles constantly.

When 20, she was admitted to hospital. The *case records* state:

Previously healthy. No history of venereal diseases. Normal parturition at the age of 27 (the child adopted).

During the past six months prior to admission, menstruation has been ir-

regular, lasting 10–12 days. Clinical examination suggested a large uterine fibroma, but laparotomy disclosed that the uterus—apart from being retroflexed by widespread adhesions—was normal. The ovaries and the left tube were also normal, but the right tube was considered thickened. Salpingectomy dextra cum appendectomy per occasionem was performed. (Microscopy: chronic salpingitis). Diagnosis: *Salpingitis chronica dextra, retroversio uteri fixata*.

THE TWIN RELATIONSHIP

Although the twins had grown up in neighbouring parishes they rarely saw each other during their childhood. This was partly due to the fact that their foster-families, because of their differences in religious opinions, saw little of each other, partly to the fact that the twins did not like each other and when together always disagreed. Their aunts did not attempt to promote closer contact between the twins, who were, in fact, never regarded as a “unit” by their family, hardly even as sisters, but rather as “cousins” like their corresponding foster-siblings. “We have never been inseparable like other twins usually are”.

As children they were never mistaken for each other, not even by strangers. They were differently dressed and did their hair differently. Photographs from 1½ to 14 years confirm that although there were considerable resemblances when one takes each feature by itself, they did not, as a whole, look so similar that one would expect them to be mistaken for each other. Their environment also seems primarily to have accepted that they were different. After they had become adults, one of them once met a nurse, who immediately asked her whether she had a sister who also was a nurse, but apart from this they had only been mistaken for each other on the telephone.

The twins themselves always felt that they were different, and when initially approached they both doubted whether they could be monozygotic twins. They had always felt that they were direct contrasts mentally, Maren the “serious” twin and Jensine the “happy and smiling” one.

In Maren’s opinion, Jensine had always been “forced or unnatural” because she had opposed the sombre religious atmosphere of her childhood. She also thought that their general attitudes were very different, including their attitude towards sexual problems; Maren had always disagreed with Jensine in this respect, although she did not directly criticize her. During a single interview, Maren mentioned that when the twins were quite young, they had both been in love with the same young man (Jensine’s fiancé?) but further details on this point were never presented.

Jensine was openly aggressive in her criticism of Maren, whom she described as “pedantic, narrow-minded, apt to paint everything black, and egocentric”. She stressed that “even though she had also faults and was some-

times hot-tempered and hysterical", she, contrary to Maren, was optimistic, did not stand on ceremony, was far more independent and mature, whereas Maren had gradually become more and more "spinsterish, dependent and self-pitying".

Both twins, nevertheless, also said that after they had become adults, they had been able to understand each other better and that, in spite of their differences, they somehow felt mutually bound to each other. When alone they often had confided intimately with each other, but as soon as others were present there were invariably tension and disagreement, and they both felt a stranger, uncertain and ambivalent toward each other. Maren summarized this once by saying: "It would surprise you if you knew how little we know about each other", and Jensine said: "... perhaps we really resemble each other more than we realize". It was characteristic that, as opposed to the other twins reported here, they seldom used "we" when referring to themselves.

CLINICAL EXAMINATIONS

The investigation comprised 15 interviews, 5 with Maren, 8 with Jensine and 2 with both of them. In addition, I had a short interview with Jensine's husband but did not explore the twins' environments otherwise. In view of the practical difficulties, the twins cooperated well, but we did not succeed in retesting Maren with the Wechsler-Bellevue Scale.

In appearance the twins' differences were more obvious than their similarities, and at no time was one apt to misidentify them. Both were slim, relatively slight built. Each was 162 cm. tall and there was little difference in weight: Maren 51.7 and Jensine 50.7 kg. Their hair was dark blonde with a tinge of brown, straight and without natural curl. The hair boundary was identical and both parted their hair on the left, the hair-whorl being anti-clockwise. Their eyes were greyish-blue. Special ophthalmological examination was not carried out, but examination with a magnifying-glass showed that the details in the iris were identical; both had a distinct yellowish-brown concentration of pigment about the size of a pinhead in the left iris. Ophthalmoscopy was normal and showed no remarkable differences. Their relatively high, slightly rounded foreheads, the position of their ears, the details of the ears and their free lobes, as well as their eyebrows and the surroundings of the eyes resembled each other closely. The shape and size of their noses, with a characteristic slight "hump" at the middle of the dorsum of the nose, and the nostrils also showed close resemblance.

They differed somewhat, however, as regards the lower part of the face, most clearly in profile. The shape of their mouths was identical, but whereas Maren had rather prominent front teeth, Jensine's mouth was more withdrawn and

the line from the bottom of the nose to the tip of the chin more vertical, thus making her chin relatively more prominent than Maren's. It must be noted, however, that Maren had artificial enamel crowns on all front teeth, whereas Jensine used a denture. (A detailed examination by a dentist was planned but never carried out).

The other somatic examinations did not disclose definite differences, apart from the fact that Jensine had a small café-au-lait-coloured naevus haemangiosus on her right leg. Blood-pressure were normal. Both were right-handed.

The immediate impression of difference in appearance was primarily due to Jensine wearing spectacles and because she had her hair waved and used a considerable amount of cosmetics. Maren was a subdued, quiet, "worrisome" type, whereas Jensine was openly sexual in appearance, and their clothing differed to a corresponding degree.

Their movements were not particularly similar, but their voices resembled each other closely as regards tone and pitch. Maren, however, was rather more low-voiced and apt to mumble and be at a loss for words; occasionally she stammered slightly. When they smiled, they resembled each other more than else, but otherwise Maren's expression was without mimicry. Both appeared to be about five years younger than their age and both, when together, often reacted rather "childishly" with a tendency to "giggle".

They both appeared as normal and approximately average in intelligence without obvious differences, but their emotional reactions and personalities were for the most part different.

Maren was more difficult to establish contact with than Jensine. During the interviews she made relatively few spontaneous remarks, was tense and apt to hesitate and be on the defensive; she appeared to be more balanced and less restless than Jensine. Contact during the interviews was, however, generally good, she was extroverted and her statements were precise, almost meticulous, and she appeared to be more trustworthy than Jensine. She manifested only slight hysteriform features; her personality inclined more to the obsessive-compulsive. There were no depressive features.

Jensine was far more extroverted and, undoubtedly, had a considerable desire to establish contact with others, bordering on flirtation, but she varied to the extent that she sometimes appeared very unsure of herself, impulsive, anxious, evasive and sometimes she gave misleading statements. On the whole she appeared to be obviously hysteriform with manifest anxiety symptoms.

When Jensine was to be retested it was necessary to employ a new (female) psychologist in a Copenhagen psychiatric department. Jensine did not object to this at first, but when she entered the office, she reacted very violently indeed. She asserted that the room was dirty, nasty and immediately demanded to "get out into the sun", after which she quickly left and came to me, very upset, flushing, tense and restless. She explained that she had felt

very ill at ease, "childish and hysterical", almost panic-stricken, because she had been incapable of not identifying herself with a patient who was about to be admitted to a closed psychiatric ward. She soon calmed down and offered to let herself be re-examined at another place by the psychologist who first examined her, and the retests was carried out some days later.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Maren

Attempted 53 matrices in 40 minutes (matrices E_{6-12} were excluded). At first she worked quite quickly but slowed down later. She was rather agitated, often hesitated between various solutions, appealed to the investigator and worked in a labile manner. Score: $10+7+8+8+0=33$. Distribution: abnormal (?); discrepancies: 8. Group: 25-50 percentile. Conclusion: normal intelligence (rather unusual way of working).

Jensine

Attempted 52 matrices in 37 minutes (matrices D_{10-12} and E_{6-12} were excluded). She was somewhat agitated, often chose her first solution very quickly and then doubted its correctness, often ending by suggesting it again. Score: $10+7+6+3+1=27$. Distribution: normal; discrepancies: 2. Group: approximately the 25th percentile. (When one attempted to see if she could improve her score it proved impossible for her to do so). Conclusion: normal intelligence, probably not above average (rather unusual way of working).

Wechsler-Bellevue

	Maren				Jensine			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	14	10			13	10	13	10
Comprehension	15	13			9	8	10	9
Digit Span	$5+4=9$	6			$3+5=8$	4	$5+3=8$	4
Arithmetic	5	6			7	9	8	10
Similarities	17	14			13	11	14	11
Vocabulary					(28)	(12)		
Verbal Points		49				42		44
Picture Arrangement	9	8			8	7	9	8
Picture Completion	12	12			8	7	11	10
Block Design	$18+2=20$	10			$12+3=15$	7	$15+4=19$	9
Object Assembly	$18+1=19$	11			$17+3=20$	12	$16+1=17$	9
Digit Symbol					$35\frac{1}{2}/36$	8	$40/40$	9
Performance Points	$41\cdot\frac{5}{4}=51$					41		45
Total Points		100				83		89
Verbal IQ		104				96		98
Performance IQ		110				98		103
Total IQ		108				97		101

Maren

Her behaviour and attitude were less peculiar in this more controlled situation, but there was still a tendency to labile reactions and she complained spontaneously about her "poor memory" which, however, seemed mostly to be an expression of her difficul-

ties in concentrating on the tasks. The relatively poor performances in Arithmetic and Digit Span, perhaps also on Block Design (item 4) might indicate that her complaints were justified. The results were unremarkable. *Re-test* (not carried out). Conclusion: normal intelligence.

Jensine

Her behaviour and attitude was hysteriform; she posed, appealed and flirted. Generally, however, it was possible to counteract these tendencies so that the test could be carried out satisfactorily. Most scores were within the normal limits, but the results for Digit Span were relatively low. Apart from this there was some variation in her performance during the individual subtests. On *retesting* (18 months later) her behaviour was on the whole unaltered. Her scores were generally the same and all were within the normal limits with the exception of Digit Span. There was a slight improvement in her scores on the performance tests and the variations within the subtests were a little less pronounced. Conclusion: normal intelligence (with an unusual way of working).

Rorschach

		Maren	
7 W	8 F+	3 H	6 P. 1 Orig (?)—
1 DW	1 F+/-	2 Hd	F+ 61 (extended 68)
10 D	5 F-	7 A	F = 100 = L = 70
2 Dd	1 M	3 Ad	A = 50
Total: 20	2 FC	4 Anat (+ sex)	Affective ratio: 30
	1 CF	1 Cg	RT: 0.6 min (I - VII)
	2 FY		0.6 min (VIII - X)
			Seq.: indeterminable
			Ap: W - (D) - Do - DW
			Exp: 1/2
			Colour shock? shading shock.

Tendency to self-criticism, non-interpretative descriptions and almost denied answers (perplexity?).

She was obviously affected by the task and often tried to master herself by posing somewhat and by filling the pauses with descriptive remarks. Her answers were often vague and she often denied them.

Psychoqram: Of normal intelligence, but does not make full use of her ability. Looses her self-confidence easily, alternates between rather banal and more personal attitudes, the latter usually being slightly maladjusted. She presumably manages best when in contact with others, although her rather immature attitude will probably also clearly show itself. She has little insight into herself, but there is no general or serious repression. Her mood appears to be more or less well-balanced, but her anxiety seems to be very near the surface. The results definitely points to sexual problems and sexual anxiety.

Double-blind test

Woman, not quite young. As regards intelligence she is in the upper half of the normal. She is presumably lacking in self-confidence and too inept in taking decisions to be able to make full use of her ability. She is easily affected and possibly rather impulsive, but tries to control herself. Her attempts in this respect probably succeed to such an extent that she will in neutral situations and when in conventional contact with others appear to be well-adjusted. In situations that provoke anxiety, however, she will probably act impulsively. She has probably few possibilities for solving her problems introspectively. She seems to be tense emotionally and possibly there are psychosomatic reactions.

Retest (18 months later)

8 W	12 F+	2 H	6 P. 1-2 Orig (-)
12 D	4 F-	3 Hd	F+ 75 (extended 66)
1 Dd	1 M+/-	10 A	F = 100 - 1 = 73
1 Do	1 FC	2 Ad	A = 54
<hr/> Total: 22	1 FY	5 Anat (+ sex)	Affective ratio: 36
	1 YF		RT: 0.9 min. (I - VII)
	+ FM		1.1 min. (VIII - X)
			Seq.: indeterminable
			Ap: W - D - etc.
			Exp: 1/1/2
			Colour shock? shading shock.

Tendency to perplexity, many exclamations and non-interpretative descriptions, motoric restlessness and many card-turnings.

She was again obviously provoked but in a more subdued manner and she posed and appealed less.

Psychogram: Compared with the first test she seems to be more inhibited, rather depressed and reacts slowly, although her answers are still vague, somewhat banal and maladjusted.

Jensine			
3 W	18 F+	4 H	8 P. 3-4 Orig (-/+)
1 DW	3 F+/-	3 Hd	F+ 74 (extended 73)
29 D	6 F-	14 A	F = 100 - L = 83
2 Dd	2 M	8 Ad	A = 63
<hr/> Total: 35	2 FM	2 Anat	Affective ratio: 43
	1 FM-	2 Cg	RT: 0.6 min. (I - VII)
	1 FC	1 Obj.	0.6 min. (VIII - X)
	1 CF	1 Other	Seq.: orderly-reversed
	1 FY		Ap: (W) - D - Dd - DW
			Exp: 2/1 1/2
			Colour shock, shading shock

Tendency to criticism and perseveration, preference of central areas, non-interpreting descriptions, answers formulated as questions. Many card-turnings.

She posed to some extent and her contact was rather hysteriform. Sometimes she was silent and seemed to have blocked (?); in the test this was manifested by descriptions and perseveration.

Psychogram: Normal intelligence, slightly over the average. Her attitude and way of working varies, and her tolerance toward conflict seems to be poor. It seems difficult for her to reach a general view of the situation; she rarely tries to do so and when she tries, the results are rather banal or mildly confabulating. When she adopts a childish or emotional attitude her responses are quite vivid. Something similar is probably true as regards her reactions toward other people where in the more superficial forms of contact she will presumably appear to be obliging, whereas she in more demanding and intimate situations will be uncertain and provoked; she will then either manifest her uncertainty or else pose and react immaturely. She appears to be able to control her mood adequately, but it seems uncertain whether she can subdue her anxiety. Her immaturity seems to be the most characteristic feature of her personality. The results suggest that there are sexual problems.

Double-blind test

Probably a woman about 35–45 years old. Intelligence in the upper half of the normal, presumably a little above, practical. Lacks self-confidence to some extent, finds it difficult to make decisions, but is apt to pose—approaching the over “fresh” type. Apt to hide her lack of self-confidence by rationalizations. Emotionally labile, hysteriform, afraid of being impulsive and tries to control her impulsiveness. Perhaps rather materialistically inclined in her attitude toward life. Her ability to establish contact with others is not too poor, but when trying to control her impulsiveness, she will be apt to avoid more intimate contact and try to avoid emotional engagement. Features suggesting anxiety-neurosis?

Retest (19 months later).

6 W	16 F+	1 H	6 P. 2 Orig (+/-)
1 W cut	2 F+/-	3 Hd	F+ 77 (extended 77)
17 D	4 F-	11 A	F = 100 - L = 81
1 Ds	2 FC	7 Ad	A = 69
<hr/> Total: 26	1 CF	2 Anat	Affective ratio: 38
	1 FY?	1 Cg	RT: 0.6 min. (I - VII)
	+ FM	1 Other	0.6 min. (VIII - X)
		+ Blood	Seq.: orderly?
		+ Sex	Ap: W - D - Ds
			Exp: 0.?/2
			Colour shock, shading shock

Tendency to self-criticism and object-criticism, perplexity, denied and questioning answers, non-interpretative and evaluative descriptions. Excessive card-turning.

Her behaviour was the same as during the first test, but less agitated, appealing and over-compensating.

Psychogram: The description must in the main remain unaltered. There are still features indicating anxiety and sexual problems, as well as a conflict between emotional-hysteriform features and the inhibitive tendencies. The slight differences between the two tests are difficult to interpret; in the main it seems that they suggest a slight restriction in activity in order to reduce the provocative effect of the test.

*Word Association Test (a. m. Rapaport)**Maren*

She was clearly provoked by many of the words and often reacted by repeating the stimulus-word several times before she responded to it.

Results: Her reaction time was very variable; there were several short reaction-times, a number of medium, and 3 were over 10 seconds (“suicide”, “mouth”, “dummy”). Her associations were often explanatory or synonyms; the main problems seemed to be sexual, interpersonal, aggressive and anxious. On the whole, she appeared to be uncertain of herself, emotional and hysteriform with pronounced ambivalence and a rather infantile attitude.

When the test was presented the second time the number of repetitions was normal (75 per cent), but a number of reaction-times were prolonged. Her general ability to compensate is rather poor and lability and anxious and hysteriform reactions must be expected.

Jensine

She was often obviously provoked by the material and reacted with agitation, tittering and posturing, but responded to all the stimulus-words.

Results: The majority of the reaction-times was short or of average length, some rather long ("breast", "shield", "suicide", "mountain"), but none was over 10 seconds. The majority of responses was of the usual type, some were emotional, corresponding to her basic defensive mechanisms (reaction-formation and repression). The major problems appeared to be libido-impulses related to difficulties in establishing contact with others.

When the list was presented the second time the majority of the reaction-times was reduced. The percentage of repetitions was normal (75 per cent). Her ability to compensate is, therefore, not poor. There were once again signs of general insecurity as well as of a more specific anxiety (a sexually-determined fear of being exposed?).

Summary and comparison of the test results

Both are of normal intelligence and approximately average. There is a slight general trend toward Maren scoring better than Jensine on the cognitive tests, corresponding to the immediate impression as regards their intelligence. Their basic attitude toward the tasks and their behaviour are similar, but Jensine seems to be more labile, defensive and apt to pose, and is, in fact, rather difficult to test. Maren complained of difficulties in learning, which to some extent was born out by the objective results. The profiles for their results, nevertheless, resemble each other closely.

Both twins are mainly extroverted and appear to be hysteriform, emotionally intense, easily affected, and labile; Maren, especially, seems to be apt to vary in mood (dysphoria). Both are rather egocentric and poseurs, particularly Jensine; she clearly attempts to behave in a "feminine" way, is definitely less mature than Maren, her tolerance toward conflict is low and her ability to subdue her anxiety does not appear to be effective. One must also assume that projection plays a marked role. She is insecure in her relationships with others and will often behave defensively, evasively, or directly misleadingly. In Maren one would expect to find depressive reactions and intrapunitive phenomena. Her defence-mechanisms seem to be more varied and effective. Both twins employ repression to a pronounced extent as a defensive mechanism. Both have sexual and identification problems, and in the case of Jensine, one must expect that there are difficulties with regard to accepting an adult, altruistic and responsible rôle.

OTHER SPECIAL EXAMINATIONS

EEG. The results are not surprisingly similar, but neither are there important differences. *Maren:* The alpha-frequency was 11.5 hz, amplitude 35–75 μ v. Considerable 19-hz-activity. No abnormal potentials. No focal abnormalities. *Jensine:* Alpha-frequency 5–9 hz, amplitude 60–100 μ v. No abnormal potentials. No focal abnormalities. Conclusion: Normal EEGs with some fast activity in Maren's case.

The zygosity diagnosis

This is the only pair in this series where I, on the basis of my immediate impression of the twins, have felt doubt about whether they were monozygotic or not. Therefore, the zygosity diagnosis shall be discussed in some details.

The findings show that the twins correspond as regard eight blood groups and two serum systems. In addition, they agree as to the PTC test. The differences between the fingerprints are consistent with monozygosity and the EEGs do not contradict this assumption. As regards the anthropological measurements, the colour of the hair (dark blonde) and eyes (greyish-blue) are identical, and no certain differences were found as regards anthropometric measurements; the difference as regards the lower part of the face could be explained by the different conditions of the teeth and the use of a denture in Jensine's case.

The twins were examined by four other physicians, two of whom are experienced in twin research. The two latter considered that it could not be excluded that the twins were monozygotic, whereas the two others felt that the twins might as well be dizygotic. The only way of solving this question, namely to ask the twins to submit to transplantation experiments was not considered.

The evidence against monozygosity comprises the facts that the twins have never been mistaken for each other, even by people who met them rarely, that they had always been regarded as being "different", and finally, that the twins themselves doubted whether they were monozygotic.

However, one may hardly compare such characteristics of twins who have been brought up apart with those of twins who have grown up together. In this particular case, it is probably of greater importance that the twins' foster-parents and other persons in the environment have never wanted to regard them as twins, but on the contrary, consciously or unconsciously, have stressed the differences between them. It seems reasonable to assume that thereby an analogous attitude was accentuated in the twins themselves. The differences immediately experienced between the twins are closely related to certain differences between their personalities as expressed by, for instance, Jensine's use of spectacles, cosmetics and dress; such criteria should, of course, be omitted from influence on the decision as to zygosity.

To summarize, I have decided to include this pair of twins in the series as I found no definite basis for assuming that they are not monozygotic and because they might very well be an example of monozygotic twins presenting relatively large differences. On the other hand, we have, as mentioned in the text, in certain respects tried to estimate the effect the inclusion, respectively the exclusion of this pair has on some general results such as, for instance, the results of the intelligence testing.

EPICRISIS

Maren's and Jensine's parents were farmers in Jutland and already had four children. Their birth was probably normal. Maren was never breastfed, whereas Jensine, after the separation of the twins, was taken care of by a wet nurse for a short time.

The twins were separated at the age of six weeks when their mother died. They were put into the care of two paternal aunts, and the twins' siblings were taken care of by another paternal aunt. Even though the twins were brought up in the same rural district, no more than about 10 kilometers away from each other, and knew from their early childhood that they were sisters, they had had very little contact with each other during their upbringing and later life.

They were 37 years old when our investigations commenced. The observation period lasted for 2¹/₂ years and the material concerning this pair is, in the main, comparable with the data from the other twin pairs.

The childhood environments of the twins were very similar in their outer structure: Both were brought up as foster-children among relatives, in both cases in the care of paternal aunts, who had both married to farmers of almost the same age, living on a similar social level. Both were brought up in stable, religious homes, and both grew up together with a number of foster-siblings, the twins' first cousins, considerably older than the twins, who, therefore, to all intents and purposes had the position of an only child. Both were closely attached to their foster-homes and neither of them established closer contact with their natural brothers and sisters.

Their childhood environments differed in other respects, especially regarding the general psychological atmosphere and the interpersonal relationships in the homes. They attended different schools and the school training was in Jensine's case perhaps slightly better than in Maren's, but the differences were probably of minimal importance. Maren's home was "Grundtvigian", Jensine's home was "Indre-Mission" with a corresponding difference in the homes' psychological atmosphere and general attitude towards life. The foster-fathers were very different personalities, and although the foster-mothers were sisters they also seem to have been rather different personalities. Maren was mainly influenced and emotionally attached to her foster-father, whereas Jensine was closely attached to and to some degree dominated by her foster-mother.

The twins' later life history also showed both similarities and dissimilarities. Both started to work as maids and left their homes shortly after puberty. Both became—apparently independently of each other—first a children's nurse and later on a general nurse. Their life histories differed clearly regarding sexual and marital status. Jensine became pregnant when quite young and gave

birth to an illegitimate child which was adopted by strangers, and she later married, but had no children. Her status was marked by her marital childlessness, and probably also sexual problems. Maren had probably never been pregnant or established sexual relationships, and she never married.

Corresponding to the environmental differences in their childhood environments and in their later life, the twins' personality development seems to have differed from an early age. When children, they both seem to have presented slight neurotic symptoms, but of a different kind. Both were regarded as a "difficult" or a "problem child". Maren seems to have been very shy, sensitive, reserved, lonely and had always found it difficult to establish emotional contact with other persons. Jensine suffered when a child from nightmares, was afraid of the dark, showed anxiety states, and was at the same time a child with a lively imagination, temper and pronounced tendencies toward hysterical reactions.

On the clinical examinations and the psychometric investigations both appeared as normal in intelligence, about average, without obvious differences.

The differences in personality were more obvious than the similarities. The immediate impression of difference in appearance was primarily due to Jensine wearing spectacles and using cosmetics and to their different clothings. Both appeared to be somewhat neurotic, but their personalities differed. Maren, who was only slightly hysterical, was more inclined to obsessive/compulsive features. Jensine, who appeared more extroverted, impulsive, hysterical, presented anxiety symptoms. Both appeared emotionally labile, but were differing in their attitudes towards people in their surroundings, and toward each other they both seemed to be ambivalent. Both seemed to have marked sexual problems; in this connection, it should be stressed that material of relevance to the twins' personality structure and neurotic development has probably only been disclosed partially.

Their medical history was also essentially different. Maren was already from childhood "weak", very susceptible to infections such as bronchitis, angina tonsillaris, pneumonia, herpes labialis, and sinusitis. Jensine, had no similar disposition towards infections, but unlike Maren, she had scarlet fever.

Apart from slight *molimina menstrualis*, Maren had no gynaecological symptoms. At the age of 29, Jensine had an abdominal operation (*salpingectomy dextra cum appendectomy per occasionem*) due to a chronic *salpingitis*, and, as distinguished from Maren, she went through a pregnancy and delivery.

Their medical histories were similar in the twins' pronounced tendency to dental caries, which in Maren's case resulted in artificial enamel crowns on her upper and lower front teeth, in Jensine's case in an upper jaw denture. Both were hypermetropic with periodic asthenopic symptoms and both had

during periods used spectacles, which only Jensine still used, when the pair was examined.

In the twins' paternal family a predisposition to manic-depressive psychosis was probably present. The twins' father had periodic depressions and committed suicide by hanging at the age of 44. A cousin, a daughter of Jensine's foster-mother, suffered from manic-depressive psychosis and had been hospitalized due to a depression. A number of the twins' siblings were described as habitually "melancholic". Neither of the twins presented clear depressive symptoms during the examinations, and they did not seem to have had long-lasting depressive periods previously.

The difficulty in evaluating this twin pair is related to the question of the zygosity diagnosis. Compared to the other pairs in this series, the twins can be said to present great differences in personality and relatively few similar features. Assuming that they are monozygotic twins, the prominent differences in personality and development of neurotic reactions contrast to the relative similarity of their childhood environments, at least regarding the outer structure. On the other hand, their childhood environments were probably quite different in other, perhaps more important, respects, such as the interpersonal relationships in their home. The differences they present can to some degree be explained by these environmental differences, but, as mentioned, probably not all relevant factors have been disclosed. If the twins are dizygotic the differences and similarities they present can hardly be said to be surprising.

Both are classified as: Normal personalities, but with rather different personality traits and neurotic reactions.

Case IV

INGEGERD AND MONIKA

Contact was established with this pair of twins in 1955.

Ingegerd was admitted to a State Mental Hospital in Jutland. She was 42 years old, married to a labourer and lived in a large market-town in North Jutland. When admitted to the hospital, she gave the information that she and her twin sister had been brought up apart during their early childhood. As adults they had seen each other only rarely due to the fact that they had disagreed since they were quite young.

Monika, who was also married to a labourer, lived in a village near a large town in East Jutland. We approached her, and after contact had been re-established between the twins, they were both prepared to submit to more detailed investigation of their case. Our examinations commenced while *Ingegerd* was hospitalized and a close contact with both twins was maintained over a period of almost three years.

The twins were born in the above mentioned town in North Jutland. They were illegitimate children of a 19-year-old maid and a 27-year-old herdsman of Swedish descent, who left Denmark shortly after the twins were born. They stayed with their mother at a children's home until they were separated at the age of 12 months. Up to the age of 7 years they were cared for by distant relatives or strangers. They then returned to their mother, who had married and lived in the town where the twins had been born, and they grew up here together with younger half-siblings until they were separated again at the age of 14. They had lived in different parts of Jutland, and seen each other only on a few occasions during the last 20 years previous to our investigation.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The father

The twins could offer little information about him. The mother had described him as "drunken and untrustworthy". He was "engaged" to her, but "after an imposing fare-well party he disappeared and failed to pay maintenance". The twins knew nothing about his later life, but *Monika* had often thought of trying to find him.

Danish and Swedish *official records* provided the following supplementary information:

He was born in Central Sweden, as a son of a travelling salesman, and was the youngest of five. It is not known when he immigrated into Denmark, but at the age of 27 he was herdsman at a farm just outside the town where the twins were born. During the following years he was wanted by the Danish police (affiliation case), but apparently he disappeared and was not charged during his stay in Denmark. He is known to have lived in Sweden later on, but could not be traced, and it seemed probably that he emigrated to the U.S.A. during First World War.

According to Swedish *official records*: *The paternal grandfather* died at the age of 71 of "disease of the kidney and prostata". *The paternal grandmother* died of "cancer of the stomach" at the age of 47, when the twins' father was only five years old. No other information was available.

The father's siblings. According to the same records two brothers emigrated to the U.S.A. when still quite young, and a sister went to Gotland. No other information, especially no known predisposition toward mental illness was registered in the twins' paternal family.

The mother

When our investigations commenced, she was 61 years old, a widow, and lived near Monika. Neither of the twins had seen her for several years and as far as they knew, she had not suffered from any serious illness and was probably mentally "normal".

With regard to the more detailed information about the twins' mother's life and personality, this will be presented later.

The twins' maternal half-siblings. The twins' mother had three children in her marriage. According to the twins the eldest was probably not the child of the twins' step-father. 1) *Half-sister*, 37 years old, married to a stable labourer. She had one healthy child, had previously had a still-birth. She was said to suffer from "gastric ulcer". 2) *Half-brother*, 35 years old, married, skilled labourer, well-situated. No children. When a child said to have had uncharacteristic "fits", when an adult "gastric ulcer". 3) *Half-sister*, 27 years old, unmarried secretary. Healthy. None of the twins' half-siblings apparently had showed signs of mental illness.

The maternal grandfather. He was said to have been "a small but strongly built, dark, curly-haired docker, who probably drank". During the last few years before his death of "cancer of the throat", when 56, he led the life of an invalid due to an accident, and the home degenerated socially and economically.

The maternal grandmother died at the age of 81. She was a relatively tall, light-blonde "nervous, irritable, and worn-out wretch", who became totally blind at the age of 50 due to "cataract". She had no less than 13 children of whom the twins' mother was the next-eldest. The twins' *grandmother's mother*, who died at 90, was a twin; photographs indicated that she and her twin sister were probably monozygotic twins.

Finally, *the grandmother's paternal half-brother* is of relevance to the twins' histories, because he took care of Ingegerd for a short time. He was a small-holder in North Jutland, married and had two children. He is said to have been in good health mentally and physically until he died 70 years old.

The mother's siblings. 1) *Brother*, 62 years old, married labourer with five children. Both twins, each for herself, were taken care of by him for a short period. They described him as "a hard man, who after 26 years of marriage divorced his wife in order to marry a younger woman". He had been hospitalized several times, according to the *case records* due to *ulcus ventriculi*. 3) *Brother*, married gardener. He had no children in his marriage, but one illegitimate child. He was hospitalized several times, according to *case records*: *ulcus ventriculi*; he died when 44 of *ulcus ventriculi perforatus*. 4) *Brother*, married street-sweeper. One child. According to *case records* he suffered from *ulcus duodeni* and died at the age of 50 from *ulcus ventriculi perforatus*. 5) *Brother*, 56 years old, married docker. He had one child in his marriage and one illegitimate child. According to *official records*, he deteriorated socially and was periodically dependent upon public assistance and unemployment benefit. 6) *Sister*, 54 years old, married to a driver. She had three children in her marriage and also one illegitimate child. She was in good health mentally and physically; previously she and her husband had received public assistance. 7) *Sister*, 54 years old, married to a fisherman. Five children. Physically and mentally healthy. 8) *Brother*, 51 years old, married carpenter. No children. He had been hospitalized, according to the *case records* for *ulcus duodeni*. 9) *Sister*, 50 years old, married to a book-binder, in good social status. No children in her marriage, but one illegitimate child previous to the marriage. 10) *Sister*, 46 years old, married to a typographer. Two children. Healthy. 11) *Brother*, 45 years old, married carpenter. No children. He was said to have had "gastric ulcer". 12) *Brother*, 42 years old, unmarried labourer. He was said to have had "gastric ulcer" and according to *official records*, he was periodically on public assistance. 13) *Sister*, 40 years old, married twice, both times to labourers. One child in each marriage and one illegitimate child. She was said to have had "gastric ulcers".

According to *official records*, none of the 12 siblings of the twins' mother had been in conflict with the law.

Summary of the supplementary information

The twins' father was presumably somewhat vacillating, but information about him is sparse, and no predisposition toward mental illness in his Swedish family has been disclosed.

The twins' mother and several of her many siblings had illegitimate children when young. Several of the members of the maternal family during periods lived on public assistance, but none of them seem to have come into conflict with the law. No definite predisposition to mental illness in the maternal family was disclosed, but a massive disposition to duodenal and gastric ulcer was present. One case of probably monozygotic twins was recorded in the maternal family.

THE SEPARATION

The twins were born at a private clinic. Apart from being two months premature (their mother "fell down some stairs"), the birth was, as far as is known, normal. Ingegerd, who was born first, weighed $2\frac{3}{4}$ and Monika, who was born three quarters of an hour later, $2\frac{1}{4}$ "pund" (1 Danish "pund" is 500 g.). No information is available regarding the afterbirth.

Neither of the twins was considered to be capable of living; they were "put

in cotton wool", and the physician is reported to have said that if they lived to be two months old, then he would pay their christening which he actually did. The twins also asserted that he had published their case in a professional periodical, but it has not been possible to verify this.

Both twins were breast-fed, probably for some months. While at the children's home, where the mother was a domestic servant, Ingegerd was looked after by her mother, whereas her girl-friend, who was a cook at the home, took care of Monika, so that each twin for the most part had her own "mother" and for example slept with her. Nothing is known about their early psychomotor development, apart from it having presumably been normal. An "English physician" is said to have wanted to adopt the twins, but for some unknown reason, their mother would not agree. When they were 12 months old, their mother put them into the care of separate foster-parents.

As mentioned earlier, the twins spent the latter half of their childhood together with their mother, their step-father, and their three half-siblings. This period will be dealt with later under the description of the twin relationship.

Before the case histories, as described by the twins during the interviews, are presented, their medical histories shall be summarized on the basis of their case records from various hospitals.

INGEGERD

She had been admitted to hospital several times. The *case records* state:

1) When 22 years old, hospitalized for the first time: *appendectomy*. 2) When 23: *salpingitis*. 3) When 25: *abortion (spontaneous)*. 4) When 28: *partus normalis*; had given birth when 27, but the child died. 5) When 30: *partus normalis*. 6) When 37: *tumores hæmorrhoidales*; had given birth to a child when 36. 7) When 38: *tumores hæmorrhoidales*.

8) When 39, admitted to a medical department. The *case records* give the following information: During the past four years she had felt tired and depressed. After an argument with her husband, she had taken barbiturates and "a couple of mouthfuls" of ammonium chloride. She denied the intention of suicide, but could not otherwise motivate her action. She asserted that her husband was fond of her and her children, but that she had never liked her youngest child. She stressed that her own childhood had been very unhappy because she was illegitimate and her mother would never have anything to do with her. During the stay at hospital, she seemed to be depressed and despairing, wept frequently, but soon improved, and she was discharged after four days. Diagnosis: *psychosis psychogenica, veneficium barbituricum et ammonii chloride (tentamen suicidii?)*.

9) When 40, re-admitted to the same department. *Case records*: During the day previous to admission, she had taken 10-15 phenemal-tablets. She

had been depressed for about six months, and she gave a list of things that depressed her: Her husband did not understand her and merely said she ought to pull herself together; she could not manage her housework or even her only interest, gymnastics; she always felt tired, had headaches and palpitations, fits of perspiration, hot flushes and giddiness, finally she was afraid of coitus and afraid of becoming pregnant.

Her husband, a labourer, 2 years older than her, stated: "She became depressed without reason, she broke down and could not do a single thing at home". According to him, their marriage, which had lasted 16 years, was "good", and the family had a reasonable income. They had three children, one girl and two boys, aged four to 13 years all in good health. During her three weeks stay at hospital, she was advised to let herself be transferred to a psychiatric hospital, but she calmed down sufficiently, so that she was discharged before there was a vacancy. Diagnosis: *depressio mentis psychogenica*.

10) When nearly 42, she was admitted to a mental hospital. (It was on this occasion that our contact was established with the twins). The *case records* give the following information:

From 1 to 7 years of age, she had been in the care of foster-parents; then with her mother together with her twin-sister until the age of 14. From then onwards, she had various jobs as a domestic servant until she married when 24. According to her own description, her premorbid mentality apparently had been that of a person of average intelligence, "rather obstinate, but good-humoured". Her husband had always been irritable, but had never manifested pronounced nervous symptoms and up till her last birth, their relationship had been harmonious. A few years later they moved and came to live next door to her married sister-in-law, who soon began to participate in their life, was commanding, criticized their house-keeping and their children's upbringing, and this led to their breaking with her. After two years, they still did not speak to her, but could not avoid seeing her; this had affected her considerably and had led to arguments with her husband and difficulties with her family-in-law.

She was two months pregnant and definitely did not want the child—neither had she wanted her last child, but at that time the physician she consulted did not consider that there was a sufficient reason for a legal abortion. Since this birth, she had been very afraid of becoming pregnant again, and her husband had been dissatisfied with their sexual intercourse. She said that she herself had never reached orgasm, but always been frigid and disliked sexual intercourse. They had employed coitus interruptus, but neither had been inclined towards other forms of anticonception.

The children had been very "difficult". She could not get along with her 13 years old daughter, and she had, as mentioned, never liked her youngest

son. During the past few years, she had felt moody, had lost interest in her housework, had no energy, and felt that everything was too much for her. She saw no end to what she had to do, and she cried easily. She had lost her appetite and now smoked about 20 cigarettes a day. She was happiest when alone, but was unable to stand being alone for long. She had been an official in her gymnastics club for some years, but no longer felt capable of the work. Finally, her daughter was due to be confirmed very soon, and she felt incapable of arranging the traditional festivities.

When admitted, her mood was labile; she cried at one moment and smiled broadly at the next. On the whole, however, she seemed to be slightly depressed. During the next few days, she continued to be rather depressed and labile in mood; mostly, she was talkative, mainly about her present situation, rather restless, and emotionally impulsive. She was childish in behaviour, primitive, and did not seem to be very intelligent. She was very critical in her attitude toward her husband and felt badly treated. She wanted an abortion, because she disliked being pregnant and did not want to have more children. She also wanted to be sterilized, and mentioned that her twin sister had "had it all taken out".

During her stay at the hospital, her twin sister, who "resembles her physically and mentally to a point of confusion" was at the hospital several times and offered her opinions to the doctors in a very knowledgeable manner. The twin sister was offended that her sister had been admitted to a mental hospital as she herself had actually been in far worse condition, but had managed without psychiatric assistance, because she had a good physician and was able to control her "nerves" by taking up folk-dancing. She talked unceasingly about herself during the interviews with the doctors, described her long history of abdominal symptoms and her previous "nervous break-down", and recommended that her sister ought to pull herself together or at least convalesce at a more appropriate place than a mental hospital.

Ingegerd's stay at hospital lasted three weeks and during this period, a declaration was submitted to the authorities stating that according to the law, there was adequate basis for therapeutic abortion and sterilization.

The conclusion of the statement was as follows: "The patient has for several years had manifest neurotic symptoms and at present is in a severe depressive neurosis, related to a sexual neurosis. She is definitely taxed to her utmost limits, and the birth of yet another child must be assumed to give rise to considerable risk that her neurosis will so develop that she will become a chronic invalid, and one cannot disregard the danger of serious panic reactions". She was offered psychiatric treatment after the operation, but preferred to go home in order to attend the daughter's confirmation, and be operated upon at the local hospital. Diagnosis: *neurosis depressiva et sexualis, psychoinfantilismus* (observation for legal abortion).

- 11) Admitted to the local hospital: *legal abortion, sterilization.*
- 12) When 42, re-admitted to the mental hospital. *Case records:* She had been at home two months, but had not been happy and had spent some time convalescing at her twin-sister's home. She was still depressed and felt, in fact, more depressed than before the operation. She said that neither her husband nor her family liked her or understood her, but teased her about having been in a "mad-house" and said that they had far more pleasant time when she was away. She felt unwanted and lonely. In spite of the sterilization, her sexual relationships with her husband were unaltered; she still disliked coitus, "preferred not being bothered", and she wanted her husband to continue coitus interruptus.

Her state appeared to be unaltered since her last stay at hospital; her mood was labile, and she alternated quickly between tears and smiling talkativeness, but seemed less forced than before. She complained in a hypochondriacal manner of irregular menstruation, difficulties in urinating, giddiness, and sleep disturbances. She was treated with chlorpromazine and became gradually more calm, was able to do some work and concentrate on letters to her husband. After four weeks' stay, she was discharged and treatment continued in an outpatient clinic. *Diagnosis: as previously.*

- 13) Re-admitted at the age of 43. *Case records:* Her physician stated that during the 13 months she had been at home, her state had not improved, but it became especially worse when she stopped taking chlorpromazine two weeks previously. She had continuously been depressed without reasonable grounds, sat most of the day on the kitchen table and did nothing but drink coffee and smoke. Her husband had lost patience with her. She said that she was unhappy because her husband and daughter were cruel, derided her, and her daughter had even hit her. Again her twin sister came to the hospital, developed her own case history in great detail and defended her sister against the husband and family.

When admitted she had gained some weight, but her mental state appeared to be unaltered since her last admission; she was not clearly depressed, spoke freely, although in a stereotyped way about conditions at home, and cried violently in a childish way. Otherwise she seemed to feel well, but she nagged her sister about convalescing at her home; her sister gradually changed sides, thought that the husband was "goodness itself", and she supported him in arguing that the main thing was that the patient should give up smoking so much. The husband visited the hospital and stated that he was tired of his wife neglecting her house-work; he did not consider that her state was an "illness", she was only "childish, just like she has always been"; she had never been able to accept criticism, always felt offended by it. He did not think psychiatric treatment would make any difference, and therefore he

felt he might just as well take her home again. She was discharged after having been in hospital for only two weeks. Diagnosis: *as previously*.

14) Re-admitted two months later. *Case records*: Her state had not changed, but she had talked of committing suicide on one or two occasions. She was in hospital for three weeks, and as her husband said he disliked the idea of her returning home, it was suggested that she might be placed in family care under the auspices of the hospital. Her twin sister, however, now acceded to her wishes and offered to let her stay with her, and rather against the medical advice she left hospital. Diagnosis: *as previously*.

A little over a year later, she wrote to the hospital: "I am happy and just as I was before I became ill . . . I have not taken any pills for it . . . I thought that you might like to know that one can easily get better, if one just pulls oneself together".

Addendum

After we had terminated our investigation of this twin pair, Ingegerd was admitted to a surgical department and operated due to: *incontinentia urinae, cystis glandulae Bartholinii*, and when 46 years old, she was re-admitted to the mental hospital.

The *case records*: She had been rather unhappy for about a year, periodically tired, depressed, but later she improved and felt completely well until about 2-3 months before admission. Until then she had been able to manage her house-work and liked doing so, she had felt energetic and was on a friendly footing with her family. She again became unhappy, restless, had difficulty in sleeping after she had been operated upon, had attacks of weeping. She again had difficulties with her husband and the children. Chlorpromazine and restenile had failed to help her.

On admission, she was obviously depressed, worried, somewhat self-accusing, dissatisfied, argumentative and restless. She was given imipramine, but as she seemed more depressed than on previous occasions, self-accusing and disparaging, it was decided to attempt treatment with ECT. She was given six shocks, and her state improved rapidly, both subjectively and objectively; after the first treatment, she said that she was now "in good spirits" and that the treatment had helped her, but at the same time she began to talk about that if she had not had an abortion then her child would have been four years old now—just as she often returned to old problems, such as her relationship to her mother. After five weeks it was considered that she had returned to her habitual state and she was discharged to her home. Diagnoses: *neurosis depressiva et sexualis, psychoinfantilismus, psychosis manio-depressiva (depressio mentis)*.

MONIKA

Also Monika had been admitted to hospital several times. The *case records* provide the following information:

- 1) Admitted for the first time when 16 years old: Menstruated since the age of 14, always regularly, but accompanied by slight molimina menstrualis and vaginal discharge. Gynaecological examination: Hymen adest, whitish-yellow vaginal discharge, uterus antelected, on the left it seems as if there is a tender resistance. WR and GR: negative. Diagnosis: *salpingitis?*
- 2) When 17: Still vaginal discharge in spite of daily irrigations with various solutions, pain in both sides of the abdomen, especially on the left. Diagnosis: *elythritis*.
- 3) When 17: For 3/4 year pain in the epigastrium and the right fossa iliaca, accompanied by vomiting; she had, therefore, been on a diet. Operation showed that the appendix was twisted, adhered to the surroundings and difficult to remove. It was necessary to invaginate the root of the appendix, which showed typical chronic, but none acute signs of infection. (Microscopy: not performed). Diagnosis: *appendicitis*.
- 4) When 20: Had been incapable of work, constantly fatigued, the vaginal discharge had increased and there were almost constant pains in the left side of the abdomen. She had started at a job as a domestic servant a few days previously, but had to go to bed because she had "cramps so the whole abdomen knotted itself". Gynaecological examination: unaltered conditions. Diagnosis: *salpingitis?*
- 5) When 21: Conditions unaltered. Diagnosis: *salpingitis*.
- 6) When 21 admitted to a medical department: Complained of dyspeptic attacks with irregular pain in the left side of the epigastrium, accompanied by regurgitation. Had been in bed for three weeks on a diet, vomited when she tried to get up. Still vaginal discharge. An X-ray of the oesophagus and the stomach as well as other routine examinations disclosed nothing abnormal. She received a diet. Diagnosis: *dyspepsia nervosa, gastritis*.
- 7) When 22: Complained of almost daily pains in the left side of the abdomen, had a distressing vaginal discharge. During two weeks there had been fever and incontinence of urine, and she had been catheterized for several days. Cystoscopy and other routine examinations disclosed nothing abnormal. During the stay at hospital, she did not appear to be in pain—on the contrary, she seemed well pleased with herself. Diagnosis: *observatio*.
- 8) When 22: Half a year earlier she had been treated on account of a slight pyelonephritis. Three months before the admission she had married a farmer; since then, she had not felt well, had constant, severe pain in the lower part of the abdomen, and she had been bedridden. During the week previous to the admission, she had had subjective symptoms of pregnancy. The examinations disclosed normal pregnancy in the 3rd month. Diagnosis: *graviditas*.
- 9) When 22 (5 days after she had been discharged) re-admitted: At home she had

been given morphia because of pain and sleeplessness. Diagnosis: *graviditas*. 10) When 23: For about a month pain over the hips and imperative, painful urination. Examinations showed normal pregnancy in the 5th month. Diagnosis: *graviditas*. 11), 12) and 13) When 23, admitted to medical departments. Had given birth to a boy 6 weeks previously. Diagnoses: *lactationis causa*. 14) When 24: Had breast-fed her child until three weeks previously, but the boy was ailing, and for some time she had had pain in the abdomen and slight vaginal haemorrhage as well as tendency to faints. Examinations: Normal pregnancy in the 5th–6th month. Diagnosis: *graviditas*. 15) When 24: A week before the admission she had given birth to a girl. For three days there had been pain in the abdomen and smelling vaginal discharge. She was treated with streptomide. Diagnosis: *observatio (febris puerperalis)*. 16) When 25: Had breast-fed her child but had since parturition had menstruation-like haemorrhages. An abrasio mucosae uteri was performed. Microscopy: Nothing abnormal. During her stay at hospital there was apparently fever, but when the nurse controlled this with the same thermometer, the temperature was normal. Diagnosis: *metrorrhagia*. 17) When 26: Complained still of abdominal pain and vaginal discharge as well as varicose veins on the right leg. She was pregnant in the 5th–6th month. Diagnosis: *graviditas*. 18) When 28: Had born her child at home. During pregnancy continued pains resembling labour pains, and a month before parturition severe pains, “the foetus loosened too early”. The child was born in a footling presentation and was said to have been asphyctic. An abrasio mucosae uteri was performed again. Microscopy: Endometritis. Diagnosis: *perimetritis*. 19) When 29: She still breast-fed her child. As before she complained of abdominal pains, especially in the left side and constant vaginal discharge. During a few weeks previous to the admission, she had also suffered from periodical headache and nausea. Gynaecological examination showed nothing abnormal apart from tenderness on both sides of the abdomen. She was given short-wave therapy. Diagnosis: *parametritis levi gradu*. 20) When 13: Six months previously a menostasis lasting 2–3 months, since then irregular menstruation with severe molimina due to which she took to her bed. On examination, the abdomen was found tender in both sides and the portio uteri showed a slight ulcer. Again she was given short-wave therapy. Diagnosis: *salpingitis chronica, dysmenorrhoea*. 21) When 32: Normal parturition (the fifth in eight years) three weeks earlier. Since then again pain and vaginal discharge. Diagnosis: *perimetritis post partum*. 22) When 32: Had applied to the Ministry of Justice via her physician for permission to be sterilized. The operation had disclosed that the uterus, the salpinges, and the ovaries were completely normal, but there were widespread peritoneal adhesions. Diagnosis: *resectio tubarum (sterilization)*. 23) When 33: For a year pressure in the vagina, pain on coitus, pain when defecating and incon-

tinence of urine. There was a cystocele of the size of an egg and a somewhat smaller rectocele. A plastic operation was performed. This left the vagina rather narrow, not quite passable for two fingers. Diagnosis: *descensus vaginae*.

Four months later, her husband attended the surgical out-patient clinic to complain that coitus was difficult because of the narrow vagina. On examination of the patient it was disclosed that there was more than enough space for two fingers. It was explained to the couple that the difficulties must be due to psychic causes, and they were instructed in sexual technique. A month later they came again because of the same difficulties. The examinations showed that conditions were still normal, especially when the patient's attention was distracted. Three months later the patient returned. As one still found no ground for assuming the presence of a surgical complication, it was suggested that she let herself be admitted to a medical department "in order to get peace from the husband for some time".

24) When 34, admitted to a medical department: The *case records* stated that she complained of "bad nerves", reduced libido, dyspareunia, constant vaginal discharge and pain on both sides of the abdomen.

In the records is mentioned, regarding the social-psychological factors, that the husband was a farmer of "good family". During the first year of marriage, he had leased a farm, but had been forced to give it up and take a smaller farm, and at the same time he started to work as a labourer on the railways because of their economic difficulties. Partly due to these difficulties, partly due to the patient's illness, the husband was finally forced to sell the farm and ended in debt. They continued to live in a small, cold and damp cement house, which was taken over by creditors. Their five children, aged from 1 to 11 years, slept in the kitchen, and the husband and she slept in the attic. Their marital relationship deteriorated after the patient at the age of 28 began to suffer from nervous disturbances, and especially after she had tried to commit suicide by taking barbiturates. The husband was hotheaded and they often argued and hit each other; the children cried, and the patient cried the whole day and could not manage her work. Their sexual intercourse was a complete failure because of her dyspareunia, and the husband forced coitus. The patient often had severe pain during coitus and "fainted or screamed so that the neighbours came running". The patient's family and friends had advised her to obtain a divorce, but she did not want to do so, partly out of consideration for the children, partly because she still liked her husband and thought that their marriage would be successful, if she was only freed from her dyspareunia.

In the record, the patient is described as a small, fat, talkative, smiling woman, rather excited, but apparently not very much distressed by her present condition. She gave a detailed description of her life at home in a rather naive way, and she seemed to be of rather dull intelligence.

During this stay at hospital, Monika became a proband in a psychiatric investigation. In a case history, published in Danish in 1957 (*Helsborg*, case history No. 52) it is concluded that "there did not appear to be reliable psychogenesis for her symptoms prior to her marriage, but the symptoms that appeared later did seem to have a psychogenesis". It is stressed that: "The patient's monozygotic twin is said not to have manifested nervous symptoms, and this suggests that genetic factors have not played an important rôle".

Three months later the patient attended the surgical out-patient clinic and it was still impossible to find an organic cause for her frigidity.

25) When 35, re-admitted: Still pain and a feeling of descensus of the vagina. She now wished to have her uterus removed. An operation was performed (amputatio supravaginalis a. m. Chrobak). The uterus was found to be normal. As the ovaries were normal, they were not removed. Microscopy: Hyperplasia præmenstrualis glandulae endometrii. Diagnosis: *Descensus vagina*. 26) When 36: A laparotomia cum oophorectomia bilateralis was performed. The ovaries were full of distended cysts. Microscopy: Haemorrhagia cystes corpora lutei ovarii utriusque, degeneratio cystica folliculi et perioophoritis chronica. A small fissura ani was treated with dilatation. There were no haemorrhoides. She was discharged for convalescence. Diagnosis: *degeneratio cystes ovariorum, fissura ani*.

27) When 37: Complained of left-sided abdominal pains, which increased if she worked hard or even thought about work. The children got on her nerves, and her sexual relationships with her husband was still unsatisfactory. She had been given hormone injections without improvement. She still did not seem to be depressed, but, in fact, exceptionally pleased with her life. She was treated with phenemal and short-wave treatment. Diagnoses: *colica abdominis, neurosis sexualis*.

28) When 39: Admitted unconscious after having taken 10-15 tablets, but she soon came around.

The husband stated that they lived in very primitive conditions, but he could give no reason for the patient's attempted suicide. He maintained that their marriage was reasonably harmonious and that his wife was usually in good spirits and a very economical wife. He denied absolutely that there had been sexual difficulties and did not think there had been "much talk" about a divorce.

The patient, however, stated that her husband always complained that she was frigid, uneconomical, and of no use at all. The immediate reason for her taking the tablets had been that she used some of the income from the chickens she looked after to buy food for her children and, therefore, the husband got very angry. She knew from previous experience that her husband could continue for days without speaking to her when they disagreed, and this attitude of her husband always frightened her, so she had hoped that she could scare him by taking the tablets.

At hospital, she was quite happy and allowed herself to be persuaded to go home, when her husband brought her flowers, chocolates, and cigarettes. Diagnosis: *veneficium pentymali*.

29) When 40: She was treated with a dilatatio ani and told to ensure regular defecation. Diagnosis: *fissura ani*. 30) When 40 years old: A superficial fissura ani was dilated. Diagnosis: *obstipatio*. 31) When 40: She felt unhappy because she "could not feel like a woman" after the many operations. Diagnosis: *extirpatio portiois uteri*. 32) When 41: A dilatatio ani was performed, and a small tumour about the size of a pea was extirpated. Microscopy: fibromyoma simplex. Diagnosis: *fibroma analis*.

After our investigation of the twins was finished, Monika had been admitted to hospital with the same complaints, but we did not pursue the matter further.

INGEGERD

During *the interviews*, Ingegerd said that from the age of 12 months and until she was seven years old, she had had three different foster-homes in Northern Jutland.

She only stayed a few months in her first two homes; at first, she stayed with her maternal uncle and then with a labourer, who had many children. Apparently both places were rather poor foster-homes.

Conditions were also poor in her final foster-home at her grandmother's half-brother's home. Her foster-parents were in their early forties and had a small-holding. They had two children, both girls, of their own. The foster-parents were paid for taking care of Ingegerd, and she meant that she was actually neglected.

She did not remember much about these years, except that she had felt extremely unhappy there. She came to the twins' mother when seven, and she did not later come into contact with her foster-parents or their children.

The conditions in the twins' common home will be described later.

After having left the home at the age of 14, she worked as a domestic servant in various places in Jutland, until she married at the age of 24. She married because she was pregnant, but she had a spontaneous abortion a few months before she married. When 27, she gave birth to a son. The child had been born several months too early, weighed only four "pund" and died two days old. Ingegerd felt that she could not have living children, and she and her husband therefore thought of adopting one, but then she gave birth when 28, 30 and 36 years old. She was able to breast-feed all her children, the eldest for 15 and the others for 2-4 months.

Ingegerd talked very freely about her husband and the conditions in her home as well as about her mother, and she stressed that none of them had really understood her problems.

She described herself as having been "temperamental, hard, and stubborn" when a child, but she had changed and she meant that it really was her family which was "hard-hearted".

She talked spontaneously about her sexual problems. She had early felt sexually touched and had shown great interest in the opposite sex ever since puberty and menstruation started, when she was 14. She "liked men a lot and liked going out to have a good time". Between the age of 17 and 20, she had several short-lived sexual relationships, among others with a young man, who was interested in both twins. The young man had no luck as far as Monika was concerned, but he "raped" Ingegerd. She became pregnant, but aborted some months later. She did not think that her libido had been especially strong and she preferred to call it "a strong wish to have an amusing time". After she married, she had certainly not been much interested in sexual matters, she felt "cold", had dislike of the sexual act, felt that her husband demanded too much of her, and she was always afraid that she would become pregnant.

She was much worried about her daughter's sexual development; she mentioned dramatically that the daughter had been exposed to a sexual attack when only 10 years old. A man had exhibited himself, and her daughter had since then been very interested in sexual matters and also too inquisitive about her parents' intercourse; this seemed to annoy Ingegerd, because their flat was so small that she and her husband slept in the same room as the children. She seemed to identify herself strongly with her daughter and was afraid that the daughter had the same desire to "have an amusing time", which she meant she herself had "inherited" from the twins' mother.

Ingegerd's husband seemed during a short interview to be mentally normal, probably of average intelligence. Apart from an operation for "a gastric ulcer" when 41, he had been in good health. He had been a boxer at one time, but otherwise had no particular interests and especially no interest in common with Ingegerd. He had been out of work for various periods, but never incapable of working. They had never had much money, but they had never accepted assistance from others and, on the whole, the husband meant that their home and life had been "quite normal". He did not appear to have been able to accept that her state and reactions were due to an "illness".

Ingegerd's children. 1) *Son*, died two days old. 2) *Daughter*, 14 years old, physically in good health. Ingegerd described her as "previously easy, afraid of being smacked", but during puberty the girl became difficult and resisted Ingegerd, "conspired with her father". The girl still attended school, managed well and apparently she was somewhat above average in intelligence. 3) *Son*, 12, healthy. Ingegerd described him as quiet, he had never been "difficult". He was the only child, she spoke fondly of, and he was apparently also very

fond of Ingegerd. 4) *Son*, five years old. He was described as "difficult, not to control, very hysterical, could fall on the floor, bite and kick his mother". He suffered from occasional enuresis, but apart from this he was in good health.

MONIKA

During *the interviews*, Monika said she had had two foster-homes in Northern Jutland, at first with her maternal uncle for a short time, where she was unhappy, often beaten, and then with the parents of the cook, who had known her mother and looked after Monika at the children's home.

Her foster-father was a tailor and had a good income. The foster-parents were in their early forties and apart from the above mentioned daughter, who was 17, they had a boy and a girl, who were 12 and 9 years older than Monika. Monika remembered her foster-home well. She had been very happy there and always well treated. "It is the only home I have ever had". Her foster-mother wanted to adopt her, but when Monika was six years old her own mother, who had married a year before, demanded to have her back again. Monika continued to keep in touch with her foster-home and also with her foster-siblings.

Monika's environment from 6 to 14 will be described later.

After having left the home at 14, she had various positions as a domestic servant in different parts of Denmark, until she married at the age of 22. Her husband, who was eight years older, was a labourer and also had a poultry-farm. They had little money and lived in a poor house to which was added marital difficulties and later Monika's many admissions to hospital. They had, however, never received assistance from others or public assistance. Between the ages of 23 to 32, Monika had five children. She was able to breast-feed them all, the eldest for about six months and the youngest for some months. She had never had a still-birth or an abortion.

Monika talked about her own medical history in great detail. During one interview she summarized it as follows: "When I had my fifth child I was near death . . . and a year later I had a big tumour on my ovary . . . and then things fell over one another . . . my ovary and tubes and finally the whole lot was taken out . . . but I had pains and could not stand being together with my husband so they took part of the uterus and my intestines have been dilated three times . . . and similar small things . . . and now I must probably be operated upon again because I have a wound in my anus and it keeps opening again . . . and I cannot get my stomach to work as it ought to do and even if I take paraffine . . . it runs right through and then I am obstipated . . . I have been in the local hospital 31 times and also in some other hospitals".

That she had been able to manage life since, she said, was because she had become "hardened and able to pull myself together", and finally because she had a physician, who really understood her and gave her sedatives and hormone injections and never suggested sending her to a psychiatrist. She was quite definite that she would never allow herself to be admitted to a psychiatric hospital; she mentioned that the youngest of her foster-sisters for many years had been in a mental hospital. (I knew this patient, who had protracted severe depressions and suffered from a manic-depressive psychosis). Monika repeatedly returned to this foster-sister and expressed her dislike of the idea of her twin sister or herself being admitted to such a place.

When young, she had been very shy and reserved—as opposed to Ingegerd—especially about sexual matters, and very early in puberty, she decided that she "would at least not make the same mistake" as her mother, and this attitude meant that she was a virgin when she met her husband. Their sexual relationships had always been unsatisfactory, and she probably rarely if ever reached orgasm. She was always afraid of becoming pregnant and was incapable of adopting any anticonception-technique apart from coitus interruptus. After she began to have abdominal symptoms, she was no longer capable of hiding her dislike of coitus from her husband. In this respect he placed considerable demands on her, he did not understand her, was often violent and hot-tempered, and their disagreement often went over into blows. After they had been married for almost 10 years, they talked of obtaining a divorce, but her husband's family with whom she had always got on well resisted it, and since then her marriage had continued more or less satisfactory, "because we like each other really as well as our children". Her husband, Monika said, was otherwise "good enough". He came from a very well-situated family and was the youngest child and only boy of six. He had taken over his father's relatively large farm, but had been unable to manage it, and he had already commenced his social decline when Monika met him. The husband's siblings, on the other hand, had got on well, and Monika never missed an opportunity for mentioning her family-in-law, especially two of her husband's nephews, who were physicians.

After some years, Monika and her husband improved their living conditions by means of a strict economy. I visited Monika in her home several times. It was a rather damp house of cement with two rooms and a couple of small bedrooms, very untidy and neglected; perhaps the most impressive feature was the large amount of old furniture, which the husband had received from his parents.

I had a long talk with Monika's husband, when he approached me to hear what type of investigation his wife took part in with such energy. His immediate mistrustful attitude disappeared when he was given the information he desired, and he became very positive and spoke instructively about an

experiment, he had taken part in together with a veterinary surgeon on monozygotic calves, which were raised in different ways. The husband seemed to be definitely about average in intelligence and without overt signs of neurosis. Apart from hospitalization due to a concussion, he had always been healthy. Although the husband thought that the twins were obviously very similar physically and mentally, he nevertheless felt that they were also "different", and he stated that he had no desire to "change". In his opinion, Monika was "soft" because she had grown up in a "good" home, whereas Ingegerd was "hard" because she had been in a "bad" home, where no one liked her.

Monika's children. 1) *Son*, 18 years old, unmarried apprentice. During puberty, he was, according to Monika, "difficult, refractory, and had fainting-fits". After an argument with his parents when 16, he left home, wandered about, was later admitted to a neuro-medical department. No suspicion of epilepsy or signs of mental abnormality. 2) *Daughter*, 17, unmarried domestic servant. Physically and mentally normal. 3) *Daughter*, 15, at school. Physically and mentally normal. 4) *Son*, 13, "rather nervous and difficult", but otherwise normal and healthy. 5) *Son*, nine years old, perhaps also "rather nervous and difficult".

THE TWIN RELATIONSHIP

After the twins had been placed in their foster-homes, the twins' mother worked for some years as a house-keeper, and when the twins were five years old she had yet another illegitimate child. She married some months later a carpenter, one year older than herself, but according to the twins, he was not the father of the child. The twins' mother and her husband went to live in the town where the twins had been born, and as mentioned Monika returned home when six and Ingegerd when seven years old. They lived for almost seven years together with their younger half-siblings.

During the first year, from seven to eight, they attended different schools, but when their step-father took over a coffin-maker's establishment in a village on Zealand, they went to the same school and class until the family returned to Jutland, when the twins were almost 14 years old. They did not appear to have met serious problems while at school; Monika was the cleverer, especially in arithmetic, but otherwise they did not differ in important respects.

The family's income and housing conditions were more or less satisfactory and, on the whole, there were no important social problems. Both twins stated, however, that they were not at all happy in their home.

They were never fully accepted by their mother, and they felt "pushed to one side" in comparison with their half-siblings. Their mother treated them "harshly". She never kissed them or petted them or allowed them to caress her. They were also not allowed to call her "mother" but had to use her

and the step-father's Christian names. They clearly remembered once being hidden in the bedroom, when some visitors came and were not to know that they were children of their mother. "We were always a stone around her neck".

Their step-father, on the other hand, was really fond of them, kind and understanding, played with them, and he was the only person in the home, who ever payed attention to them. However, he was dominated by their mother, and the relationships between the mother and the step-father was not harmonious. On some occasions, their step-father criticized their mother for not treating all the children equally, but this only increased her rejecting attitude towards them. Until they left home, the twins had always believed that their step-father was their true father. They became very unhappy when they learned that this was not the case. They had difficulties in their relationship with their half-siblings and had not been in closer contact with them since adulthood.

When children, the twins resembled each other very closely indeed. They were usually dressed alike and very often confused by strangers, at school, and sometimes also by their step-father and half-siblings, but never by their mother. The mother had told them that they had, in fact, been mistaken for each other when they were christened; the coloured ribbons they had around their wrists had been interchanged so that the "eldest" had not been christened "Monika" as had been planned. The twins always kept together when children, they played only with each other and were treated as a unit by their environment, but their attitude toward their surroundings and particularly toward their mother were different from an early age. Ingegerd was the domineering twin, she talked for both of them and was very stubborn, defiant, and temperamental. She often answered back and was, therefore, more often punished than Monika. Monika was more quiet, reserved, "had an inferiority complex", was afraid of the mother and did not dare to resist her. When Ingegerd was punished, it was Monika who cried, whereas Ingegerd remained silent and obstinate. Neither felt that they had manifested "nervous" symptoms during their childhood, and neither of them suffered from enuresis, nail-biting or other disturbances.

After the twins had been separated again at the age of 14, they continued to keep in touch with each other during the first years. Among other things, they often went to dances together, and here Ingegerd was very popular. She criticized Monika because Monika would not approach the young men and said that Monika would probably never get married. Gradually the twins ceased to see much of each other, and when they were about 20, they parted as Monika became engaged to her coming husband. Ingegerd had great difficulty in accepting this situation, and the twins' mother encouraged Ingegerd in the twins' disagreement. Finally, the twins quarrelled, and for some

years they did not come into close contact with each other and they often even did not greet each other if they met. During the last 20 years prior to our investigation they had only met on a few occasions.

Both soon lost touch with the mother, especially after their step-father died at the age of 43 after an operation for "gastric ulcer". They could never forget that their mother had deliberately not informed them of their step-father's death so that they had not been present at his funeral. During the last 20 years the twins had hardly ever been in touch with the mother, and she had never seen the youngest of their children. Monika had completely broken off relationships with their mother although she lived near to Monika. The mother did not even greet Monika when she met her in the street. Ingegerd, on the other hand, wanted to re-establish contact with her and tried to do so while she was at the mental hospital. Her mother first allowed her to visit her, however, after having made sure that it was not Monika, who rang the bell. After this meeting, their relationships did not, however, improve. The twins both said that they had always been very disappointed by their mother's attitude, and during the interviews they both repeatedly returned to this topic. They agreed in describing the mother as a "woman with a heart of stone", "bad-tempered and very egoistic". As far as the twins knew, the mother had always been healthy. They stressed that physically, particularly regarding the colour of their hair and eyes and their building, they resembled their mother in many respects.

The relationship between the twins during our investigation was ambivalent. They realized that they resembled each other in various respects, and they were also still confused by friends, but their children and their husbands found that the twins were "different", and the twins themselves also thought that they differed in mentality. Ingegerd thought that she was "more serious, could look angry and hit back", whereas Monika thought that Ingegerd was "more temperamental and uneconomic" and, in particular, she thought it "unreasonable for a woman to smoke so much", in spite of the fact that Monika had smoked a lot herself earlier and presumably even more than Ingegerd. Both despised alcoholic beverages. Monika also thought that Ingegerd in many ways resembled their mother more than she did herself. They agreed that Ingegerd's foster-home had been "bad", whereas Monika's had been "good", and also that their husbands and present homes were very different from each other, but both expressed the view that the other had had an easier life in most respects.

CLINICAL EXAMINATIONS

The examinations comprised 14 interviews, six with each twin and two with both twins together. In addition, I interviewed their husbands and I

visited Monika's home. The twins cooperated satisfactorily, but it is doubtful whether they ever speculated about the real object of our investigation. Some of the psychological tests were carried out by a psychologist at the mental hospital when Ingegerd was there, but the results have been re-evaluated by the psychologist, who took the other tests reported.

The twins resembled each other very closely, indeed; they were the only twins in this series, whom I occasionally confused, but then only when I saw one of them alone. They were of the same built, relatively small and plump. Ingegerd: 149.0 cm/52.6 kg., Monika: 150.0 cm./52.6 kg. Their faces were similar both in general and in all details, especially as regards their characteristic "round and happy" faces and their "concave" noses. Both had poor teeth with pronounced caries. The shape of their heads, the position of their ears and the detailed structure of the ears with free lobes were completely identical. Their hair colour was brown. The hair was straight and parted on the left, with a clock-wise whorl. Their eyes were bluish-grey with no difference in the structure of the iris. Apart from the abdominal scars and hairy legs in both twins, the somatic examination did not disclose anything in particular. Bloodpressure: normal. Both were right-handed.

The twins' general behavior was very much alike. Both had lively facial expressions. They were mostly smiling, but Ingegerd often looked rather glum. Their voices resembled each other to the point of confusion, and both spoke with the same Jutlandish dialect. They dressed very much alike, had the same stance and gait, and at a distance it was difficult to differentiate between them; the most obvious difference was that Ingegerd nearly always had a cigarette in her mouth.

During the interviews, they primarily appeared very similar, and dissimilarities were only disclosed after one had got to know them fairly well. Both appeared to be of rather poor intelligence, presumably somewhat below average, but without obvious differences.

Both seemed extroverted, primitive, childish, rather immature and undifferentiated. Both were very interested in describing their life and case histories in great detail and talked in a stereotyped fashion. Their descriptions of their many symptoms were strikingly alike, and their topics of conversation were almost identical, primarily dealing with their relationships with their mother, their stays at hospital, their sexual problems, the conditions at home, and especially the problems concerning their children and husband.

Monika appeared to be more balanced and self-satisfied than Ingegerd, whereas Ingegerd appeared less sure of herself and also apt to be depressed in mood, but neither appeared to be in a clearly depressive state, and neither seemed to have pronounced obsessional or compulsive traits.

Speaking generally, however, their resemblance in personality was dominating, and the differences were difficult to specify. Both presented marked and

very similar symptoms of a neurosis of long standing, dominated by hysterical, psychosomatic and at times anxiety symptoms and depressive traits.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive matrices

Ingegerd

Attempted 57 matrices in 30 minutes (Matrices E₁₀₋₁₂ not used). Cooperative, worked independently, seemed to be slightly confused by questions and uncertain even when her answers were correct. Score: 12+8+5+5+2=32. Distribution: normal; discrepancies: 4. Group: 25-50 percentile. Conclusion: normal intelligence.

Monika

Attempted 60 matrices in 20 minutes. Worked quickly but rather impulsively. Score: 11+6+5+8+2=32. Distribution: abnormal, the high score in group D particularly; discrepancies: 8. Group: 25-50 percentile. Conclusion: normal intelligence.

Wechsler-Bellevue

	Ingegerd				Monika			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Formation	12	9	12	9	13	10		
Comprehension	7	6	7	6	10	9	13	10
Digit Span	4+3 = 7	3	4+3 = 7	3	5+2 = 7	3	4+2 = 6	2
Arithmetic	8	10	6	7	8	10	7	9
Similarities	7	6	11	9	11	9	10	8
Vocabulary	(19)	(8)	(19)	(8)	(21)	(9)	(23)	(10)
Verbal Points		34		34		41		37
Picture Arrangement	4	4	11	10	7	7	10	9
Picture Completion	11	10	11	10	9	8	11	10
Block Design	12+1 = 13	7	12+2 = 14	7	15+3 = 18	9	15+3 = 18	9
Object Assembly	17+1 = 18	10	18+5 = 23	14	17+2 = 19	11	18+4 = 22	13
Digit Symbol	27/27	6	30/30	7	37/37	9	35/37	8
Performance Points		37		48		44		49
Total Points		71		82		85		86
Verbal IQ		88		88		96		92
Performance IQ		97		110		105		111
Total IQ		91		98		100		101

Ingegerd

Was quite cooperative, apt to be despairing, seemed naive and concrete. The poor score on Digit Span is striking, and together with Block Design tends toward "organic" results. The results for the performance tests are rather fluctuating. Conclusion: Normal intelligence (the difference between the Verbal IQ and the Performance IQ seems to depict her quite well, as one at first takes her to be less intelligent than she is). When retested (10 months later) her cooperation corresponded more or less to the first test, but she seemed more unsettled. The scores do not show many important changes, and it is still characteristic that the Verbal IQ is lower than the Performance IQ. Conclusion: As previously.

Monika

Quite cooperative, did not despair, tried to answer even when her knowledge was insufficient. Her answers are often naive and rather concrete. On the whole, her attitude was rather emotional and hysterioform. Her scores fluctuate within the sub-tests both in the verbal and performance scales. Her Digit Span is particularly striking, and she solved Block Design in a peculiar fashion. Conclusion: Normal intelligence. (A striking difference between the results for the verbal and performance tests, corresponding to the fact that she does not seem to be as intelligent as the test-results indicate). When *retested* (10 months later), she appeared to be less labile and talkative. The variations in the verbal scale are unimportant, but her scores for 3 performance tests are somewhat higher than before. Apart from this, however, the pattern is almost unaltered. Conclusion: As previously.

Rorschach

1 W	19 F+	1 H	5 P. 0 Orig?
21 D	2 F+/-	2 Hd	F+ 77 (extended 77)
1 DdD	5 F-	5 A	F = 100 - L = 100?
2 Dd		9 Ad	A = 54 (anat + sex % = 31)
<hr/>		3 Anat	Affective ratio: 31
Total: 25		1 Cg	RT: 1.3. min. (I - VII)
		5 Sex	1.3. min. (VIII - X)
			Seq.: indeterminable
			Ap: (W) - D!
			Exp: 0/0
			Colour shock, shading shock

Tendency to perseveration and object-criticism, preference of central areas.

Quite cooperative, but rather unsure of herself and confused. Her sexual and anatomical responses ("abdomen") were striking. She often seemed to be in doubt as to from what angle she should look at the plates and whether they depicted male or female objects.

Psychogram: Her intelligence is difficult to decide, but probably she is within the normal range. She seems to have great difficulties in obtaining a general view of the situation, as well as great difficulties in integration and productivity. Occasionally her ability to observe appears to be good, but presumably she does not make use of this ability constructively in her attempts to adjust herself. She is apt to react in a stereotyped and unflexible manner. She seems to have a very restricted possibility of experiencing things, emotionally she reacts banally, stereotyped and without spontaneous emotion. This emotional inhibition and aversion probably reflects her anxiety. There appear to be sexual problems, partly conscious, and there are also signs of identification problems with undeveloped or repressed female identification, feelings of inferiority and uncertainty as regards her sexual role, and probably also a compensatory, masculine way of reacting. Conclusion: Neurotic, lacking in self-confidence, inhibited, partially compensating. Sexual problems and identification problems must be presumed to exist. It seems possible that she might react with an acute depression. Due to her difficulties in identification, she presumably reacts rather "by chance", superficially, compensates, and is rather confused. (Report of the hospital psychologist).

Supplementary evaluation: Is undoubtedly examined during a relatively poor phase. Seems obviously perseverating in definite problems. There is a general reduction in the breadth of thought. Perhaps also rather dysphoric. It seems doubtful whether the emotional inhibition is characteristic of her normal state. The test results are, on the whole, thin and stereotyped, and it is difficult to judge her resources both in intellectual

and emotional fields. In connection with the deep-lying sexual problems, one will probably find somatic symptoms, partly of a directly sexual, partly of a more indirect (psychosomatic, converted) type. Her habitual state is probably typified by manifest lability and her personality must be assumed to be immature and hysterioform.

Double-blind test

Probably a woman, perhaps middle-aged. Intelligence presumably below average. Seems unsure of herself, rather cautious, probably does not dare to attempt extensive tasks, presumably does not show much initiative or independence, is stereotyped and not spontaneous. She seems rather egoistic without much interest in or understanding of other persons. Her ability to achieve adequate emotional expression seems to be poor, she will probably be inhibited, but emotionally tense, with a tendency toward somatization. Problems of identification? There seem to be sexual problems.

Retest (10 months later)

2 W	7 F+	0 H	3 P. 2 Orig. (-)
1 W cut	2 F+/-	1 Hd	F+ 53 (extended 50)
10 D	6 F-	6 A	F = 100 - L = 94
1 DdD	1 CF	2 Ad	A = 50 (anat + sex % = 43)
2 Dd		4 Anat	Affective ratio: 37
<hr/>		3 Sex	RT: 0.8 min. (I - VII)
Total: 16			0.5 min. (VIII - X)
			Seq.: indeterminable
			Ap: (W) - D
			Exp: 0/1
			Colour shock, shading shock

Tendency to perseveration, denied answers; preference of central areas; low "experience-awareness".

Her behaviour did not appear to have altered, apart from that she was perhaps slightly calmer and subdued.

Psychogram: It is difficult to estimate her intelligence from the test alone, at least her maximum intelligence. She appears to be dull, primitive, and lacking in nuances. Again one finds clear restriction in breadth of thought and a perseveration regarding sexual problems. (One may assume somatic symptoms in connection with this). She is unsure of herself and her ability to control anxiety is poor, she is primitive and hysterical (repression and denial). She seems inhibited in her behaviour and her insight into herself. In spite of the suggested lability in reaction, it is difficult to estimate the extent to which this lability will manifest itself. Perhaps sexual and "somatic" phenomena provide a release. She is rather sthenic, tending toward the extrapunitive.

Monika

4 W	11 F+	0 H	4 P. 3 Orig. (-)
2 DW	1 F+/-	1 Hd	F+ 60 (extended 60)
2 DdW	7 F-	12 A	F = 100 - L = 100?
9 D		3 Ad	A = 79
1 DdD		3 Anat	Affective ratio: 32
1 Dd		++ Sex	RT: 0.6 min. (I - VII)
<hr/>			0.6 min. (VIII - X)
Total: 19			Seq.: indeterminable
			Ap: W - DW! - DdW! - (D)
			Exp: 0/0
			Colour shock, shading shock.

Tendency to perseveration, low "experience-awareness", preference of central areas: questions without proper appeal.

Somewhat agitated, but adjusted superficially to the test. Asked many questions, but did not appeal and tried to get through the test as easily as possible.

Psychogram: The results make it difficult to evaluate her intelligence. Presumably she functions as if she was rather poorly endowed with slight ability to work thoroughly on tasks presented by others. Her attitude toward the tasks is, however, possibly an expression of a tendency to a flight-reaction, and there seems to be a latent feeling of insufficiency, perhaps also anxiety. Her ability to withstand conflict, her adjustment and "energy" seem to be poor. This means not only that she is inhibited, but also that she in a childish manner tries to act out. Her insight into herself and her empathy are likewise poor, and presumably she also has little interest in contact with others. There are probably sexual problems and anxiety, but her ability to identify herself with the feminine role in a mature way is presumably poor. One must assume hypochondriac and somatic symptoms.

Double-blind test

Probably a woman, probably in middle-age. She is presumably poorly endowed intellectually (or else of ordinary intelligence but showing signs of intellectual reduction due to age). At present, she seems to have great difficulties in obtaining a general view of a situation and realizing the consequences of her actions. If she tries to attack complicated problems, she will probably often reach hasty conclusions and wrong results. She seems to be superficial, stereotyped, and perseverating in her line of thought. She seems to lack emotional nuances and her ability to establish contact with others is restricted. Hypochondria? Tendency to somatic symptoms? Neurasthenic traits?

Retest (10 months later)

2 W	9 F+	0 H	2 P. 2 Orig. (-)
1 W cut	4 F+/-	0 Hd	F+ 58 (extended 58)
2 DW	6 F-	9 A	F = 100 - L = 100?
1 DdW		8 Ad	A = 90
8 D		2 Anat	Affective ratio: 42
2 DdD			RT: 0.7 min. (I - VII)
1 Do			0.4 min. (VIII - X)
2 Dd			Seq.: indeterminable
			Ap: W-varied! - (D)
			Exp: 0/0
			Colour shock? shading shock.
Total: 19			

Tendency to low "experience-awareness", preference of central areas as well as edge areas?

Her behaviour was, on the whole, unaltered.

Psychogram: One gains the same impression of her intelligence as before. She is still superficial and she still tends to dramatize. The presumed somatic-hypochondriac phenomena must be related to this aspect, but possibly one must also expect that she consciously aggravates and is to some extent untrustworthy. The latent anxiety is clearly still present. Presumably it is based upon an infantile sexual attitude, but the more detailed background for the development of these problems and the form in which they will make themselves manifest is difficult to decide. There is perhaps a phobic tendency in some of the symptoms. In spite of repression of experience and expression, she does not appear to be depressed, although she is far from being unaffected or at ease.

*Word Association Test (a. m. Rapaport)**Ingegerd*

There was some diffuse agitation and her reactions alternated between a tendency toward blocking and impetuous responses. On the whole, however, she managed well and responded to all the stimuli.

Results: The reaction times varied, and there were 4 above 10 seconds ("bag/case", "friend", "sheath", and "husband"). Many of the answers were emotional, naive, and concrete (corresponding to the emotional-hysterioform, primitive, and immature personality suggested by the other tests). Similarly, one finds poor self-insight and interpersonal sexual problems (latent homosexual impulses?). When repeated, the number of prolonged reaction times corresponded approximately to the number of reduced reaction times, but none was 10 seconds or above, 2 almost reached 10 seconds ("father" and "husband"). The number of repetitions is relatively low (43 per cent). The general impression from the first test is confirmed.

Monika

She seemed restless, did not understand what she had to do and merely repeated the stimulus-words, the first five of which were repeated in order to lead her into the correct attitude. It was, however, only partially possible to alter her attitude, as she mostly explained or defined the words rather than associated to them.

Results: Her attitude meant that the reaction times were comparatively short, the longest was 6 seconds. Her attitude was partially defensive, but it probably also reflects her primitive and restricted intelligence. Her explanations of the words are mainly descriptions of functions, and her choice of words is stereotyped. Most striking are her interpersonal and sexual problems, her emotional-hysterioform attitude (a type of exhibitionism) and the pronounced but immature desire for contact. When repeated, approximately the same number of reaction times increased as decreased. The percentage of repetitions was not calculated due to the lack of proper associations. Qualitatively, one gains more or less the same impression as before, although the traits mentioned may be rather more obvious, and one noted ambivalence and a tendency toward projection. (Perhaps this is also true of the latent tendency toward homosexuality?).

Summary and comparison of the test results

Both twins seem to be of normal intelligence, but their behaviour when dealing with verbal tasks corresponds to the lower limit of the normal, this is especially true of Ingegerd. On practical tasks they are near the average. Their ability to concentrate on the tasks is strikingly poor in both cases, and there is an obvious tendency to react emotionally. Both appear to be extroverted, immature, undifferentiated, and hysteriform, and they apply their intelligence to only a small extent of their problems. Both lack the ability to see things from a general point of view. The difference between them is mainly that Monika's ability is better and more stable than Ingegerd's.

They resemble each other closely from a qualitative point of view. Emotionally both are characterized by uncertainty and poor tolerance toward conflicts, which is manifested in flight-reactions and denial. Although they seem to be immature, their emotional life is, on the whole, best described as being inhibited by anxiety(?), though, perhaps especially in Ingegerd's case, there

seem to be fluctuations in mood and emotional break-through. Both are probably apt to dramatize and react primitively. Their ability to establish contact with others as well as their desire for such contacts seem in both cases especially typified by egocentric and infantile traits. The suppression of anxiety does not appear to be effective, but possibly the above mentioned manifestations together with general defensive mechanisms may more or less avoid the anxiety becoming conscious. The difference between the twins once again consists in Monika being more "effective and sthenic". Somatic symptoms must be presumed to be present in both cases. Their defensive patterns resemble each other closely, and both twins especially use repression, denial, fixation, and regression to a wide extent. Neither uses sublimation or reaction formation very much. Ingegerd is more apt to project than Monika. Both are thus characterized by sexual and interpersonal problems. Their early conflicts in connection with libido-impulses are still partly unsolved and both have problems of identification (latent, partially projected homosexual impulses?).

OTHER SPECIAL EXAMINATIONS

EEG. The results were identical. Alpha-rhythm for both was 9-10 hz, amplitude 50-75 μ v, the distribution in time of the dominant activity 50 per cent. No abnormal potentials and no focal abnormalities. Both manifested increased alpha-activity during hyperventilation. Conclusion: Normal in both cases.

ECG. Considerable resemblance. Conclusion: Normal in both cases.

Ophthalmologic examination (summary of report). Neither striking similarity or dissimilarity. Axes parallel. *Ingegerd*: very slight converging strabismus, *Monika*: some converging strabismus; in both cases the strabismus was within normal limits. Ophthalmoscopy did not disclose anything abnormal. Iris: bluish-grey, slightly brownish toward the edge of the pupil. Conclusion: Normal in both cases.

EPICRISIS

Ingegerd and Monika were born out of wedlock. Apart from being two months premature, their birth was probably normal. The twins were breast-fed and stayed together with their mother at a children's home, until they were separated when 12 months old.

Both were placed in foster-homes in Northern Jutland. Ingegerd was chiefly brought up with distant relatives and had three different foster-homes: at first she was put into the care of a maternal uncle, a labourer with five children, then she stayed with another labourer with many children, in both

cases apparently under rather poor circumstances. She only stayed a few months in these two homes. Also her final foster-home at her grandmother's step-father, a small-holder with two children, was poor and she stayed there nearly six years. Monika also stayed for a short period with the above mentioned maternal uncle but not together with Ingegerd; she then came to a rather well-situated tailor's home, where she grew up together with three older step-siblings and apparently was well treated, until she came back to the twins' mother when six years old.

The last part of their childhood, from their 7th to their 14th year, was spent together with their mother, who had got married, and they grew up together with their three younger half-siblings and a step-brother. After that time, their lives ran apart, although they kept up some relationship with each other when quite young until disagreements arose between them.

Our investigation, which lasted about three years, commenced when the twins were 42 years old, at which time they had not had closer contact with each other for at least 20 years.

There were thus marked points of similarity in their childhood environments and their later life histories, but also differences were present.

Even before their separation, when they were one year old, they each had their own "mother-figure"; Ingegerd was looked after by their mother, whereas a girl-friend of the mother took care of Monika.

With regard to the psychological atmosphere, their foster-homes had undoubtedly differed, since by comparison with Monika, Ingegerd grew up in a home, which was probably "more cold and loveless".

Both had always been rejected by their natural mother, and both were at a very early age aware that they were illegitimate children, but in the period when they shared a common outside world in their mother's home, they had different relationships to their mother and were different in their casting-out of the roles played by each in the twin relationship.

Apart from the first year, they attended the same school and there was probably no important difference in this respect in their upbringing.

Even though, there were many points of similarity in the development of their personalities in childhood, they presented at an early stage emotional and characterological differences, which by the twins themselves and their relatives were described as a tendency to make Ingegerd more "hard" and Monika more "soft".

Their later life followed a similar course; both had been in domestic service, both had married comparatively early, Ingegerd when 24, and Monika when 22 years old. Both had children; Ingegerd, who had an abortion when 25, gave birth to four children; the first child died immediately after birth. Monika had five children but no abortion or still-birth. Socially-economically their outer circumstances when adults can hardly be said to have been very

dissimilar. Sexually, there was a difference in their primary attitude, which had brought about a conflict between the twins, and a difference with regard to their choice of sexual partners and husbands.

Somatically as well as psychically, the development of the twins has run in the main parallel. Both were frigid, complaining of dyspareunia and fear of pregnancy with the resultant marital-sexual problems. Both had repeatedly been hospitalized and treated for primarily gynaecological disorders, for which both had been operated and finally sterilized, Monika when 32 and Ingegerd when 42 years old. The chief difference seems to lie in a term-shift, as Monika's medical history began some years before Ingegerd's and, at the time of our investigation, had reached a certain outer stability.

The clinical and psychometric examinations revealed that their intellectual endowment was very similar, just about or below average, with no clear difference and in accordance with the fact that their formal education had virtually been the same.

As regards personality, both appeared primitive, undifferentiated, and both presented marked symptoms of a neurosis of long standing.

The information available concerning the twins' biological family, especially the paternal family, is scarce and no definite disposition to psychiatric illnesses has been disclosed. It has been suggested that Ingegerd might probably be suffering from a manic-depressive psychosis, but this possibility can hardly be sufficiently substantiated.

The twins thus present marked points of similarity in intelligence, personality structure, and development of psychiatric illness. The differences, which may be assumed to have existed in their respective childhood environments and life histories, do not seem in any appreciable degree to have produced differences between the twins.

Both must be classified as: neurotic with dominating hysterical, psychosomatic and at times anxiety symptoms and depressive traits.

CASE V

KAJ AND ROBERT

This twin pair was registered at the Institute of Human Genetics in Copenhagen in 1955.

Robert, a 45-year-old draughtsman, married and domiciled in a harbour town in North Zealand, approached us by letter. He stated that he had been brought up in Copenhagen and during his adolescence, he had been told that he was an adopted child, and, about ten years later, that he had a twin brother, who had been placed in Jutland. He had often toyed with the idea of trying to trace his twin brother and, possibly, to effect a meeting; this was, however, not put into practice until he was 40.

During several years he had, in the street, often been mistaken for someone else, especially by young women, who called him "Kaj". Through the national registration office, he succeeded in establishing the fact of his brother's existence, along with getting the information that he was also living in Copenhagen. He got into touch with him by telephone, and immediately after, the twins had their first meeting.

Kaj was a commercial traveller, married, and living in one of the suburbs of Copenhagen. I looked him up in his home, and he told me readily about the course of his life and about his relations with his twin brother.

Kaj had been brought up in humble circumstances in the home of an English born "riding master" in a village in Central Jutland. He had been informed, during his adolescence, that he was an adopted child and that he had a twin brother. Some years before the time when he had been approached by Robert, he had succeeded in tracing him, but had, at the last minute, refrained from contacting him, fearing that Robert was too "distinguished" and would reject him.

They were both very much impressed by their mutual resemblance. Their reunion was, nevertheless, not a success; they fell out almost at once, and, after barely a year, their relationship was terminated. Kaj stated further that he wished they had never met; they had "nothing in common and did not like each other".

In the course of the first interview, Robert had said that he wished to place himself "at the disposal of science", but he was not sure whether his brother was similarly minded. During the ensuing interviews, Kaj agreed to collabo-

rate in an investigation provided it did not necessitate the twins' being examined together. The investigations were, therefore, carried out concurrently and, for this reason, I have never seen the twins together. The twins did, however, effect a meeting, with the result that their dissensions briefly flared up again and the connection was quickly dropped. We were in touch with the twins, separately, for a period of 4 years.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The twins knew very little about their parentage. They were born out of wedlock. Their parents had both been married.

The father

He was a wholesale merchant of Copenhagen, a member of a reputable and well-to-do family of business men. The twins had been informed that he had been a "ladies' man, charming and handsome, who used to lounge about town and who was considered the black sheep of the family". It was the father who arranged for the care of the twins; Kaj's adoptive parents had, apparently, been distant acquaintances of his, and Robert had been adopted through a newspaper advertisement.

Both twins had, prior to their first meeting, sought out their father's family but had been turned away with the information that their father had long been dead (cf. later).

The mother

They only knew that she had been married to a wholesale merchant of Copenhagen and that she had died long time ago.

The twins have no knowledge of the supplementary information we collected concerning their father's and mother's families (cf. later).

THE SEPARATION

The birth took place at a private maternity clinic in Copenhagen. Apart from the fact of its having run a normal course, no information, especially about the afterbirth, is forthcoming, nor is it known which twin was born first. (Both felt, without being able to give any explanation, that Kaj must be the "elder"). They can hardly have been breast-fed, since they were taken from their mother immediately after they were born, and put into a children's home in Copenhagen.

It is not known exactly when they were separated. Robert meant that they had been separated immediately after birth. Kaj said that they were separated when three months old. With certainty it can be stated that the separation

must have happened before they were nine months old, at which time Kaj was registered in the official records in Jutland.

They saw nothing of each other until their chance meeting when they were 40 years old.

KAJ

He was formally adopted at the age of 14 months; there do not seem to have been any adoption papers, but information derived from a variety of *official records* throws light on Kaj's background and upbringing:

The adoptive father was born and brought up in England and had immigrated as a youth to Jutland, where he was employed on a large estate as groom and trainer. At the age of 42, he married. They had no children of their own, and, after they had been married for eight years, they took a boy (Kaj) in. The adoptive father ceased to work when he was about 70; he drew his old age pension, and, shortly after, they moved to Copenhagen, where he died aged 73, (according to the *death certificate* of arteriosclerosis and angina pectoris).

The adoptive mother, when the investigation on the twins was initiated, was about 77 years old and living in a home for old age pensioners in Copenhagen. She had several times been admitted to hospital and the following information is compiled from the *case records*:

At 52 years admitted to a neurological department: She was the 11th of 13 children of a baker (living in the town in which Kaj had grown up). After leaving school, she had entered domestic service and married when she was 24. They had no children but adopted a boy (Kaj). They lived in a small three-roomed flat in humble but honest circumstances.

Apart from an abrasio mucosae uteri at the age of 26, she had always enjoyed good health; she had never been pregnant. Menopause occurred at the age of 46 without causing any particular distress.

Shortly before admission, the WR test produced a positive reaction, but she could give no information about venereal disease. For the past year, she had been complaining of a feeling of "emptiness" in her head, of "rubber" in her legs, of a slight unsteadiness of gait, and of dizziness. She was also depressed on account of financial difficulties and the delicate state of her husband's health. The examination revealed only slight, neurological disturbances, and mentally she appeared unremarkable, neither demented nor depressive. She was treated with salvarsan and bismuth. Diagnosis: lues cerebrospondinalis (meningitis l. g.).

At 56 years, she was admitted to a psychiatric department in Copenhagen (case record not forthcoming), and again (during the War) at 64 years.

According to the *case records* her husband had died seven years previously. To begin with she had had a small pension, but, on account of her financial straits, she had been obliged to take the management of an undertaker's shop, sleeping in the back room, which very much got on her nerves. Later she obtained a flat of her own and an advance on old age pension, but she felt lonely and depressed, and did not feel that she had anything to live for; she missed her old friends and acquaintances of the Jutland days. About a month after the suicide of a sister, she had become increasingly nervous, had tremors, globulus sensations, and "cardial hiccups" lasting for hours. She had always

got on well with her son (Kaj), but as they did not live near to each other, she had not seen much of him for the last few years, and he had cost her a lot of worry because he had, at times, been out of work. The immediate reason for her admission to hospital was that she had applied to the local police station because she had lost a rationing coupon for butter. The police had sent her to the registry office where she had had one of her "attacks" and whence she had been admitted, first to a casualty ward, and later to the psychiatric department.

She is described in the record as small, slight, thin, exhausted, pitiful, care-worn and extremely neurasthenic, fussy, but not, apparently, with weakened or reduced powers of memory. She soon calmed down and was discharged happy and smiling. Diagnosis: *Lues antea, senilitas incipiens? depressio mentis psychogenica (hysteriformis)*.

According to *The State Registry*, Kaj had been prosecuted or convicted on several occasions. The following appears from *the legal documents*:

At 19, living as an unmarried workman with his adoptive parents in Jutland, he was sentenced to 8 months' imprisonment for grand larceny and receiving. A brother-in-law of the adoptive mother reported that certain valuables, including some silver, which had been deposited in an unlocked cupboard up on the loft in Kaj's home, had been stolen.

The adoptive parents ("worthy and honest") could not conceive that Kaj could have had anything to do with this, but when it transpired that he had "a bad name" in the neighbourhood and that he kept dubious company, he was interrogated by the police. He denied the accusation, but, immediately after the hearing, suddenly disappeared from home. For the next few days, he roved about the district, putting up with a friend of about the same age (whose trial for an act of assault was pending), and with whom he broke into houses and "borrowed" food, spirits, bicycles and various effects including a gold watch; at the same time they joined in the dances held at the local inns. He was arrested after a few days, and then pleaded guilty, stating that he had disposed of the silver to obtain money for drinks and amusement.

It appears from the documents of the case that, after leaving school, he had held a series of brief trainee employments without completing training in any: When he was 15, he was apprenticed for three months to a local iron-monger. He then proceeded to a furrier in Copenhagen, who dismissed him because he was slovenly, careless, unfitted for the trade, rude to customers, with whom he, as well as with his colleagues, picked quarrels. Further, he pilfered chocolate from the shop next door, and, in spite of warnings, did not mend his ways. He was then apprenticed to a relation of his adoptive mother, a baker living in a large town in East Jutland; but he stayed there for only a few months. At 16, he was apprenticed for some months to a grocer in his native district, but the grocer was dissatisfied with him, chiefly on account of his dealings with the customers, and said that he was untrustworthy, unprincipled, and unreliable. Finally, at 18, he served as baker's boy, and got a similar character; he had kept small sums back from customers.

The records also give the following information about Kaj's later life:

When he was 25, and employed as a farm hand on Funen, he was again suspected of larceny, but the case was dropped. When he was 33, having spent the War years in Copenhagen, he was prosecuted for profiteering. This charge, too, was withdrawn without sentence being pronounced.

He had, at this time, been married, but divorce proceedings had been instituted against him. He was paying maintenance for a child of the marriage and also for another, born outside it. In the course of the year preceding the outbreak of the War, he had begun to support himself as a driving instructor. In the years following, he had had a variety of occupations: warehouseman, workman, delivery man, debt collector, etc. He does not seem to have been engaged in any form of political activity during the Occupation. About the time of the Capitulation, he put in an application for permission to use another of his Christian names, and to have the one he had previously used cancelled. Shortly after, he resumed his business as a driving instructor, got married to a ballet dancer, and, it seems, enjoyed together with her, a period of relative prosperity and indulgence. There were no children of the marriage.

When he was 37, he was fined 300 kr. (with the option of 20 days' imprisonment) for infringing the petrol rationing regulations, and, in this connection, lost his petrol allowance.

At the age of 38, after having been employed for about one month as general help and delivery hand to a timbre merchant, he was charged with larceny. About 5,000 kr. had disappeared from a safe which it was his business to lock up. While he was being interrogated, a further charge was brought against him for embezzling. It was reported that he had, a short time previously, been employed as book-keeper in an automobile business; he had been dismissed after a few months because his work had presented grave irregularities. He was stated to have procured a radio together with various spare parts for his own car and to have mislaid or destroyed the accounts. He flatly denied these charges and his former employer withdrew them. As he also denied all knowledge of the theft from the safe, the case was dropped on the ground of insufficient evidence. Up to the time of our investigation he had had no further charges.

During *the interviews*, Kaj stated that he had always "lived in clover" with his adoptive parents. They had been very fond of him, and, as he had grown up as an only child, he had become "spoilt" and was practically idolized. He was seldom scolded or trashed, was allowed to do almost anything he liked.

When he was seven years old, he was sent to the village school. He never did very well, he was lazy and uninterested, playing truant whenever he had an opportunity, but he managed, nevertheless, to obtain a scholarship to a free-paying secondary school, from where, he had taken his "middle-school examination" ("Mellemskole-eksamen") somehow.

The financial circumstances of the home were fair. They lived in a comparatively good, detached house on the outskirts of the village, which is situated in pleasant, wooded surroundings. The adoptive parents led a quiet life. The adoptive father, who had never learned to speak Danish properly, was "a good-natured person who would not hurt a fly" and whose chief interest in life lay in his work as "horse-trainer". The adoptive mother was considerably younger, rather "delicate and nervy"; she was always worried about something, was fussy and over-conscientious. After he had grown up, Kaj still felt attached to her; she was understanding, "one could always talk to her"; she had never thrown him over.

Kaj rather thought, however, that because they were relatively elderly, his adoptive parents had not had a "proper understanding" of him during his boyhood. "They did not utilize my talents". When he was about 14, they had told him that he was an adopted child; he had no recollection of his reaction to this information, nor did he give any impression that it had played any decisive part for him. "Family relationships have never interested me".

During his adolescence there had been various problems. He had begun an apprenticeship with an ironmonger, but had not gone through with it because he had been more interested in going out and enjoying himself. He used to play the piano ("by ear") at the dances at the local inns, was very interested in girls and had his first sexual experiences in early adolescence.

At the very first interview, he admitted spontaneously that he had served a sentence of imprisonment in his youth (at the same time, however, he stressed that Robert had also had thievish tendencies in his boyhood). He made light of it, calling it a "boyish prank" and declared that it was a friend, who was a bad lot, who had prevailed upon him to keep a certain gold watch in his possession. On account of the sentence, he was not called up for military service. Of his later conflicts with the law, he made no mention.

After his release from imprisonment, he spent some months in England, chiefly with relations of his adoptive father in London, but he could not settle down, and never learned to speak the language properly. As to his subsequent career, he gave information that was incidental, vague, and occasionally distorted. He seems in his youth to have had countless different employments of brief duration, partly in the provinces and partly in Copenhagen, where he, at one time, lived together with his adoptive mother. He was employed for some years as a warehouse hand, a job that had been procured for him through his acquaintance with a girl with whom he was "engaged". He found the work, like most of everything else with which he had been occupied, "dull and tedious". When he got tired of the girl and left her, he was "given the cold shoulder".

During these years, he had had several girl friends; he ended up by marry-

ing a mannequin who worked in a department store and with whom he had a child, at which time he was 27 years old. The marriage was not happy; he was unfaithful to his wife, and their financial circumstances were unstable. After five years, they parted. The immediate cause of the break up of the marriage was the fact that a girl, for whom he did not particularly care, had fathered a child on him, while he asserted that the blood group test disproved it. He described this step as "the stupidest thing I have done in my life". He referred to his first wife in warm tones, describing her as "a tall, fair, fine looking girl and a wonderful person", who understood him. "She waited for me for two years before marrying a well-to-do business man". The child, a girl, was brought up by its mother.

During the War, he had worked as a debt collector and had maintained a "neutral" attitude to the events of the Germany occupation. At the age of 35, he married again, having met his second wife, the dancer, through his business as a driving instructor. She had a good income, they ran a car, lived in an expensive flat, travelled a good deal, but after four years, she left him for reasons which he did not specify.

His third marriage had been contracted about a year before our investigations were begun. The wife, a divorced woman, worked in an office. They had a child, a girl of two years. At this time, he was a travelling salesman, selling rubber door mats. They lived in a comparatively expensive, well-appointed, three-roomed flat, situated in a modern block. Their finances were, undoubtedly, precarious.

During my visits, I once had the opportunity of a brief conversation with the wife. She was 30 years old, a medium blonde, fair-skinned woman, of unremarkable appearance and mentality, beyond the fact that she gave an immediate impression of being somewhat immature and naive. She had never met Robert.

During the four years that we were in contact with Kaj, he moved around a good deal. He held at any rate four different jobs of similar nature, the last being a somewhat dubious, secondhand car business in the provinces. He talked each time with the greatest enthusiasm of his work, feeling that now, at last, he had "found his niche in life". "I am in my element, meeting new people every day". He was, in fact, never in doubt that the business world was the right world for him, because he had always wanted to make money and could easily talk to people when once he had "got the foot inside the door". He insisted that he had "now calmed down and had learned from experience". He maintained that he had told his present wife "everything", "making a clean breast of it" and said that they shared "the same outlook". "We both wish to make money, and deny ourselves nothing . . . We neither of us wish to have any more children, to put it plainly, we set greater store by our car".

He had previously, including the time when he was married, had numerous, brief sexual contacts. "I have always cultivated women". It had always been an easy matter for him to pick up an acquaintanceship with members of the opposite sex and he had spent much time in the Copenhagen restaurant world, but he admitted that, apart from his present wife, no other woman he had ever met had been able to stand him for more than a short time.

He had always had difficulties in his relations with other people because he was "temperamental and could flare up and become very voluble". He had always felt "restless", could never stop fidgeting, shaking his keys or fingering his lighter, which irritated those around him. When confronted with people he did not know, he always felt uncertain of himself until he had discovered whether "it is someone I need be afraid of, or whether it is a good-natured person". Sooner or later, he usually got on the wrong side of both types, which was the reason why he had always wanted to be "my own master".

As regards his medical history, Kaj stated that apart from the common diseases of childhood, he was a healthy child. He had no knowledge of his early psychomotor development, had not suffered from enuresis, nor displayed any particular psychosomatic symptoms. When he was aged 13, he had a brief stay in hospital on account of a febrile complaint; otherwise he had never been to hospital and had only seldom seen a doctor. "I have always been afraid of doctors".

He had had gonorrhoea once, and aged 37-40 years, he had had "slight concussion of the brain" on two occasions after motor accidents; he had each time been taken to a casualty ward, but had refused to be admitted. He did not think that he had suffered any ill-effects in consequence.

He was liable to attacks of unspecific headache, but was of the opinion that these were due to his being somewhat "short-sighted". He had been advised to wear glasses, but did so only when at home.

Of late years, he had had rather persistent "backache", which had been treated with massage. Apart from this, he was of the opinion that his health had always been exceptionally good. He made special mention of the fact that he had always appeared considerably younger than his years and that he had always spent a lot of money on his teeth. He had never cared much for alcohol, making do with a single glass of beer. Since his youth, he had been a heavy smoker of, exclusively, cigarettes, 1-2 packets a day. He denied consumption of drugs.

Kaj's children. 1) *Daughter* (1st marriage), aged 18, unmarried shop assistant. She was said to bear a marked resemblance to her father. She had been "nervous" since childhood, for which reason she had consulted a doctor, but had never been to hospital. Physically, most probably, healthy, 2) *Son* (born out of wedlock), aged 14. No information forthcoming, and Kaj never mentioned him. 3) *Daughter* (3rd marriage), aged 2, healthy.

ROBERT

He was formally adopted at the age of 13 months. From the *adoption papers* the following appears:

The adoptive parents were a 35-year-old boatswain and his 34-year-old wife. They had been married for about 10 years, were childless, and wished to adopt a child of "well-to-do parents". They came upon Robert through a newspaper advertisement, had him examined by their own doctor, and declared themselves willing to adopt him without charge. Their socio-economic circumstances were good, they lived in a three-roomed flat in the heart of Copenhagen.

The adoptive father had been brought up by his parents, who kept a small grocers' shop in Copenhagen. After leaving school, he had attended The Danish Royal Naval Training College, and had become a petty officer in the fleet. His superiors described him as "intelligent, conscientious, reliable, honest, and of excellent conduct". The family doctor gave him the following character: "I have hardly seen his like. He is a very paragon; towards his parents, a self-sacrificing and loving son; he has completed his training for the navy with flying colours, winning every possible prize and distinction; a worthy soul with an unassuming disposition, and an upright character".

The adoptive mother, who was the child of a chandler in Copenhagen, had, after leaving school, been employed for several years as a shop assistant in a large store until her marriage at the age of 24. She was described by her employers as "clever, reliable, conscientious, and fond of children". During the first years of her marriage, she had had miscarriage, and had, thereafter, suffered from "an internal complaint", and had given up all hope of bearing children. She wished to adopt a child, amongst other reasons, because she felt lonely, her husband being away at sea for six months of the year.

Concerning the later life of the adoptive parents, the following information was derived from other *official records*:

The adoptive father became a widower when he was 40. The adoptive mother died at the age of 39 (according to the *death certificate* of an intra-peritoneal abscess). Shortly after, he married again. He became a naval calculator and cartographer, his speciality being "views of land seen from the sea", and he was, thence, promoted to the Defence Supply and Secretariat Corps, and held an administrative appointment connected with the upkeep of building property belonging to the Navy. When our investigation of the twins were instituted, he was again a widower, pensioned off, and living in Copenhagen. One of his colleagues (a relative of the investigator) described him as "a typical petty officer, erect and sprightly, wearing a moustache and a back parting, and the soul of honour".

Robert's name did not figure in The State Registry (cf. his own information on this point).

Robert had sought psychiatric treatment twice, once at an out-patients' psychiatric clinic in one of the larger provincial towns in Jutland, and once from a practicing psychiatrist on Zealand. From the *case records* it appears:

At the age of 40, he was referred to a psychiatrist by his doctor, who was of the opinion that he was suffering from an anxiety neurosis aggravated by difficulties connected with his employment, and which was prejudicing the appointment he held as draughtsman at a scientific institute.

He had no knowledge of any disposition to mental illness as he was an adoptive child. He had no recollection of his early childhood, but when he was six, his adoptive mother had died, and his adoptive father, a boatswain, had married again the year after. This event heralded a considerable change in his life, which then became painfully filled with conflicts. His relations with his second adoptive mother were the worst possible, especially after she had got children of her own. He was looked upon as a "difficult child". He presented disturbances of behaviour, was very strictly brought up, receiving corporal punishment for every misdeed. The relations between the adoptive parents were, moreover, not particularly good, and had filled him with loathing.

He attended school from his 7th to his 16th year, had done fairly well, and had passed his school leaving examination ("Realeksamen") with average marks. With the help of his adoptive father, he was then apprenticed as a draughtsman in the navy in which capacity he worked from his 17th to his 30th year. He left the service of his own free will and became engaged as draughtsman at public offices for a couple of years, thereafter he had become a "free lance" in straitened circumstances until he found his present employment.

He had been twice married. The first time at the age of 29. This marriage was dissolved after six years. At the age of 37, he married again. He had always had financial troubles, especially in his first marriage. This marriage had, apparently, been somewhat peculiar in that his wife first had a miscarriage, and, when she ultimately gave birth to a live child, they had it adopted, after which they separated "as the best of friends". In his second marriage, there was a child, two years old, of whom he was extremely fond and who he seemed to molly-coddle in every way. This marriage appeared to be thoroughly happy.

He had never been particularly interested in his work, nor did he find any satisfaction in his present employment, which he had had for about six months. Things had gone very well at the beginning, but he had since got on the wrong side of his colleagues, and he was under the impression that his superiors were dissatisfied with him and wanted to dismiss him. In his

opinion, the difficulties that he had encountered in his work were due to the fact that he was so extremely sensitive and self-referring. In unforeseen situations, he was overcome with diffidence, and added to this, he was highly conscientious, having a great sense of pride, and desiring "to give every man his due". It seemed to him that in view of the fact that he was so exceedingly conscientious, everyone ought to have full confidence in him, and he should be allowed to work on his own, at his own pace, and, to a certain extent, in his own time.

During the preceding years, this situation seemed to have come to a head, and, in his endeavour to find someone who could "understand" him, he discovered that he had a twin brother who had been brought up under another roof. He had made his acquaintance, but, although their outward appearance was very similar, their inward natures were so entirely at variance with each other that they must clash. The meeting with the twin brother, on which he had placed such high hopes, turned out to be a deep disappointment, due, partly, to the fact that the twin had, apparently, for years been aware of his existence without getting into touch with him, and also because his twin brother's character deviated widely from his own and was repellent to him.

The case report concludes with the following: "The patient is suffering from a severe neurosis the cause of which must partly be sought in his constitutional peculiarities and partly in his conflicting circumstances. He must be deemed beyond the reach of therapeutics inasmuch as it does not seem possible to offer him any causal treatment. An "amateurish" attempt at psychotherapy would probably aggravate his symptoms. On the other hand, it does seem that some form of milieu therapy might be advisable; a more independent form of employment might obviate some of his greater conflict. This might be combined with "an open-air life", for instance, as land surveyor, or he might seek an appointment with a society for moorland reclamation, where a man with his qualifications might conceivably find employment. These suggestions have been discussed with him, and he has been told that he is "nervous" and that nothing much can be done about it apart from recommending him a change of occupation on the lines indicated. He has been advised against free-lancing". Diagnosis: *neurosis (sensitive, self-referring)*. His doctor was advised not to recommend a lengthy sickleave, and to alleviate the present acute phase, amytal and verbal encouragement were suggested.

The following is appended to the case report: "The patient has *not* been informed that his "case" is of considerable scientific interest: Twins, apparently monozygotic, brought up in widely different environments, one becoming extremely sensitive, overconscientious, with a marked lack of adaptability, the other developing into a charming, vacillating psychopath".

At the age of 42, Robert again consulted a psychiatrist. *Case records*: Had been referred by a doctor on the island of Funen, where he was then holding

a public appointment as a draughtsman. The private doctor was of the opinion that he was suffering from a severe neurosis, requiring treatment. He described the patient as follows: "He is pleasant, undoubtedly intelligent, but touchy, ambitious, periodically depressed, and encumbered with "an inferiority complex". He refers to this condition with the phrase "my neurosis", complains of headache, skull-cap sensation, and fatigue, especially when his thoughts turn to the future. He wakes up in the morning feeling dependent and quite overwhelmed. His irritation towards his colleagues mounts up to explosive outbursts. He will take sudden, unprovoked dislikes, he "falls out with everybody". He is filled with anxious feelings, dares not meet his colleagues on the stairs, taking refuge in the lavatory until they have passed".

The psychiatrist had four interviews with him and one with his wife. He states: "The patient is a twin, born out of wedlock, strictly brought up under home conditions otherwise good. He is, presumably, good at his work but he is definitely a case of a "square peg in a round hole". His professional training was begun at his father's instigation. It has always been difficult for him to get on with his colleagues at those offices at which he has been employed. He has met with failure nearly every time including this last one. He has sought out his twin brother. They bear an outward resemblance to each other, but the twin brother's life has been a failure, and each had the same difficulties. His illness has its roots, partly in constitutional factors, partly in his upbringing, and, most especially, in the difficulties with which he has been confronted and to which he has exposed himself through his work. He is much given to heart-searching. His marriage is fairly happy, but the wife does not have an easy time. It would, presumably, be infeasible for him to continue doing office work, and he has been advised to change for freer work where he would be less dependent on his colleagues. In his wife's opinion, which he shares himself, he has a splendid aptitude for business as he can easily talk to people. His happiest periods have been those spent in free-lancing. He has persevered in his profession because he is ambitious and because he feels that it would be a degradation to relinquish it for business. He has, therefore, been recommended to try the life of a commercial traveller or the like, and, henceforward, to try to check himself in his continual brooding over his past life, which he himself terms "a tragedy". He is assuredly clever, and will, presumably, get on far better in business life. He possesses intelligence, but gives an immature impression, about ten years younger than his actual age. He has suggested psychoanalysis, but I think it is too costly and too time-consuming considering the remedial chances".

The medical practitioner, who had first referred Robert to a psychiatrist knew him very well. He had been treating him for "sciatica and eczema of the hand". He stated to me: "My impression was that he was very neurotic,

fussy, rather self-centered, inordinately easily hurt, sensitive, permitting no discussion as to his abilities or his working methods. The conditions at his place of employment were a constant source of irritation to him. He was rather unreasonable in his demands on his fellows; his powers of adaptability were poor. His neurotic state had, presumably, been triggered off by his meeting with his twin brother and the resultant disappointment. He suffered from a certain sense of loneliness, had difficulty in establishing contacts on an emotional basis, he felt the lack of kith and kin with whom he would have had feelings in common. Taken all in all, he is a most disharmonious nature. Depression was hardly imminent. His wife was psychically unremarkable, but she had no clear understanding of his mentality, and was only aware of his problems from their external aspect. Their child, who was then one year old and presented no problems, was treated rather over-carefully and very conscientiously".

During *the interviews*, Robert stated that shortly after his adoption, his adoptive parents moved to a capacious official residence where the whole of his childhood was spent in comfortable circumstances.

He was six years old when his adoptive mother died rather suddenly. He had no certain recollection of this event, and remembered very little of his early childhood at all; his adoptive mother, who was much alone with him, is said to have been kind and loving and to have "spoilt" him.

About a year later, his adoptive father remarried. His second adoptive mother, a cousin of the former, was about ten years younger than his adoptive father. She did not like Robert, who described her as a "scolding fury". After about a year, the adoptive parents had children of their own, first a girl, and, later on, two boys. Robert felt that he had been "pushed out of the nest". The adoptive father brought him up most strictly, in a military fashion, exacting implicit obedience, not tolerating the slightest deviation from the literal truth, and constantly chastising him, whether with solitary confinement or with a special cane. Robert carried a particularly vivid recollection of the violent fury of his adoptive father when, as a schoolboy, it had come out that he had tried to "pinch" a small sum. He thought that the brutal beating, then accorded him, checked the development of every tendency in that direction. He was sent to a good school, but was not, in the eyes of his adoptive father, sufficiently diligent, and did not obtain satisfactory results; it was altogether impossible for him to live up to the high standard and to the ambitions set by his adoptive father. Their mutual relationship was already wavering. On the one hand, he had a constant admiration for his adoptive father, always desiring to please him and longing to gain his confidence, a fact which his adoptive mother, brothers and sister often did their best to hinder; on the other hand, he felt unsure, was afraid of being

repulsed, which his adoptive father could do in a most insulting fashion. His adoptive father was rather temperamental, a tyrant, and the relationship between him and his wife was not particularly harmonious.

Robert had never been on a specially friendly footing with his eight years younger adoptive sister, of whom he seems to have been very jealous from the start. She resembled her father both in appearance and mentality, did exceptionally well at school, was "pushed into a government department", and at the end of the War, she went abroad, where she held an important administrative post. Robert described her as a "typically emancipated woman, hard, arrogant, and affected". His relations with his adoptive brothers, who where, respectively, 10 and 11 years younger, were, on the other hand, fairly friendly. The elder, a bright, good-looking boy, "the apple of his father's eyes", died when he was five years old (*Death certificate*: meningitis). The younger, "a sensitive character", and the only person to whom Robert had felt emotionally tied in childhood, died when he was 16 (*Death certificate*: tuberculosis pulmonis, peritonitis).

The adoptive father never got over the loss of his sons, nevertheless, this did not affect his attitude towards Robert. On the contrary, their relations worsened as the years went by. When Robert was 17, he was informed that he was an adoptive child. He had no special recollection of his reaction, except that the information had come out in the course of a scene with his adoptive parents, during which his adoptive mother had reproached him for his lack of gratitude. His adoptive father then told him curtly of the real circumstances of his birth, but it was not until several years later that he learned, almost by chance, that he also had a twin brother living in Jutland.

Robert continued to live at home until he was 21, when he served as a conscript in the navy. His naval service presented no particular problems for him; he would like to have become a naval officer, but he had had to give up the idea on account of his being "too short-sighted". He resumed his profession as a draughtsman in an appointment which his adoptive father had procured for him. This work never gave him satisfaction; it called for great precision, he lacked interest, and stayed on, chiefly because his adoptive father desired him to do so. His superiors were far from satisfied; to be sure, he was given a permanent appointment in the civil service, but after some years, he received a warning, and in the end, he was requested to send in his resignation when he was 27. He did this with some satisfaction, because he wished to try his hand at free lancing.

During the years that followed, he held a series of brief appointments, chiefly, but not solely, within his profession. There was, for instance, a period during the War when he was employed as a labourer, and, at one time, he was even in receipt of public assistance. During the German occupation, he remained "passive", a fact which he deemed in keeping with his character.

He experienced the greatest difficulty in adapting himself wherever he was employed, and his finances were always unstable. On the top of all this, his connection with his adoptive parents gradually loosened and it ended with a complete rupture between him and his adoptive father.

When he was 29, he married. As a young man, he had been uncertain of himself and shy, especially with regard to sexual matters, and he had no sexual experiences until he was over 25. His first wife was 20 years old when he married her. She came from a well-to-do Copenhagen business milieu, and it was entirely a marriage of convenience, and he made no attempt to conceal the fact that he had principally been attracted by her grand and wealthy family. He described her as "a wonderful person", but they did not suit each other in any way, the sexual not excepted. Added to this, there were difficulties connected with his work and with his finances. Their disharmonious wedded life came to an end after seven years. There had been two children of the marriage. The elder, a boy, was born within the first two years and had died at the age of six months for "unknown" reasons. Three years later, another boy was born, whom they had adopted immediately after birth. It had always caused him embarrassment to recall this episode; it was incomprehensible to him how *he* especially could ever have had his son adopted. He could not give any explanation, save that he and his wife had both agreed to it as they had decided to separate and did not wish to be "tied".

He vouchsafed spontaneously that, during his first marriage, he had been prosecuted for assault and battery: He had been giving his dog a run, when he met a lady (who, it transpired later, was married to a solicitor). This lady was also exercising a dog. He never knew what really happened, but, apparently, first the dogs, and subsequently, their owners started quarrelling; it came to a scuffle, "and suddenly, she had fallen down". She had broken her ankle and he was prosecuted in consequence. The case was dismissed, but it was a distressing episode of which he had a painful remainder from the police when he, at a later date, was charged with the theft of some money from his place of work. He had, otherwise, never been in conflict with the law.

His second wife, whom he married when he was 37, was a dressmaker's cutter, aged 30, coming from an honest working class home. The marriage was chiefly remarkable for the many changes of address and the unstable finances which accompanied his difficulties in his places of work. He described her in positive terms, as a clever, a stable "but a very middle class housewife". Their temperament were very different, and their life together, especially sexually, was not happy. She may possibly have been frigid, and for long periods, there was no sexual intercourse; he then fell to masturbation and sexual fantasies, practices which also had caused him "many heart-aches"

in his youth. He felt "tied", and the three children of the marriage got on his nerves. He tried to bring the children up according to "old-fashioned" methods, which only worsened the home atmosphere. He was irritable, unbalanced, could not stand noise and disturbance, and began to suffer from headache. To escape from his "imprisonment", he bought a scooter on the instalment system, and began to go for long rides into the country. "Life in the open air has always meant a lot to me. I have always wished I could have had open air work, been a forester, for instance, then I could have felt free". During his expeditions, he made the acquaintance of a 23-year-old "outdoor" girl, who was working in a business office. They entered on a liaison that had lasted for about six months before he found himself obliged to inform her that he was married.

The situation, at the time when our investigation on the twins began, was that he was living with this girl, while his wife and children had left him and gone to stay with relations in Jutland. During the interviews, he reverted, constantly, to his "dilemma" and to "the pangs of conscience" that he suffered for all concerned. He seemed to be completely at a loss, taking all and sundry into his confidence, describing himself as "the prey of conflicting emotions". After some months, he came to the conclusion that, "out of consideration for the children, I must give up the girl and start afresh, and choose to return to my wife"; he was, however, soon divorced, evidently at his wife's instigation. He kept up his connection with the girl, and, ultimately, they were married.

During the four years that we were in touch with him, he changed his job 3-4 times, keeping to his profession, but working chiefly for private firms. He moved around a good deal, and were last living in one of the larger towns in East Jutland, where I met him. He stated that he was now finding his work far more satisfactory as it did not demand such accuracy or such boring attention to detail, but was primarily designed to make a "smart and slick" impression, for purely commercial purposes. He said that his married life with his third wife was happy. She earned her own living, their financial circumstances were good, they could afford to buy a small car, live in a comparatively expensive flat, could enjoy the luxury of travelling and the pursuit of common hobbies. They had agreed not to have children (according to Kaj, they had procured an abortion), and, sexually, they were very well suited.

As regards his medical history, Robert stated that during childhood, he had been "nervous and had refused to eat". He had suffered from nocturnal enuresis until he was 12, and, intermittently, diurnally also, and there had been encopresis as well (he stated that Kaj had had the same complaints as a boy). He had also suffered from "eczema"; during childhood, it had been confined to his legs, but after he had grown up, it had become localized

to his hands; he was of the opinion that it was due to "nerves". Apart from one occasion, when, at the age of 12, he had been admitted for "pleurisy", he had never been to hospital, and beyond common complaints he had had no diseases during childhood.

As an adult, he had always been extremely sensitive to cold, and suffered, at times, from attacks of "lumbago". During the last five years, he had had practically uninterrupted headache of diffuse localization, "like a cap". For this reason, his consumption of tablets, largely coffazine-preparations was rather heavy. Owing to "short-sightedness", he had worn glasses for the last 15 years. Earlier, his teeth had been exceptionally good, but there was now increasing paradentosis which worried him a lot. Like Kaj, he made much of the fact, that he had always looked considerably younger than his years.

He had never had a taste for alcohol. He had always ever since he was a lad, smoked a good deal, mostly cigarettes, seldom, however, beyond 20 a day; he would really have preferred pipe smoking, but had never been able to get into the habit of it.

During the interviews, he gave a detailed account of his psychiatric history, which he usually described as "my neurosis", unless he employed circumlocutions like "my life's difficult course" or "my tragedy". He constantly recurred to a doctor's pronouncement to the effect that he "was not a psychopath". His description of, and his apprehensions of his own psychic state was, continually, closely connected and compared with the experience of the relationship between himself and his twin brother.

Robert's children. 1) *Son* (1st marriage), died aged six months. According to the *case records*, the child had previously been hospitalized for dysnutritio, hypovitaminosis C?, morbilli, and was readmitted in a state of unconsciousness, suffering from "cramp". 2) *Son* (1st marriage), 11 years. He was adopted through the auspices of a Mother's Aid institution. (The adoption records seem to have been destroyed). (2nd marriage): 3) *Son*, 7 years. 4) *Daughter*, 4 years. 5) *Son*, 2 years. All healthy with psychically normal development.

THE TWIN RELATIONSHIP

The content of the interviews was greatly marked by the mutual identification experiences of the twins, their ambivalent attitude to each other, and the marked tendency of both to project various differences and similarities in their personalities on to the other part.

Robert was of the opinion that they resembled each other in almost every respect, he could only point to isolated differences and because of them he disapproved of his twin brother. Kaj was, on the whole, apart from their outward resemblance, disinclined to admit that they had much in common,

and the points of similarity accepted by him were especially connected with traits which were obviously unflattering to himself.

Both maintained that their meeting had been a "fiasco", "almost a shock", and "a most unpleasant experience". They had, to be sure, felt some sense of affinity to begin with; they had been able to exchange experiences and points of view, and they had, in every way, attempted to find points of agreement, but feelings of antagonism and antipathy very quickly made their appearance. When they met, Robert was living in his second marriage, while Kaj was "free lancing" between his second and his third marriage. It was, primarily, Robert who had been eager to strengthen their connection, but he did not very much care to have Kaj, accompanied by a succession of "glamour-type" girls, in his home, but preferred to see him alone, driving out in Kaj's car, or going to a restaurant, and not wishing to have his wife mixed up in it. Kaj said, in short, that Robert was envious of him and morbidly jealous; Robert was revolted by the glimpses he got of Kaj's way of living, particularly by his experienced manner in restaurants and towards the opposite sex. They soon discovered that they dared not trust each other, and disagreements resulted. After having exchanged a lot of "home truths", especially with reference to money and sex, they broke with each other. They had, in connection with our investigations, a brief and cursory meeting, after which both admitted to feeling happier when apart. Robert regretted ever having looked Kaj up, and Kaj described his twin brother as "the most unpleasant person I have ever come across".

Robert, whose remarks concerning their twin relationship were the more instructive, described their character in these words: they both lacked, what he called "a practical fitness for life". "We have never become mature or properly grown up, we have a "certain childish pattern". "We suffer from a fundamental lack, about which we can do nothing". "We differ from other people, in that neither of us has ever been capable to benefite from experience". It seemed to him typical of them both that, when they were in difficulties, "we shut our eyes to reality". For instance, they would make decisions that they knew perfectly well at heart were impossible of realization, or they attempted to prove to themselves that they were masters of a situation, capable of making decisions, by moving or by giving notice, or the like. They were quite aware that such a step was merely "a flight", but they took it, none the less, without thought for the consequences. It was, in fact, typical of them that they hardly ever gave the future a thought, never laid plans, but lived entirely in the present or the past. Even though they possessed abilities above the average, neither of them was capable of utilizing them to the full. They had always been rather ambitious, wishing to better themselves. They attached great importance to "what people would say", but they lacked self-assurance and felt that, as a rule, other people "looked down" on them.

Owing to their appearance and charm of manner, they had always been able to make new acquaintances with the greatest ease. Both were glib of speech and had a facile style in writing. As a result, it had never been particularly difficult for them to obtain new employment, but they were always beset with the fear of not being able to give satisfaction. Every new job started well, but, sooner or later, the moment would come, when they were no longer able to live up to their first impression. Difficulties arose, and they invariably got on the wrong side of their superiors and of their colleagues alike. For this reason, both had always wished to be "independent", but, on account of their restlessness and lack of assiduity, they had never been able to effect this satisfactorily. They were, as a rule, violently enthusiastic at the start, but their interest soon waned, they found the work tedious, and, instead of attempting to solve the problems and get rid of the difficulties in their path, they merely "let them lie". They were irresolute and capricious, "we let ourselves glide with the current and let chance rule".

In their attitude to "authority", there was some difference, which Robert attributed to their different upbringing. He had always wished to recognize authority and was, as he put it, "happiest so", whereas Kaj, except towards people who played some special part in his life, treated everybody more or less equally without caring one way or the other. He could be deliberately insulting and rude, a thing which Robert meant he himself could never be.

Both had, from childhood, been "fanciful and had difficulty in keeping on the truth, always wanting to embroider on it", even when mere trivialities were concerned. They were inclined to "day-dreaming and wishful-thinking, dwelling much on the past" and they were "dreamy, romantic, and inclined to be sentimental". Neither had ever had any real interests or hobbies; Robert had previously read a certain amount of fiction, chiefly dealing with psychological subjects resembling his own problems. He had attempted the study of a few popular books on psychoanalysis, but had quickly given it up. Kaj read detective stories; "He would never dream of looking for "a solution" in a book".

Robert thought they were both extraordinarily quick to take offence. They could, in fact, not stand criticism. There was, however, this difference that Kaj had become "harder and more robust", and Robert did not think that he nursed the same scruples or had the same tendency to self-analysis. "Maybe there are some, few points on which we disagree, but I am convinced, all the same, that under certain circumstances he feels absolutely as I do . . . the difference lies chiefly in the fact that he never has pangs of conscience and will never admit that we are really alike".

Robert stressed that they had had difficulties of adaptability at their work and in their marriages in common. Their attitude to money was also identical. "Anything that glitters has always attracted us, and money has always been

important". He thought that it was especially typical of them that their affairs had been "in a mess" all their lives. Over money, they were particularly on their guard, each often accusing the other of dishonesty. He was "deeply shaken" over Kaj's lack of restraint in money as well as in other matters, and over the fact that Kaj found it quite all right if he could cheat others or wangle some cash benefit out of them. He clearly remembered an episode where Kaj had expressed great annoyance at having been obliged to hand over a well filled pocket book, which he had discovered in a call box, to the rightful owner who had returned to claim it. Robert would not deny that he might have had the same impulse himself but he would, in any case, never have mentioned it to anybody. Another time, they had helped each other steal a bicycle by smashing the lock. They had both used the bicycle, but, while Robert was uncomfortable about it, Kaj seemed to be entirely unaffected.

Sexually, it also seemed to Robert that there were appreciable differences. The libido of both was probably rather above the average, but, whereas, Kaj had numerous sexual experiences, Robert had always felt bashful and constrained with women. He made no concealment of his sense of "inferiority" to Kaj, coupled with his disapproval of him. When Kaj's second wife had obtained a decree nisi, Robert, at Kaj's instigation, had attempted to effect a reconciliation, and when Robert announced that he intended to leave his second wife, Kaj had expressed great indignation and had offered to act as mediator. He recommended that Robert "lay his cards on the table" and to "compromise" in the sense that he was to stay under the same roof as his wife and children, but to make other arrangements for himself by "taking a trip to town, now and then". Robert thought this suggestion utterly immoral; "I would never be able to lead such a double life". Their different outlook on sexual matters made Robert feel extremely agitated and embarrassed whenever they were in female company. "I knew exactly what he was feeling and thinking, and yet we are different". There was, moreover, a difference between their wives and the type of woman to whom they were attracted. Robert had always preferred "fair, respectable types with a certain intellectual or artistic dash", whereas Kaj was drawn to "dark-haired, slim and smart, preferably passionate types". Robert thought it remarkable that both his and Kaj's matrimonial circumstances had been completely reversed since their first meeting. He was, moreover, of the opinion that Kaj's third marriage was already doomed, and he asserted, dramatically, "I believe we will continue to vacillate all our lives, changing jobs, and, perhaps, wives too. It is symptomatic of us that we always leave a door ajar".

It seemed to Robert that their health was the same also. Both had a disposition for "lumbago" and both were sensitive to cold, which was pooh-poohed by Kaj, who sneered at Robert for wearing long under-pants, a body-

belt and knee-pads. The only reason why Kaj, despite his being every bit as "short-sighted" as Robert, did not wear glasses was that he was vain. It had, further, always annoyed Kaj that people took him to be "the elder"; both had, however, often concealed their right age.

Neither had ever cared for alcohol, but they were both excessively sweet-toothed, especially Kaj, who was also fond of food and inclined to be slightly "fleshy".

They had always paid particular attention to their personal appearance, and, even when things were at their worst, they had always appeared well-groomed; Kaj, especially, always insisted upon "having the best of the best", spending a great deal of money on his clothes. Both were "sticklers for order", in the sense that they could not stand muddle and untidiness, noise or disturbance; both having an extremely low threshold of irritation towards children.

Kaj, for his part, admitted their resemblance to each other, as far as their restlessness and their mutual suspicion went. Kaj also considered that Robert's unlawful tendencies had been "in no way less than my own". Robert seemed to Kaj to lack balance, being apt to flare up. Towards his wife and children Robert was "a proper domestic tyrant". Robert's attitude to sex was beyond Kaj's comprehension, particularly that Robert had been prone to masturbation while he was married. He never felt at ease in Robert's company, and asserted that Robert had tried to libel him to his employers and to his adoptive mother amongst others.

In the course of the very first interview, Kaj described an incident, the significance of which, on account of the proclivity of both twins to misrepresentation, it is difficult to assess. He related how, during a visit to Robert's home, immediately after they had become acquainted, Robert had requested him to go with him to another room, under the pretext that he did not care for them to be together with his wife and children. Robert had then asked him to lie on a couch side by side with him. He wanted them to hold hands, caress each other, and exchange kisses, "even on the mouth", all of which seemed utterly abnormal to Kaj. On other occasions, it had also happened that, on parting, Robert would kiss him on the cheek. He did not think that Robert had homosexual propensities, but only wished to emphasize that this behaviour of Robert's was abhorrent to him.

Robert made no direct mention of circumstances of this sort, but, during an interview, he once suddenly asked me whether "one twin might inherit traits from the father and the other traits from the mother". He explained that he always felt absolutely certain that Kaj was "the big brother". He also felt that Kaj was the "masculine" and he the "feminine" partner. Ever since their very first meeting, he had tried to subordinate himself to Kaj, and, in the beginning, he had tried to look up to him. He could not explain these sensations, which he termed "purely psychical". When I, during

later interviews, tried to return to this subject he became evasive and I did not try to explore it further.

While Robert felt considerable interest in his natural family and had, for instance, visited his mother's grave, Kaj said that this had never interested him at all. Before they met, they had, however, as has already been mentioned, separately attempted to contact their father's family; Robert had been turned away with, amongst other things, the information that Kaj had been there before him and had tried to impose upon the relationship. Robert felt very injured over his reception, because, as he expressed, "I only asked for a job".

Both twins agreed that their childhood had been spent in entirely different environments, possessing no points of similarity whatsoever beyond the fact that they were both adoptive children.

According to Robert's opinion, Kaj's adoptive parents had been good and kind; they had spoilt him and made a fuss of him, and Kaj's adoptive mother was "the sweetest person". "Her home was overflowing with pictures of Kaj, but he treated her badly". He had, for instance, always got money out of her. Robert thought that Kaj's milieu would have suited him much better, and he thought too that it might have done Kaj good to have been brought up in Robert's adoptive home.

Kaj, for his part, thought that Robert's chances in life had been far better, but that he had made poor use of them. Kaj thought that they had become entirely different personalities; he had, however, after having been in Robert's company, often felt extremely ill at ease, sitting afterwards for hours on end, repeating to himself: "We are really like each other, but am I really like that?". During one of the last interviews, he said: "I hardly know, but, sometimes, I am afraid that, in reality, we are much more alike than I want to believe".

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

Various *official records* provide the following information:

The father

When the twins were born, he was 55 years old, a wholesale dealer living in Copenhagen. He was the 5th of nine children of a prosperous farmer. Following a commercial training, he was taken into the family business started by his elder brothers. He was married at the age of 26 to a wife four years younger than himself and, apparently, well-to-do. They had four children. The marriage was not happy (but was not dissolved until about ten years after the birth of the twins). He died, aged 66, of "influenza". No further information of his health, and (apart from what the twins could relate), nothing that can throw further light upon his personality.

The twins' paternal half-siblings. 1) *Half-sister*, 70 years, unmarried, retired piano teacher. No information. 2) *Half-sister*, died aged seven years (*Death certificate*: diphtheria). 3) *Half-sister*, died, aged six months (*Death certificate*: tussis convulsiva). 4) *Half-brother*, aged 60, a business man. No children. Emigrated to Canada at the end of World War II. Otherwise no information.

The father's siblings. These seem all to have been exceptionally public-spirited persons of high intelligence and ability; three of them played prominent parts in the Danish business world (mentioned in the Danish "Who's who"). One of the twins' cousins, a divorced wholesaler, was addicted to alcohol and died, aged 52, in a mental hospital. *Case record*: confusio mentis transitoria, abusus spirituosorum. No further psychiatric disposition is known.

The mother

At the birth of the twins, she was 38 year old, divorced and domiciled in Copenhagen. She was the only child of a miller in East Jutland, and married when she was 20 to a business man, a prosperous wholesale dealer about 10 years older than herself. He was from North Slesvig (then a German province); they settled there, and, in the course of eight years, had five children. The marriage was not happy, and, about a year before the birth of the twins, it was dissolved.

Whereas she does not seem to have taken any interest in the subsequent fate of the twins, she kept up the connection with her other children. She died when she was in her seventies. There is no information that can cast further light on her personality.

The twins' maternal half-siblings. 1) *Half-brother*, 62 years, a twice divorced business man. According to *official records*: In his youth, convicted several times for larceny and fraud. When 48, sentenced to six years imprisonment for treasonable activity during the German occupation; he was an officer in the "Schalburg Corps". The following is from the *mental observation statement*: Brought up in an unhappy home, of divorced parents; served as a German conscript during World War I. Apart from slight depressions, habitual hypomaniac, enterprising, energetic, intelligent, and full of ideas, but also cantankerous, fanatical and pigheaded. Diagnosis: psychopathia constitutionalis l. g., psychosis manio-depressiva antea. Aged 61 years admitted to a psychiatric hospital. Preoccupied with problems connected with his work, his finances and his marriage, depressed and plagued with thoughts of suicide. Diagnosis: depressio mentis praesenilis. 2) *Half-brother*, 60 years, divorced business man. According to *official records*: Convicted for infringement of the Price Regulation Act. Otherwise no information. 3) *Half-brother*, 59 years, divorced, a retired journalist. According to *official records*: Several convictions including a lengthy sentence for fraud. 4) *Half-brother*, 57 years, business man. According to *official records*: Convicted for petty larceny and once charged with fraud; since his 39th year admitted five times to psychiatric hospital. From the collected *case records*: Lability of mood and paranoid delusions of persecution. Originally diagnosed as a psychogenic psychosis, later as a schizophrenia, and finally as psychosis manio-depressiva. 5) *Half-sister*, 55 years, unmarried confidential clerk. No information.

In the *paternal* family of the twins' maternal half-siblings, a disposition to psychiatric illness was found: Their father committed suicide when he was 62, having gone bankrupt in a concern involving millions of Danish kroner immediately after the end of World War I; a cousin committed suicide at the age of 38, while in a mental hospital for dementia praecox; several other members of the distant family have been in hospital for psychoses.

Summary of the supplementary information

The twin's father, probably, presented some resemblance to the twins as regards personality structure, but the information to hand is meagre. No certain disposition to psychiatric illnesses was disclosed in the twins' paternal family.

Information about the twins' mother is also meagre. Among the twins' maternal half-siblings, cases of manic-depressive psychosis and, probably, psychopathic personalities were found, but there were also cases of psychiatric illnesses in the half-siblings' paternal family.

CLINICAL EXAMINATIONS

The investigation comprised 20 interviews, 8 with Kaj and 12 with Robert. (In addition numerous telephone calls from both). I paid several visits to Kaj's home, none to Robert's; I had a brief conversation with Kaj's wife, and I obtained verbal and written information from Robert's former private doctors.

The attitude of the twins to our investigation was different. Kaj was, particularly to start with, reserved and evasive, but, later, he displayed considerable interest, particularly in the results of the psychometric tests, but he could not be persuaded to submit to retesting; he explained that the test situation had been extremely disagreeable. "I had the feeling that I was showing my cards". Robert was, on the whole, very cooperative.

The twins bore a marked outward resemblance to each other, but, as already mentioned, I never saw them together. They were of almost the same height and weight, Kaj 170 cm./70.0 kg., Robert 169.5 cm./65.5 kg. They were dark-haired, and the structure of their hair was the same. They both had a left parting, the hair whorls curling clockwise. A conspicuous difference was that Kaj, in contrast to Robert, used profuse quantities of brilliantine, but both were invariably outstandingly well-groomed and neat in their appearance; another difference in their immediate appearance was that Robert wore glasses enclosed in a somewhat robust frame. Both had rather severe myopia—2.00 on the right eye and—4.00 and—4.25 on the left for Kaj and Robert, respectively. (A special ophthalmic examination was not performed). The eyes were grey-blue, and, on comparison with a standard scale, identical (lying between Nos. 7 and 8), no difference in the structure of the iris. The colour of the skin had the same tone (No. 7). Their physiognomy was strikingly similar; they both possessed regular, probably good-looking features that were wellmarked, masculine, particularly in Kaj's case. The details, nose and chin in particular, were extraordinarily alike. The teeth were in good condition and well-cared for; Kaj having numerous gold inlays.

The ears and their position showed no differences; the lobes being free in neither case.

The routine clinical examination produced nothing of particular account. Blood pressure: normal in both cases. Both were right-handed.

They were exceptionally well-dressed and most presentable. Their posture, gait, and general motorical activity were extraordinarily alike, marked by considerable restlessness. During the interviews, they liked to smoke cigarettes, mostly the investigator's, for which Robert always apologized; Kaj had always left his "in the car", but, in exchange, he promptly produced his "Ronson". Their voices differed slightly, Kaj's being a little hoarse, Roberts more modulated, but the vocal pitch was the same. Both used standard Danish language.

There were other differences in their attitude to the investigator. Kaj was usually on his guard, he was slightly suspicious and evasive, but towards the end of an interview, he could, on occasion prefer a certain emotional contact. Robert was far more eager for emotional contact; he was studiously polite, using the titular style of address, and was evidently anxious to arouse sympathy. In comparison with Kaj, Robert was the more informative, giving a detailed history of his development, gladly availing himself of the opportunity for self-expression. He seldomly showed open aggression, but could seem unsecure and embarrassed; at times, he would blush. He was rather introspective; it is to be doubted, however, whether there was any real difference in their, rather superficial insight into their own characters. In the course of the period covered by our investigation, Robert, in contrast to Kaj, was subject to fluctuations of mood; he was greatly occupied by his actual conflict situation, but his affects seemed rather superficial, and at no time did he present a state of real depression.

They both seemed to possess normal intelligence, and they were endowed above the average. There were no definite differences, except that Robert was the more ambitious intellectually, although a real difference in their efficiency may be doubted.

Emotionally and characterologically, they were both noticeable. They deviated from the average and the following traits of character predominated: first and foremost, they gave a vacillating impression; they appeared unstable and egocentric, easily influenced, but superficial in their emotions, given to fantasy and rather unreliable. Possibly, they also suffered from slight obsessional traits, at least in Robert's case.

Their personality structure thus presented striking points of similarity, but in their attitude to persons in their surroundings, dissimilarities became apparent, Kaj appearing predominantly extroverted, more self-assertive, anti-social and "psychopathic", Robert predominantly introverted, more inhibited and "neurotic".

PSYCHOMETRIC EXAMINATIONS

*Raven's Progressive Matrices**Kaj*

Attempted to solve all 60 matrices in 23 minutes. His cooperation was rather poor; he worked rapidly and superficially. Score: $11+7+2+5+1=26$. The distribution was remarkable; discrepancies: 6, especially striking was the low C-score. Group: 25-50 percentile. Conclusion: Normal intelligence.

Robert

Attempted to solve all 60 matrices in 30 minutes. His cooperation was good. He worked fairly perseveringly and effectively. Score: $11+9+9+7+5=41$. Distribution: unremarkable; discrepancies: 4. Group: 75-90 percentile. Conclusion: Normal intelligence.

Wechsler-Bellevue Scale

	Kaj		I		Robert		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	19	13			21	15	23	16
Comprehension	14	12			15	13	16	14
Digit Span	5+5 = 10	7			6+5 = 11	9	5+4 = 9	6
Arithmetic	8	10			6	7	6	7
Similarities	14	11			20	16	16	14
Vocabulary								
Verbal Points		53				60		57
Picture Arrangement	10	9			10	9	10	10
Picture Completion	11	10			12	12	11	9
Block Design	12+3 = 15	7			15+5 = 20	10	18+3 = 21	10
Object Assembly	16+2 = 18	10			18+2 = 20	12	18-3 = 31	12
Digit Symbol	43/43	10			28/28	6	34/34	8
Performance Points		46				49		49
Total Points		99				109		106
Verbal IQ		110				118		115
Performance IQ		111				114		114
Total IQ		111				117		115

Kaj

While being tested, Kaj seemed rather self-assured, displaying not the slightest agitation; in a way, he wanted to do well, but preferably at the cost of the least possible effort. His scores in the majority of the subtests correspond, however, more or less with the average, some even being slightly higher. In contrast to the free situation in Raven's test, the present test situation seems to raise his performance to a more reasonable level. *Retesting* not made. Conclusion: Normal intelligence (probably above the average).

Robert

Seemed cooperative, rather tense, with an undoubtedly high "Anspruchsniveau". In a few of the subtests, it seemed as though he might have scored better, this applies particularly to the Digit Symbol test which he worked through slowly and painstakingly. The low score in Arithmetic seem partly to have been due to "nervousness". Otherwise,

the results, particularly of the verbal orientation and abstraction tests, are high. *Retesting* (26 months later): His behaviour was, more or less, unchanged. He appeared less tense, but he was obviously tired and in poor form. This was particularly noticeable in the Digit Span test. The other verbal performances do not differ essentially from the results achieved in the first test; this also applies to the performance tests, where small increases and decreases in the scores cancel each other out. Conclusion: Normal intelligence (probably above the average).

Rorschach

		Kaj	
10 W	7 F+	1 H	5 P. 2 Orig. (+/-)
1 DW	1 F+/-	6 A	F+ 63 (extended 47)
1 DsW	4 F-	2 Ad	F = 100 - L = 67
6 D	1 M	6 Anat	A = 44
<hr/> Total: 18	5 CF	2 Bt	Affective ratio: 44
	+ YF?	1 Fire	RT: 0.9 min. (I-VII)
			0.5 min. (VIII-X)
			Seq.: indeterminable
			Ap: W, (d)
			Exp: 1/5
			Colour shock? shading shock: indeterminable.

Tendency to anatomical perseveration, crude and emotive percepts.

His attitude was noteworthy. Beneath his assumed selfassurance and "cocky" manner, a considerable degree of uncertainty could be discerned, which was, now and again, revealed by direct appeals to the psychologist. The number of answers achieved is rather poor, although he made some sort of an answer to every card, alternating between a tendency to blocking ("Versagen") and an attempt to talk himself away from the point at issue.

Psychogram: His very fair intelligence can only be glimpsed in the test result. He is far too disposed to get off as cheaply as possible. He does not appear to be "an intellectual type" and, in this test, he is clearly affectively provoked. Anxious-hypochondriac phenomena must be presumed and a failing stability of his object-cathexis also. In accordance herewith are his, probably, considerable problems in connection with his relations to women (undoubtedly, in connection with the mother-figure also). On the other hand, he appears clearly extroverted with facile forms of contact, and with very fair realization of affect. This applies both to his aggressive and to his sexual impulses, which it can be difficult for him to keep under sufficient control. His mood seems neutral and stable, but his anxiety suppression is hardly effective. He appears, predominately sthenic, self-assertive and unreliable, with hysteriform traits, and must be characterized as somewhat psychopathic.

Double-blind test

Man, not quite young (acceptation grade?). Presumably intellectually well-endowed, but, probably, lacking the thoroughness and the emotional stability requisite for a reasonable utilization of his abilities. In anxiety and emotionally provoking situations, he will, at any rate, hardly be able to live up to the level which his intellectual endowments seem to justify. He will, presumably, attempt to mask his uncertainty beneath a cloak of nonchalance—a rather forced facade? He is, probably, not particularly productive, and seems, in every way, to seek the easy way out. Emotionally, he seems rather domineering, easily influenced, and egocentric, without many qualifications for grappling with his problems introspectively. In his relations with other people, he will, probably, be demanding, without possessing much capacity for entering into their feelings. He

seems, however, to be able to adopt an appraising manner in interpersonal relationships, and he, very likely, possesses a certain sense of situations, presumably enabling him, in more superficial relationships, to adjust himself to others, but if frustrated, he will hardly be able to avoid impulsive and hasty action. Fear and dysphoria seem very easily mobilized. The test bears a hysteriform stamp. Hypochondriac, self-centered?

Retest (Not performed, cf. the case history)

		Robert		
13 W	28 F+	4 H		10 P. 20 Orig. (+/-)
36 D	2 F+/-	13 A		F+ 70 (extended 70)
1 Ds	9 F-	12 Ad		F = 100 - L = 67
3 DdD	3 M	10 Anat		
10 Dd	4 FM	5 Bt		Affective ratio: 47
1 Do	2 V	2 Cg		RT: 0.8 min. (I-VII)
	6 FC	4 Ge		0.7 min. (VIII-X)
<hr style="width: 100px; margin-left: 0;"/> Total: 64	7 CF	2 Ls		Seq.: methodological + reserved.
	2 FY	9 Obj		Ap: W. D, Dd, DdD.
	1 YF	3 Sex		Colour shock? shading shock.
	+ m			

Tendency to "perplexity", symmetry, preference for central areas and pseudo-self-reference in remarks.

Displayed unusual willingness to cooperate, as can, for example, be seen from the many answers (64). He was, moreover, at pains to give each answer an exact form, proffering further shades of meaning and fuller descriptions.

Psychogram: He is intelligent, but utilizes his intelligence ineffectively. His need for "showing off" and for producing something really "intellectual" is, undoubtedly, considerable, but is evidenced in an almost compulsory fashion. In spite of this inhibition and "the intelligence complex", he is highly self-satisfied. His personality structure is marked by conflicting tendencies; affect pressure and disharmony. Beneath the clearly (character-) neurotic surface, he seems to possess great reserves of modes of experience and action that are effectively guided but of little effect. It seems to be the sexual impulses particularly that are brought into operation, but he is unstable in his attitudes and in his object-cathexis. Hypochondriac, anxious phenomena seem probable, fear suppression is probably not entirely effective. Discouragement reactions, which are, apparently, fairly well under control, must also be presumed. His personality bears narcissistic traits, and, thereto, it must be presumed that he (from an early date) has problems with respect to authority figures (dread and fear of disclosure).

Double-blind test

Man, not quite young. Probably quite well endowed intellectually, fairly active and energetic, with interests in a variety of fields, and, at all events with regard to the solving of practical problems, with a sensible utilization of his abilities. In more theoretical fields, he is too prosaic and too much inclined to squeeze the idea into too narrow limits, not daring to exploit the resources that his imagination should afford him. Emotionally, there seem to be labile and egocentric affects, but, probably, he is fairly able to repress these impulses, which will, presumably, only sporadically force their way beyond the outer, calm facade. In his deeper emotional contacts, he is exacting rather than giving. He seems rather too egocentric to be capable of taking a genuine and warm interest in other people. He is certainly capable of versatile behaviour, and he has a marked sense of what the situation calls for; in neutral and superficial social contacts, he can swiftly adapt himself to his surroundings. Anxiety seems manifest, but its control seems quite effective, and hasty actions will seldom occur. Is some of the fear connected with hypochondriac ideas?

Retest (18 months later)

6 W	17 F+	2 H	7 P. 10 Orig. (+/-)
21 D	3 F+/-	1 Hd	F+ 69 (extended 61)
1 Ds	8 F-	12 A	F = 100 - L = 72
3 DdD	2 Me	12 Ad	A = 57
7 Dd	1 V	8 Anat	Affective ratio: 40
1 Do	2 FM	2 Cg	RT: 0.7 min. (I-VII)
3 Do?	2 FC	2 Ge	0.6 min. (VIII-X)
Total: 42	5 CF	1 Obj.	Seq.: methodol. + reversed
	1 FY	2 Sex	Ap: (W), D, Dd, Do, etc.
	1 YF	+ Art	Exp: 2/6
			Colour shock? shading shock.

Tendency to "impotence", symmetry, preference for central areas, pointing out areas without giving interpretations.

Seemed rather less tense than at the first test, more subdued, not engaging himself to the same extent as previously. This is evidenced partly by the smaller number of answers and partly by the smaller number of original answers.

Psychogram: As in the first test, he gives an impression of intelligence poorly utilized, being notably inclined to lose himself in details. His attitude is still marked by uncertainty which he seeks to suppress in a somewhat forced fashion. His desire for "showing off" still runs parallel with his inhibition, but is, this time, somewhat less marked. His adaptation is poor, and a number of his former independent and quite good performances have not been repeated. This seems, similarly, to apply to his personal and emotional contacts also. Sexually, this is also true. As in the first test, there are signs of moderate tendencies to discouragement and poor reliability.

*Word Association Test (a. m. Rapaport)**Kaj*

Accomplished the test without displaying apparent agitation or provocation. This may be due to a certain edging away from a poor acceptance of the task.

Results: Reaction times are, as a rule, brief or of average length; a few were very prolonged (but no blocking reactions). The sexual and interpersonal stimulus words, particularly, seem to cause him obvious difficulties, but compensation is, however, fairly effective. Morally and socially, he is, presumably, rather unreliable; sexually and emotionally susceptible. Latent anxiety? Somatization tendencies?

When the list is presented a second time, most of the reaction times are shorter, or unchanged. The repetition percentage is rather low (47 per cent). Probably, this reaction-form can be interpreted partly as an urge for variation without there seeming to be anything particularly new in his line of thought. On the other hand, his compensation is fairly adequate.

Robert

Despite his attempts at compensation, he is clearly agitated by the situation. It is, undoubtedly, characteristic of him that he appears just as provoked at the second presentation of the stimulus. But even with blocking reactions, his cooperative attitude was still apparent.

Results: The reaction times are of average length, some rather prolonged, there are two blocking reactions. The formal plane stretches from near, concrete responses to strikingly abstract associations. There can hardly be a doubt of his marked ambitions (bordering almost on "intellectual exhibitionism"), but neither can it be doubted that this manner, together with an attempt at a repressive and controlling attitude, is a de-

fence, although it by no means always succeeds in damming up the anxiety on the one hand, and in preventing the bursting through of affect and impulses on the other. His difficulties embrace diverse impulse- and need-areas (arising, presumably out of all phases in his psycho-sexual development).

When the list is presented the second time, there are more increased than decreased reaction times; at the same time, the repetition-percentage is very low (22 per cent). This probably reflects his emotional vulnerability as well as his attempts at intellectualization and at "showing off".

Summary and comparison of the test results

There is a considerable difference in their intellectual functions. This difference is, presumably, predominately characterologically conditioned, and is variously revealed in the various tests. It is most marked in the freer situations (Raven and Rorschach), less so in the controlled ones (Wechsler-Bellevue). The difference is more apparent in their acceptance of the task than in their presumable maximum efficiency. There is, correspondingly, a considerable difference in the importance they attach to intellectual functions, and in their general employment of defence mechanisms. While Kaj is outstandingly action- and affect-determined, with an ulterior motive lying behind his every action, and always setting the palpable first, the defence mechanisms employed to Robert are chiefly those of isolation and intellectualization. He is intellectually more ambitious, but, at the same time, lacks self-assurance; he is a perfectionist who loses himself in details; he is more introverted, tense, disharmonious, and neurotic. Like Kaj, he has, however, tendencies to reactions that are not only moody but also affect-loaded. On the other hand, it must also be presumed that, as far as Kaj is concerned, there are considerable neurotic traits and problems, particularly in the sexual and interpersonal fields, but his reaction to anxiety, for instance, is more "extroverted", he overcompensates or he employs direct denial or repression. Whereas Robert seems narcissistic and dissatisfied, Kaj seems more at ease in his object-cathexis, which, however, is probably not altogether happy either. In situations where Kaj would probably display regular hysteriform traits, Robert would probably display symptoms bearing a more anankastic or phobic stamp. But Robert is also so vacillating and disharmonious that his behaviour, taking a long view, will be marked by fluctuation and instability (poor ego strength). While in Robert's case, general impulse-anxiety and problems with regard to authority as well as difficulties of adaptation to the masculine and to the sexual roles are evident, in Kaj's case, as it were "behind a certain facade", one got the impression of his also having considerable problems with regard to self-assurance and the masculine sexual role. Kaj may seem more extroverted than Robert, but here too, the difference is a surface one, and, taken all in all, there are considerable basic resemblances in their personalities and their problem circles have been the same.

From the picture disclosed by the examination, Kaj must be classified as bearing a predominately psychopathic stamp, whereas Robert is predominately character-neurotic.

OTHER SPECIAL EXAMINATIONS

EEG. The results are remarkably similar. Alpha-rhythm for both is 10 hz, amplitude 70 μ v for Kaj and 120 for Robert. The distribution in time of the dominant activity calculated as a percentage of the total period was 75–100 per cent. There were no abnormal potentials in either case. No change during hyperventilation. Conclusion: Normal in both case.

EPICRISIS

Kaj and Robert were born out of wedlock. Their birth was probably normal. They can hardly have been breast-fed, since they were taken from their mother immediately after they were born, and put into a Children's Home.

It is not known exactly when they were separated; according to Robert they were separated immediately after birth, whereas Kaj meant that they were separated when 3 months old. The period of early parental deprivation was probably short, and with certainty it can be stated that they must have been separated *before* they were 9 months old, at which time Kaj was registered in his fosterhome in Jutland.

The separation was complete until they were brought together at the age of 40 after having been mistaken for each other.

Our investigation started when the twins were 45 years old, and the observation period lasted for about 4 years. The twins were examined separately and have never been seen by us in each other's company.

The childhood environments were entirely different. Apart from the fact that they were both adoptive children, a fact which neither of them learned until they had become adolescents, there can hardly be said to have been points of similarity at all in their upbringing.

Kaj was brought up as an only child in a village in Jutland. He received a minimum of school education, failed to complete special training after school, and had various jobs until he ended up in business life as a salesman. As regards appearance, intelligence and personality, Kaj seems to have differed markedly from his adoptive parents. His adoptive father was an elderly groom of English descent, a "weak" personality, who apparently did not have much influence on the home. Kaj seems to have been closely attached to his adoptive mother, a presumably asthenic, hypochondriacal, and oversolicitous woman, who was childless and almost 20 years younger than

her husband. Kaj seems to have been allowed great liberty during childhood. He developed rather in an uninhibited fashion, and at an early age he presented behaviour disturbances which were accentuated at puberty, and when he at 19 came into conflict with the law due to theft.

Robert's childhood environment was essentially different. He grew up in the city of Copenhagen in the home of a naval petty officer. His schooling was far superior to Kaj's and, in contrast to him, he completed special training, and became a draughtsman. He lost his adoptive mother when he was six years old, and he felt pushed aside by his second adoptive mother and his younger adoptive brothers and sisters. The atmosphere of the home was authoritative and his development was strongly influenced by his adoptive father. From early childhood, Robert seems to have presented partly neurotic, partly psychosomatic symptoms, he had enuresis and encopresis in childhood (but maintained that Kaj had had the same complaints).

As regards their medical history there were only few points of interest, as both twins had been generally speaking healthy. They presented some slight differences which were characteristic of their different personalities; Kaj had contracted gonorrhoea and seemed to be rather "accident-prone"; Robert suffered from a probably psychogenic headache and for this reason used analgetic drugs. Both were myopic but only Robert wore spectacles in public. Both were rather hypochondriacal and occupied with some lumbar symptoms. Both were happy smokers; neither of them were addicted to alcohol.

Despite their different upbringing, there have been many and striking points of similarity in their later life histories. Both have experienced great difficulties of adaptability, primarily in their places of employment and marital life. Both have constantly been on the move, both have led lives filled with outer conflicts and difficulties in interpersonal relationships, both have been married three times and divorced twice.

There seems to have been differences in their attitude to sexual matters, which is indubitably a result of their different environmental conditions during upbringing.

There has also been a clear difference in their attitude towards authorities and society. Kaj was early at variance with the law and his later life was marked by an asocial attitude. Robert had not been in open conflict with the law; he had, from the age of 40, sought psychiatric assistance.

The personality differentiation they presented, seems clearly dependent on differences in their childhood environments and related to the difference in personality between Kaj's adoptive mother and Robert's adoptive father.

Taken all in all, it may be said that Kaj's conflicts have predominately, but probably not exclusively, been "outer", whereas Robert's have predominately, but certainly not exclusively, been "inner", although this may hardly be taken literally.

On the clinical and psychometric examinations they presented corresponding resemblances as well as differences. They both appeared to be intelligent beyond the average, but with poor efficiency.

As regards personality, they were both deviating from the average, vacillating, imaginative, unstable and unreliable. Kaj was more extroverted and self-assertive, Robert more introverted and sensitive, but these differences in their character seemed to be primarily differences in degree, rather than kind.

If the case histories are evaluated separately, Kaj's personality development has born a "psychopathic" stamp, whereas Robert's personality development has been predominately "neurotic" or "character-neurotic". The fact that they are monozygotic twins and submitted to a comparison provides a special basis for a discussion of the concept of psychopathy.

However tempting it might be to assume that the personality of the twins' natural father had a certain resemblance to the twins', it must be admitted that the information available on this point is meagre. On the other hand, one should not forget that certain advantages had been transmitted to the twins, such as their intellectual endowment and their rather prepossessing physical appearance.

The re-union of the twins was not a success, partly on account of their different environmental background, partly on account of resemblances in personality structure between the twins. Their meeting resulted in mutual identification experiences of a probably very unpleasant nature and ended in a break between them.

Both must be classified as: Characterologically deviating personalities.

CASE VI

MARTHA AND MARIE

These twins were 49 years old, when we came into contact with them in 1956 through the twin register at the Institute of Human Genetics.

Generally speaking, they were both cooperative, but both lived in Western Jutland, and alone for practical reasons, we have not been able to investigate them as systematically as the other twins; for example, they were not retested psychologically. The material available, nevertheless, seems to justify including them in the present series.

Martha, married to a farmer, with 6 children, lived some miles from where she was born. She had been adopted by a mill stone grinder and his wife, and had been brought up as an only child.

Marie was unmarried and manageress of the laundry of the general hospital in her native town. She had been brought up by a day-labourer, who was married to a cousin of the twins' mother, together with a foster-brother.

The twins were born in a small town in Western Jutland. They were the 4th and 5th of 6 children from a smallholder's home. According to the information available their parents lived a very disharmonious life, and when the twins were $3\frac{1}{3}$ years of age the family split up after their father had disappeared suddenly without ever informing anyone as to his whereabouts. Their mother placed her children in foster-homes in the neighbourhood and the twins were sent to separate families.

Although the twins knew of each other's existence ever since childhood, had gone to the same school and had spent practically all their lives in the same district, they had always had but occasional contact with each other.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The twins' family had been fishermen, smallholders or day-labourers in West Jutland for several generations.

The father

He was 32 when the twins were born. He was son of a fisherman, and the youngest of two brothers. Shortly after he was born, his mother died. He

was brought up in a poor home by his father and stepmother, and "when still quite young he was sent out to earn money". He married the twins' mother at the age of 24, because she was pregnant. He was a day-labourer, and they moved about several times, were periodically on public relief, and lived a very disharmonious life.

Neither of the twins remembered their father, and could give no data regarding a possible predisposition to mental illness in their paternal family. The twins knew nothing about the father's reason for leaving home, but thought that their mother perhaps had been responsible; various suggestions to the effect that he had been killed, had committed suicide or had emigrated have never been confirmed.

The mother

She was 30 when the twins were born. She was the younger of two girls; her father was a shoemaker and she worked as a domestic servant until she married the twins' father. They had been married 12 years when he deserted her; during this period she had given birth to six children and is said to have had several abortions. Partly at public expence, she obtained foster-homes for all her children except her youngest child, a 2-year-old boy, whom she retained.

Regarding their mother's later life, the twins knew that during some years she worked as a housekeeper at various places in the district, until she moved to another town where she married a commercial traveller, a widower with six children. There were no children by this marriage, which is said to have been harmonious with stable economy. When our investigation commenced, the twins' mother was 80 years old and had been admitted to a home for the aged.

Both twins had known, since they started going to school, that she was their mother, and they had seen her sometimes while children. Martha, when her foster-mother died, had visited the mother occasionally, but Marie, who never hid her negative attitude toward the mother's behaviour and particularly the way she had treated her children, had always avoided her. The mother and the twins, perhaps Martha in particular, were said to resemble each other closely. Their physical features were very much alike; they had the same colour of hair and eyes, and their mother had always, like Martha, been overweight during adulthood. The twins, however, did not consider that they resembled their mother mentally. They knew that, particularly when younger, she had suffered from "migraine" and that two of her cousins, one of whom was Marie's foster-mother, had the same complaint.

A *physician*, who had known the twins' mother for many years stated: "When young she was definitely abnormal in character, emotionally blunt,

crude, sexy, almost obscene in language and behaviour, wanton and only interested in amusement, uneconomic and disinterested in her home and children whom she was completely unfitted to look after. No known predisposition to mental illness in her family”.

Shortly after the termination of our investigation the twins' mother was admitted to the local hospital. The *case record* states:

When 40, hospitalized for “nerve infection”. From the age of 60 mild symptoms of diabetes which, however, never required treatment, especially not insulin. During later years cardiac complaints. On examination rather small, very overweight (70 kg/155 cm), appearance arteriosclerotic but mentally unimpaired. Slight hypertension, electrocardiographic signs of myocardial degeneration, spondylosis and pronounced cyphoscoliosis of the column. On ophthalmological examination some opacities of the lens, but no definite cataract. Diagnosis: Diabetes mellitus, adipositas, morbus cordis (angina pectoris), obstipatio chronica, lumbago.

The twins' siblings

1) *Brother*, 57 years old, married, smallholder. Always a pronounced tendency to “headache”. One of his two daughters had a similar tendency. 2) *Brother*, 55 years old, married, road-worker, as far as is known always in good health. Several children; one son was rejected for military service due to “migraine”. 3) *Sister*, 53 years old, married to a labourer. During climacterium admitted to hospital several times due to “weakness of the back, overweight and headaches”. One of her two daughters had the same symptoms. 6) *Brother*, 47 years old, married, factory-worker (brought up by his mother). Mentally normal and physically healthy as far as is known. His 8-year-old son was said to have “migraine”.

They also grew up apart and first established contact with each other and with Martha when adults; they had never been in direct contact with Marie. They all resembled their mother in looks; none of them is known to have manifested mental abnormalities.

Summary of the supplementary information

The information available, especially regarding the paternal family, was sparse. The twins' parents both appear to have presented characterological abnormalities when young, but there were otherwise no clear indications of predispositions to mental illness in the family. Their mother had suffered from migraine, and there was an undoubtedly predisposition to this disorder in their maternal family.

THE SEPARATION

As far as is known the twins' birth, which took place at home, was normal. The twins are said to have been very small, but their weight is not known; neither is their state on birth or the order of birth. No information about the afterbirth. They were probably not breast-fed and perhaps their early motor development was slow, but they are said not to have suffered from serious diseases.

During the almost four years they were together in their home they resembled each other closely and were easily misidentified by strangers. Their close resemblance is confirmed by a photograph taken shortly before they were separated. Apparently they did not differ particularly in mentality during this period—on the contrary they both were "very apprehensive and glum". Martha was three years and six months, and Marie a little older than four years, when they were sent to their foster-homes.

MARTHA

The adoption papers state: She was 13 years old, when she was formally adopted and given her foster-parents' surname. Her foster-parents were "worthy, honest and well-situated", otherwise nothing of importance was noted.

During *the interviews* Martha stressed that she had had a good home and had always been fond of her foster-parents. From her earliest childhood she knew that she was foster-child. She was brought up as an only child and was, "perhaps spoilt". Her foster-parents were both 31 years old when they took her into their care. They had always been rather well-to-do and their marriage had been harmonious and without important problems. They were both very religious and were members of a lay mission ("The Lutheran Mission Society").

Her foster-father was rather reserved, passive, quiet and did not have much influence on the home. He died at the age of 54 from a lung-disease (pneumoconiosis?) contracted due to his work as a mill stone grinder. Her foster-mother seemed to have dominated the home, and she brought Martha up authoritatively. (According to various informants she was "a clever housewife, but at the same time a sour and grasping shrew"; they also stated that Martha resembled her foster-mother in that they were both "rather sulky, stubborn, difficult to establish close contact with and rather domineering").

After having attended school normally from six to 14, Martha remained at home while she was apprenticed as a men's tailor. Apart from a short time at a high-school on Zealand she stayed at home working as a tailor until, apparently much to the surprise of her surroundings, she at the age of 32 married a farmer.

Her two years older husband owned a large farm in the neighbourhood of Martha's home. He was a calm, pleasant man, who had "gastric ulcer". He had apparently been dominated by women all his life, primarily by his mother who died after having for several years been difficult and demented, and later by Martha, and by her foster-mother, who made her home with them and died on the farm at the age of 75 from coronary disease.

According to Martha her marriage had been harmonious and had never given rise to important problems except that she had six children and had always had a lot to do. The farm was large, well-organized with modern installations, they had a car and were rather well-to-do.

Concerning her medical history, Martha said that she had never been in hospital. She had never been seriously ill as a child and in particular had not shown signs of nervous disturbances.

Since puberty she had suffered from periodic headache, diagnosed by her physician as migraine. She had been given sedatives and analgetic drugs, but never ergotamine. When menstruation commenced at the age of 15, and probably accentuated by her apprenticeship, she began to suffer from attacks of "pressing and throbbing" headache, which were always localized to the right side of her head. The attacks were often introduced by mild "luminous spots" after which there was general indisposition, nausea and vomiting. She was forced to go to bed and usually incapable of work for a couple of days. The attacks terminated spontaneously. They were not clearly related to menstruation, and had not remitted during pregnancy, but seemed rather to have increased. During later years her headache had become almost constant and at the same time it had started to become more diffuse, although its main locus was still on the right side. For some years her previously regular menstruation had been apt to occur a little late, and Martha believed that she was about to enter climacterium. She had always been conservative about using medicine during her attacks and was afraid of becoming "addicted" to it. During our investigation she consulted a physician, who treated her with ergotamine tartrate, which had considerable subjective and apparently also objective effect.

While a child and young girl she was relatively slim, and at least not overweight. During her pregnancies, however, her appetite was considerable and she had since then been overweight. She had never thought of slimming and did not appear to regard her obesity as pathological or particularly problematic.

She had had a pronounced tendency to obstipation since youth and had on several occasions had haemorrhoids. She had occasionally had sinusitis—without obvious connection with her migraine. She had never consulted an ophthalmologist, but had for some years used spectacles due to moderate "long-sightedness". She had poor teeth when still a child and lost them all

during her pregnancies; she had complete dental prostheses when 40. Her six pregnancies and births had been normal and she was able to suckle the elder children for some months. She had never aborted.

Generally speaking, she considered that she had always been in good health, and stressed that she had never smoked or liked alcohol.

Apart from the fact that her migraine was often provoked by mental stress and that she during later years had suffered from insomnia, due to which she regularly took "a sleeping-pill", she did not think that she had ever manifested "nervous" symptoms, and at least she had never felt any need for psychiatric assistance.

Her *physician*, who had known Martha for several years, described her as "a healthy, robust country woman, rather domineering—she "wears the trousers" and manages the farm. She might well be neurotic, but probably rarely allows this to become manifest because of her many children and the farm, which demand all her energy".

Martha's children. 1) *Son*, 16 years old, worked on the farm, "nervous and apt to faint". (The physician regarded his fainting-fits to be "orthostatic"). 2) *Son*, 15, "nervous with attacks of headache". (The physician diagnosed migraine and had given ergotamine with good results). 3) *Daughter*, 13, in good health, mentally normal. 4) *Daughter*, 11. Examined by a pediatrician due to uncharacteristic colica abdominalis which was regarded as being "psychogenic". 5) *Daughter*, 8, "with a pronounced tendency to headache"; Martha believed that this was the beginning of migraine. 6) *Son*, 5, healthy, mentally normal.

MARIE

She was never formally adopted, presumably because her foster-parents, due to their poor circumstances at that time, would have found it difficult to renounce the money they received for the care. She therefore still had her parents' surname and had always known that she was a foster-child.

During *the interviews* she said that she could, in fact, dimly remember having entered her foster-home. Her foster-father was then 28 and her foster-mother 26. They had no children, but two years later they got a son. Marie and her foster-brother, who really were second cousins, as Marie's foster-mother as mentioned was a cousin to the twins' mother, grew up together and were always very fond of each other.

Her foster-father was belonging to "Indre-Mission", but religion probably did not play an important role in the home. He had always been in good health, but due to seasonal fluctuations in the building trade had been out of work for various periods. The home's economy was unstable, but it had

never been necessary to seek public assistance. Marie never mentioned her foster-father spontaneously.

Her foster-mother was clearly the central figure. She was a slim, apparently asthenic, hypochondriacal woman, who over-protected Marie. The foster-mother had been weakly since youth, had a pronounced tendency to attacks of headache—"Sunday-headaches"—which her physician had diagnosed as migraine. She had always been afraid of physicians and hospitals, especially because she had been operated upon for osteomyelitis of the skull and had since had a facial paresis. She had always been very domineering, and Marie seemed still to be dependent upon her in everything; they went for walks together daily, and according to various informants her foster-mother still treated her as a child. Marie seems to have tried to free herself from her foster-mother's influence earlier on, but apparently had given up; she had no other associates apart from her foster-brother, a greengrocer in a nearby market-town, who was married and had five children. He suffered from chronic polyarthritis, but had never had migraine.

After having been at school from six to 14 years of age, Marie remained in her foster-home and was employed in various positions as a domestic servant. She had always lived in the district where she was born. During the last 20 years she had been employed at the laundry of the local hospital, of which she was now manageress. She lived and ate at the hospital, and spent all her leisure time in her foster-home. She had never really liked her work, felt that it was too tiring, and one had the impression that she was not particularly effective or well-estimated. She had never been engaged.

Marie had been admitted several times to the local hospital. The *case records* state:

- 1) When 22 years old: *appendicitis acuta*; appendectomy was performed.
- 2) When 29: *angina tonsillaris, influenza*.
- 3) When 37: *sinusitis maxillaris*.
- 4) 37: *influenza*.
- 5) 38: *heterochromia iridis, cataracta o. dext.* Acuity of the right eye severely reduced, could only distinguish light; left eye: emmetropia but otherwise normal. *Extractio cataracta o. dext. cum iridectomia superior* was performed.
- 6) 39: There was pronounced reddening, oedema and thickening of the skin around the eyes, assumed to be due to her work with soap-powder. The symptoms disappeared spontaneously during hospitalization. She mentioned that she for many years had suffered from attacks of bilateral headache localized to the temples; the headache "pulsated" and was accompanied by nausea but never by vomiting. She also complained of palpitations and a pronounced tendency to obstipation. Diagnosis: *dermatitis artificialis (typus incertus)*.
- 7) When 42: Had to take laxatives, there was often bloody and slimy stools, and she had had a slight rectal haemorrhage seven times. She also complained of pains in her "diaphragm" immediately after meals, noises and movements in her abdomen, a feeling of

being distended "like a sausage across my stomach, so large that you can see it outside my clothes". Her headaches had become slightly worse since the operation on her eye, and she now also felt giddy. She stated that she took about 10 coffazin-tablets daily. Objectively: thin, rather pale, obviously asthenic, and there was tenderness on palpating the epigastrium. Rectoscopy and other routine examinations did not disclose anything abnormal. Diagnosis: *obstipatio chronica*. 8) 44: Her dyspeptic symptoms had disappeared and her tendency to headache was reduced somewhat, but she still took up to 10 tablets a day. About a week prior to admission: fever, coughing, severe perspiration, headache and nausea. Weight: 54 kg (had previously weighed about 60 kg). Diagnosis: *influenza*.

9) When 46: Complained of abnormal pressure after meals, had typical hunger-pains, felt nervous, lacked appetite, was losing weight and had insomnia. No clinical symptoms of thyrotoxicosis. Basal metabolism: 102-98 per cent. X-ray of the stomach and the colon: "spastic colon"; otherwise nothing abnormal, especially no signs of ulcer. X-ray of the chest and lungs: nothing abnormal. During the four weeks she was at the hospital, she seemed to be depressed, did not seem to want to return to her work, and was consequently sent on convalescence. Diagnosis: *neurosis (neurasthenia) cephalalgia*. 10) 48: Complained of fatigue, insomnia, giddiness, pressure in the chest and back, had no wish to work, found it difficult to concentrate on her work, felt that things were more hectic and demanded more of her than previously, she often stopped and sat and stared or spoke "in confusion" when someone addressed her. She denied special problems and worries. During the seven weeks she was in the hospital, she was treated with insulin in small doses and gained in weight. Diagnosis: *neurosis (neurasthenia)*.

11) 49: Still complained of headache, obstipation and also about irregular menstruation; the intervals varied from 1 to 5 weeks. Diagnosis: *panaritium*. 12) 49: Admitted because she had fainted at work. Said that she felt tired, giddy and was still affected by her headaches. Still had mild, irregular menstruation. Diagnosis: *influenza obs. pro*.

Her physician stated: "She has suffered from migraine since childhood and has been treated with various sedatives and analgetica, but never with ergotamine. She undoubtedly takes large amounts of analgetics. Her relationship to her foster-mother has always seemed "abnormal". She seems to have a severe neurosis with pronounced asthenic, hysterical and occasional depressive symptoms".

Marie said about her medical history that she had been quite thin as a child, underweight and "weakly". She fainted frequently and because of this often stayed away from school. She did not remember anything about the usual childhood diseases except that she had scarlet fever without complications.

She began to menstruate when 16. From about this time she started to have attacks of headache. They were often provoked by physical or mental exertion and were introduced by "flickering vision and flying, luminous spots", general indisposition and then a severe, pressing headache, diffused throughout her head, stretching particularly from the top of her nose backward to her neck, but never localized to one side of the head. She had nausea but "had never been able to vomit". The attacks lasted from one to several days; she was incapable of work, had to go to bed and was usually very ill indeed. The attacks had increased in frequency, and during the intervals, which lasted a few days up to a couple of weeks, she was rarely without a slight headache. She had for many years taken a large amount of drugs and still used about 10-15 coffazin-tablets daily. She also took 1-2 "sleeping-tablets" due to insomnia. Her attacks of headache had never been obviously related to menstruation, which had previously always been regular and normal, but during later years retarded and sparse; she had not menstruated for the past six months, and hoped that her tendency to attacks of headache was declining.

When young she often suffered from sinusitis, without obvious connection to her headaches. Since childhood she had had a pronounced tendency to become obstipated and used laxatives constantly. Periodically she had suffered from haemorrhoids as well as mild gastric symptoms. Whereas she had been underweight as a child, during adulthood she weighed for several years 70 kg., but during the past year she had again lost weight and now weighed about 50 kg. Her weight had always fluctuated, as also had her appetite, which depended upon her headaches. She had lost all her teeth when about forty.

She had smoked since youth, about 5-10 cheroots daily, but she had never liked alcohol.

Regarding her eye-disease, she said that she had never had anything wrong with her eyes as a child or in her youth. When 36-37 years old, however, the sight of her right eye declined rapidly. Up to that time she had never noticed that the iris of her right eye had a brownish-yellow area (her eyes were otherwise very light blue). Her ophthalmologist explained that she had a "cataract". She was operated on and had since been practically blind in her right eye and could only distinguish light. She had been given to understand that further treatment was impossible and therefore became very disappointed. The acuity of the left eye had always been normal, apart from moderate "long-sightedness" during later years. She had noticed that when tired, she was apt to squint.

She did not believe that she had manifested symptoms of "nervousness" as a child or while young. About the age of 30, however, she began to feel "nervous", tense, restless and was fatigued. It became difficult for her to manage her work and she was apt to faint. She related her "nervous" symp-

toms to her somatic complaints and found it difficult to accept that the physicians at the hospital regarded her case as "nervous". She was often afraid that she had cancer or some other serious disease. Her life had led to various problems, but she had never felt the need of psychiatric assistance.

THE TWIN RELATIONSHIP

Although they had known about their being twins ever since early childhood, this had never played an important role for either of them. They had never felt that they belonged together and in fact knew only a little about each other; thus, neither knew that the other had attacks of headache, and each believed that they suffered from different illnesses.

They attended the same school, but Martha undoubtedly received better education as Marie often stayed away from school. They did not sit together at school and neither did they associate outside school. This was mainly due to the fact that their foster-parents had nothing to do with each other and belonged to different religious sects, which opposed each other. Neither of the twins were religious-minded.

When younger they resembled each other closely and were confused by friends and teachers, but never by members of their family or by their foster-parents. They seemed to be rather irritated about their still being confused by strangers. They had never attempted to establish closer contact with each other as adults, had always had different interests and had almost tried to avoid each other. After Martha married, Marie had only visited her once; if they met, they talked a short while with each other about superficial subjects.

Both agreed that the atmosphere in the two foster-homes had been very different indeed. Both had been very fond of their foster-parents, particularly their foster-mothers, but the latter had no resemblance to each other at all. Correspondingly, both felt that they had been mentally different even when still children.

They often criticized each other during the interviews. Martha's criticisms were usually indirect; she felt that Marie was very dependent on others, "peculiar", "spinsterish", "difficult to associate with", whereas Marie more directly said that she did not like Martha, whom she described as "materialistic, glum, unapproachable and never with a smile". While Martha had shown some interest in establishing contact with her mother and her family, though first after her foster-mother had died, Marie had always avoided doing so.

CLINICAL EXAMINATIONS

Examinations were carried out at the local hospital. The twins were each interviewed separately six times, and once together. Although both were un-

doubtedly cooperative, it was not possible to carry out special examinations; thus, neither ophthalmological nor electroencephalographical examinations were available, (Marie's foster-mother strongly opposed that Marie went to Aarhus or Copenhagen, as she was afraid that this would mean, that one would then want "a spine-puncture or to put air in her head"). The twins were also not retested psychologically. I had no opportunity to visit the twins' homes or to talk with Martha's husband or Marie's foster-mother nor with other members of the family, but I had interviews with several persons, among them were two physicians and a nurse, who had known both twins for many years.

The twins were different in their immediate appearance. Martha was obese, whereas Marie was rather slim. They were both 160,0 cm., Martha weighed 75,5 kg. and Marie 58,5 kg. Martha's obesity was mainly of a truncular type and made her look rather "matron-like". Her face was rather plump with a tendency to double-chin, but her extremities were, on the other hand, like Marie's, relatively slim.

Apart from the difference in obesity their faces were of similar "oval" shape; the foreheads were comparatively high, domed, their noses rather prominent and their mouths were small, pursed and thin-lipped. Both wore dentures. There were no differences in the position of the details of their ears. The hairboundaries were identical; their hair was darkbrown, with slight diffuse greying, somewhat more advanced in Marie, thin and slightly wavy. Martha parted her hair on the left, whereas Marie had her brushed back (though she had earlier parted it on the left). Their hair-whorl was clockwise.

Their eyes were very light blue with a very faint, whitish structure in the iris. Apart from the large oblique pupil in Marie's right eye (due to the operation for cataract) examination did not disclose obvious differences; both were slightly hypermetropic and had a slight convergent strabismus. (As mentioned a special ophthalmological examination was not carried out).

The other somatic examinations did not disclose anything of importance, especially no neurological disease. Bloodpressure: normal. Both were right-handed.

The twins' overt behaviour was very similar. Both seemed rather reserved and non-committal during the first interviews, an attitude which is perhaps more or less characteristic of the population group in which they lived.

The differences between them were more obvious. They did not resemble each other particularly in clothing—Martha was dressed in dark clothes and seemed rather slatternly and uninterested in her appearance. Probably due to her slimness, Marie looked considerably younger, was better groomed and spruce, and she also used a little make-up.

Whereas Martha generally was rather passive and rarely spoke spontaneously during all the interviews, Marie became more friendly and easier to contact, even though she often became evasive and tried to change the subject; she then fell back to an attitude in which she resembled her sister considerably. Martha, who was more well-balanced and at ease, appeared to be a little "masculine", whereas Marie appeared to be obviously asthenic, rather restless, with lively movements. Their facial expressions differed; Martha's expression varied seldom and when she occasionally smiled, she never opened her mouth. Marie's expression was much more lively, smiling, rather hysterical, and she often made a special effort in trying to establish an emotional contact; on the whole, she was more informative than was Martha. Their voices were very similar; both spoke with a slightly West-Jutlandic accent.

In intelligence, both appeared normal, approximately average and without clear differences.

As regards personality, Martha did not manifest clear pathological traits but only slight neurotic, primarily obsessional, symptoms. She succeeded in maintaining a self-confident, defensive attitude; she was apparently not used to talking about herself and had no need to contact a doctor about her conditions.

Marie did not express any desire to seek psychiatric assistance, but she contrary to Martha was eager to talk about her symptoms. She appeared to be very self-centered, introspective without real insight, and was classified as neurotic with rather pronounced asthenic, hypochondriac and hysterical features.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Martha

Attempted all 60 matrices. Worked quickly, in the beginning rather superficially, apparently uninterested in whether she reached the correct result or not, but later she took more trouble. Score: $11+8+6+2+4=31$. Abnormal distribution; discrepancies: 8. The low D-score is striking. Group: 25-50th percentile. Conclusion: Normal intelligence.

Marie

Attempted all 60 matrices. Seemed uncertain of herself, wanted to have help, often commented upon the test, worked quickly but rather superficially. Score: $8+7+3+2+1=21$. Normal distribution; discrepancies: 4. Group: 5-25th percentile. Conclusion: Normal intelligence.

Wechsler-Bellevue

	Martha				Marie			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	11	8			6	5		
Comprehension	7	6			5	5		
Digit Span	5+5 = 10	7			5+4 = 9	6		
Arithmetic	5	6			4	4		
Similarities	12	10			10	8		
Vocabulary								
Verbal Points		37				28		
Picture Arrangement	10	9			12+1 = 13	11		
Picture Completion	8	7			7	6		
Block Design	18+3 = 21	10			15+2 = 17	8		
Object Assembly	17+5 = 22	13			18+4 = 22	13		
Digit Symbol	43/43	10			35/35	8		
Performance Points		49				46		
Total Points		86				74		
Verbal IQ		95				85		
Performance IQ	114+2 = 116				111+2 = 113			
Total IQ		105				97		

Martha

Seemed difficult to approach, rarely spoke spontaneously, but it was possible to establish more or less satisfactory contact with her and she cooperated reasonably well. There did not seem to be signs of intellectual deficit. It was striking that she generally did better on the performance-tests than on the verbal ones. The variation in the scores in both sets is relatively large, but there is no typical pattern. (Not retested). Conclusion: Normal intelligence (with good practical ability).

Marie

Established only rather superficial contact and did not cooperate well. She seemed unsure of herself and her ability to withstand stress seemed poor. She nevertheless worked quite efficiently on the performance-tests and there did not seem to be signs of intellectual deficit. It was striking that she generally did better on the performance-tests than on the verbal ones. Her scores on the performance-tests vary considerably but there is no typical pattern. (Not retested). Conclusion: Normal intelligence (with good practical ability).

Rorschach

		Martha			
8 W		8 F+		2 H	7 P. 1 Orig (+)
7 D		1 F+/-		9 A	F+ 85 (extended 84)
1 DdD		1 F-		2 Ad	F = 100 - L = 62
<hr/>		2 M		1 Bt	A = 69
Total: 16		1 FC		1 Cl	Affective ratio: 50
		1 CF		1 Ge	RT: 1.4 min. (I-VII)
		2 FY			0.8 min. (VIII-X)
		+ YF, FM			Seq.: indeterminable
					Ap: W! - D - DdD
					Exp: 2/1/2
					Colour shock, shading shock.

Tendency to rejection, incomplete formulations of answers.

Her behaviour was marked by uncertainty for which she was, however, able to compensate.

Psychogram: Normal intelligence, potentially a little above average. In spite of some inhibition, the quality of her responses was quite high. Presumably she will be quite effective in normal situations with natural self-confidence and assertiveness. In her relationships with others she will probably not be very obliging, rather reserved and there seems to be a corresponding restriction in her emotional reactions and imagination. There is some contrast between her manifest reactions and the considerable emotional reactivity suggested by the test. Her mood seems to be stable, with possible slight depressions; her repression of anxiety appears to be effective. The test suggests that she has deep-lying sexual and identification problems which are, however, presumably under control. There is possibly a mild tendency to projection, especially of aggressive impulses. Moderate neurotic traits, mainly obsessional in character.

Double-blind test

Woman? Middle-aged? Intellectually probably in the upper half of the normal. Careful, does not say more than she feels confident about, is hardly likely to be productive on her own initiative but presumably manages the tasks others set her. She seems to have rather restricted interests. Emotionally mainly introverted, presumably sensitive, but with difficulties in establishing immediate rapport. She is probably apt to keep others at a distance by adopting a reserved attitude.

Marie

6 W	3 F+	1 H
2 DW	1 F+/-	12 A
4 D	8 F-	1 Bt
1 Ds	1 M	
1 DdD	1 CF	

Total: 14

4 P. 3 Orig. (-)
 F+ 30 (extended 32)
 F = 100 - L = 86
 A = 86
 Affective ratio: 29
 RT: 0.6 min. (I-VII)
 0.8 min. (VIII-X)
 Seq.: indeterminable
 Ap: W - (D) - DW
 Exp: 1/1
 Colour shock, shading shock.

Tendency to perplexity and appeal, rejection, criticism and denied answers, vagueness.

Was obviously unsure of herself and apt to try to escape from the test-situation. It was, however, possible by encouraging her to complete the test so that she gave at least one response to each plate.

Psychogram: Even the best of her responses are rather banal. Judging from this test alone, one would not think she was of normal intelligence; her intellectual capacity must, however, be assumed to be reduced by emotional factors for which she cannot effectively compensate. Not only are her responses clearly inhibited, but often obviously marked by anxiety. Similarly her ability to establish contact with others is not only inhibited but presumably also definitely poor. There is considerable lack of self-confidence, and an emotional lability, which, however, primarily manifests itself indirectly and in depressive moods. When under stress, it seems possible that she may react defiantly, but probably not directly (conversion). There are obvious sexual problems (more obvious than in the case of her sister). There are possibly phobic or near-paranoid features. If she was subjected to severe stress one must expect a psychosis-like reaction.

Double-blind test

Woman? Middle-aged? Few responses, marked by resignation. Presumably poor application of rather modest ability. Possibly there is organic intellectual deficit, judging from the stereotyped responses, the subjective insufficiency and apathy. One cannot, however, disregard that this might be due to neurasthenic traits. The imagination seems restricted in content, she lacks drive and is rigid in personality. Her emotional life is probably apt to restrict itself to periodical dysphoria. Tendency to somatization?

Retest (Not carried out, cf. the case history)

Word Association Test (Not carried out)

Summary and comparison of the test results

Both are of normal intelligence. Martha, however, functions more effectively than Marie. The latter's solutions are tinged by emotional defensiveness (rejection), and a tendency toward resignation, and her ability to withstand stress seems to be poor. Martha's method of working seems more efficient, although she too does not appear to be intellectually ambitious. The comparatively sparse results do not permit a detailed description of their personalities, but it is possible to give a tentative estimate.

Martha is undifferentiated and her defense mechanisms mainly consist of rejection and "contradiction" in a stereotyped manner, but, nevertheless, are quite effective. She seems to possess considerable resources and under normal conditions she will be quite efficient, domineering and aggressive. She seems to some extent to have solved her sexual and identification problems by adopting a domineering, masculine role. Thus she seems to be moderately neurotic, mainly "character-neurotic".

Marie appears to be less mature, asthenic and generally less compensated. One must assume manifest neurotic symptoms (anxiety, somatization). She seems to be emotionally labile, lacking in self-confidence, and apt to avoid reality. Her control of her mood does not seem to be efficient. Her defensive mechanisms vary and in particular seem to comprise repression, denial and projection. Her main problems are sexual and identificational and manifest themselves clearly. She seems to react with manifest insecurity and rejection and in addition there are problems with regard to her dependency on others; there will also be outbreaks of defiance.

OTHER SPECIAL EXAMINATIONS

EEG, ECG and ophthalmological examinations were not available.

EPICRISIS

Martha and Marie were the youngest of six children from a small-holder's home in Western Jutland. Their birth was probably normal. They were hardly

breast-fed. Their parents lived a very disharmonious life, and the family split up after the father had left the home. Their mother placed her many children in various foster-homes in the district.

When three years and six months old the twins were separated. Martha was put into the care of a childless couple, a mill stone grinder and his wife. She grew up as an only child, and was formally adopted when 13 years old. Marie was taken care of by a day-labourer and his wife (a cousin of the twins' mother), and she grew up together with a two years younger foster-brother.

The twins were 49 years old, when we came into contact with them. They were both cooperative but, alone for practical reasons, we were not able to investigate them as intensively as the other twins; however, we found it justified to include them in the present series.

The outer circumstances of their upbringing resembled each other inasmuch as they were both brought up as foster-children and were well aware of their natural connection ever since early childhood. From social, economic and educational aspects, Martha's upbringing was, possibly, the superior, although the differences were only slight. Their foster-fathers apparently did not have much influence on the home, as in both cases the foster-mothers were the central and domineering figures.

There were, however, considerable differences in the mother-child relationship and in other psychological aspects of the childhood environments. Both homes were religious, but under rather different sect influences, and, in Martha's case the religious atmosphere was, undoubtedly, the stronger, although neither of the twins had been religiously inclined. The twins resembled each other in having retained a close connection with their foster-homes in their adult years. Although their childhood was spent in the same, small town, and they attended the same school and class, and although they had always lived in the same district, their mutual contact had been sparse, and their attitude towards each other was ambivalent.

As regards their medical histories, there were similarities as well as differences. Both had, since adolescence, suffered from migraine. In Martha's case it had a typically unilateral localization; in Marie's it was more diffuse with a presumably neurotic superstructure; otherwise the symptoms and the courses were substantially similar, but more severe in Marie's case. With reference to the aetiology of their migraine, an undoubtedly disposition to migraine was revealed in the twins' maternal family. Whereas Marie's foster-mother, who was a cousin of the twins' mother, suffered from migraine, Martha's adoptive mother never had this complaint. Even if, in Marie's case, an unconscious imitation of her foster-mother, as well as an unreleased "mother-fixation" and an emotional immaturity, may be presumed, this cannot be so in Martha's; a predominately hereditary aetiology seems to offer an entirely satisfactory explanation of this concordance.

They also presented some slight, rather trivial, similarities, such as for instance a pronounced tendency to obstipation and haemorrhoids.

As regards their dissimilarities, they presented a striking physical contrast to each other. Martha was, presumably on account of her many pregnancies and childbirths and perhaps in connection with her country life, stout and definitely obese, while Marie, who had previously had slight tendencies to overweight, was clearly on the slim side. Another prominent difference in their physical history was that Martha had given birth to six children, whereas Marie was a nullipara. Finally, Marie had been operated upon for a cataract which had developed in what seems to have been a heterochromia of her left iris, a phenomenon which must be regarded as a somatic mutation.

In their personality development during childhood and adolescence, the twins have differed. Martha seems to have been more independent, Marie very dependent. Their attitude to their surroundings has been marked by a certain reserve which may, however, be more or less characteristic of the population group in which they lived. Until they were about 30 years old there was a certain, at least outer, similarity in their relations to the foster-homes.

Martha married when 32 and settled down as a farmer's wife in good social circumstances, became mother of six children, and had functioned efficiently. At about this time Marie, who was a spinster, began to manifest marked neurotic symptoms, necessitating repeated admissions to hospital and resulting in a maladjustment to her work, almost bordering on disablement.

The differences in their personality development may reasonably be adduced to the differences in their childhood environments but also to their later life histories, as the marital and sexual life, and the pregnancies and childbirths of Martha must be said to take a leading place.

On the clinical and psychometric examinations, the twins primarily presented differences. The intelligence of both were about average but, as is seen from the test results, Martha was the more effective.

As regards personality, Martha did not present definite psychopathological traits but only slight psychosomatic and perhaps also obsessional features within an otherwise normal personality structure.

Marie presented very marked asthenic, hypochondriac, hysterical and psychosomatic traits; contrary to her twin sister she had given expression to a need for medical, although not psychiatric, assistance.

Marie was classified as: Neurotic; Martha as: Normal personality.

CASE VII

KAMMA AND ELLA

The twins were 50 years old when first contacted in 1956. We approached them in their homes.

Kamma was married to a mechanic, *Ella* to a small-holder, and both were living in the middle of Jutland. Their cooperative attitude made it possible to carry out the investigations in Aarhus according to plan, and contact was continued for a period of three years.

The twins were born in a village in the middle of Jutland, and were the youngest of 10 children from a sawyer-home. They were separated the day after birth.

Kamma was taken care of by friends of the family, a game keeper and his wife. *Ella* remained at home with the parents. As the mother died shortly afterwards, the twins remained apart and grew up in rural districts in Jutland about 40 miles from each other.

They first met each other again at the age of 12, when they were together for one day. This was repeated when they were 16, and they came into occasional contact with each other as adults at intervals of several years, but only superficially; for example, up to the time of our examinations they had never slept under the same roof together. The examinations led to a brief increase in contact, but they continued to lead independent lives.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

According to information from the twins, especially from *Ella*, the following could be stated:

The father

He was 41 years old, when the twins were born. The paternal family were farmers on the moors of Jutland, and he was the youngest of six children from a day-labourer's home. He was a qualified carpenter, but had been employed as a sawyer most of his life. He was 28 when he married the twins' mother; as mentioned there were no less than 10 children in this

marriage, and the many children meant that the home was poor. The relationship between the twins' parents was disharmonious, among other things due to the father's extramarital sexual relations, mentioned later. When the father was widowed, he placed most of the children in care of friends or strangers and only kept Ella and her oldest sister at home. During the following years the father had several housekeepers and cohabited with one of them for several years. This housekeeper brought her own daughter with her; she was almost the same age as Ella, and thus she and Ella grew up together in a form of "pseudo-twinship".

Further details concerning the father will be given in connection with the description of Ella's childhood environment.

After Ella ceased to have contact with the father, he lived alone for some years until he at the age of 70 married a housekeeper 30 years his junior. He died at the age of 76 in a mental hospital. The *case records* state:

No known disposition to neurological or psychiatric disease. Married twice. First wife (the twins' mother) died; remarried six years ago; has a 2-year-old daughter by the latter wife. During the past few years he has had a small grocery and, following this, old age pension. Somatically healthy, although there has been dyspnoea and tendency to oedema during the past few years (own physician diagnosed a myocardiac degeneration with a background of arteriosclerosis). Premorbid mentality: "Cheerful, always capable of his work, able to remain economically independent, normal intelligence".

During the three years prior to admission, gradual alteration in character, irritable, difficult to deal with, restless at night, has run out of the house in his nightshirt, occasionally been aggressive and threatening towards his wife, and therefore committed to hospital.

On admission possibly hallucinated, thought he saw his little daughter everywhere. He was confused, restless, dislocated his shoulder when he fell from his bed, noisy, shouting, only partly orientated as regards time and place. Bloodpressure high and electrocardiographic signs of cardiac failure. His state deteriorated gradually and he died. (No autopsy was performed). Diagnosis: dementia senilis, hypertensio arterialis, morbus cordis.

The father's siblings. The twins only knew little about his five brothers and sisters. One of the father's cousins, a young, unmarried girl, committed suicide after having concealed a birth, but apart from this nothing of psychiatric interest was disclosed in the twins' extensive paternal family, and nothing could be added from a systematic search of various official records and medical files.

The twins' paternal half-siblings. 1) *Half-sister*, 60-year-old widow of a farmer. Three children. She was an illegitimate child of the oldest of the twins' maternal aunts and the twins' father. She spent her childhood with her mother, and later took over the maternal family's farm. Physically and mentally she was said to resemble her father, "hard and only kind to herself". She had been hospitalized repeatedly. Diagnosis: hypertensio arterialis. 2) *Half-brother*, 30-year-old mechanic and chauffeur, married. Two children. He was an illegitimate child of the twins' father and Ella's foster-sister:

He was brought up by his mother and grandmother. "Resembled his father mentally", physically healthy. 3) *Half-sister*: 16-years-old, unmarried, apprenticed clerk. She was child of her father's second marriage. "Rather nervous" though physically healthy.

The mother

She was the oldest of three girls from a well-situated farmer's home and came from the same district as the twins' father. She married when quite young to the twins' father because she was pregnant, but according to the twins, "she really did not like him". She is reported to have been "small, slightly built, and wasted by the many births". She died at the age of 34, three weeks after the twins' birth. The cause of death was recorded as "poisoning", "due to eating pork infected with trichina", (the symptoms included in the *death certificate*, however, suggest puerperal sepsis). No other information was available about the mother's mentality.

The mother's siblings. 2) *Sister*, 63-years-old widow of a farmer. "Migraine" since childhood, otherwise healthy. Four children, two of which were twin boys, who died when still infants. As mentioned she also had an illegitimate child by the twins' father. She kept this child at home until she married, when it was given into care of the sister mentioned next. 3) *Sister*. Died at the age of 75 from "cancer of the uterus". Spinster, suffered from "migraine". She had an illegitimate child; father unknown (but apparently not the twins' father). Apart from this child she took care of the illegitimate child mentioned above and also the twins' youngest brother; the three children she reared were thus related to each other in a rather complicated way.

The twins' siblings

1) *Brother*, 61-year-old engineer, married. Three children. Brought up by strangers, had spent several years in U. S. A. Had been healthy until he had "cancer of the stomach" which he refused to have treated. The information available did not disclose definite signs of psychopathology; the twins knew but little about him, and Kamma, for example, had never even seen him. 2) *Brother*, 59-year-old shoemaker. Married. Four children. Brought up by strangers. Severe "migraine" since childhood, otherwise healthy. 3) *Sister*, 56 years old, married to a smallholder. Five children. This sister grew up together with Ella. "Migraine" since childhood. When young somewhat "peculiar, resembling her father". Had been repeatedly hospitalized: operated for gall-stones, had developed a severe adipositas, had a struma and possibly Graves' disease. *A daughter* had two sets of twins: twin girls, according to the description undoubtedly monozygotic, who both had pedes equinovarus, and opposite-sexed twins, the boy with pedes equinovarus. 4) *Sister*, 55 year old, married to a road mender. Two children. Brought up by strangers in a very religious atmosphere; the twins had never been in contact with her. Apart from numerous admissions to hospitals due to recurrent otitis, she had been healthy. 5) *Sister*, 53 years old, married to a smallholder. Five children. Brought up

in a religious home. "Migraine" since childhood, otherwise healthy. *Three sons* had persistent nocturnal enuresis throughout childhood. *A daughter* gave birth to twin girls, presumably dizygotic; both died in infancy. 6) *Sister* (twin), 52 years old, widow of a railway worker. Four children. Was cared for by the eldest of the twins' maternal aunts, but when the aunt married she was put in care of a religious family and from then on did not come into contact with her siblings. Suffered from "migraine" and "poor nerves"; (during the German occupation her husband was killed when the Royal Air Force strafed a train, and one of her sons died in a German concentration camp). 7) *Brother* (twin), 52 years old, unmarried, sold sausages from a stall in Copenhagen. One child. Cared for by the youngest of the twins' maternal aunts. Healthy, without signs of mental abnormality. 8) *Brother*, died in infancy, cause unknown.

Summary of the supplementary information

The information available concerning the twins' paternal family is scanty. A cousin of the twins' father committed suicide, the twins' father was probably somewhat deviating characterologically and died at a mental hospital in a state of senile dementia. Some of the twins' paternal half-siblings probably presented personality disorders.

In the twins' maternal family there was a pronounced disposition for migraine: the twins' mother, their maternal aunts, and several of the twins' siblings had migraine.

There were several cases of twins, one of them probably monozygotic, in the twins' maternal family, and among their siblings.

THE SEPARATION

The twins were born at home. The birth seems to have been normal. The twins totalled 5 "pund". Kamma was the largest and most vigorous and was born 5 minutes before Ella. No other details are available and nothing is known about the afterbirth. None of the twins were breast-fed.

As mentioned the twins were separated the day after birth.

KAMMA

During *the interviews* Kamma said that her foster-parents were 34 and 32 years old respectively when she was placed in their care. They already had a 4-year-old son, but the foster-mother was incapable of having more children, and as she had always wanted a daughter, she had for several years tried to persuade the twins' mother to let her have one of her many children. Even before Kamma was born (twins were not expected) it had been agreed that the child should be given into her care.

The foster-parents lived in a game keeper's house in an isolated moorland, and throughout her childhood Kamma saw few people except her foster-parents and foster-brother. She described her home as favourably and her life there as "a happy one". Her foster-parents were religious ("Indre-Mission"). They treated her as their own child, and even though she was never adopted, she had always felt close ties to her foster-home. She was a "boyish" girl, played football, fought her own battles and did not show interest in more feminine pastimes, "had really always wished she were a boy".

The foster-parents were amicable toward each other and during the first years of Kamma's childhood there were no problems. When Kamma was about eight years old, the situation changed. Her foster-father, a big, strong man, who had previously been healthy, was involved in an accident in the forest and sustained a serious injury to his back, presumably a slipped intervertebral disc, which led to several periods in hospital and partial invalidity. After some years he had to retire, the economic status of the family declined, and they moved into the nearby market-town. These events probably explain why Kamma had to go to work as a maid at houses when still only 11 years old.

Until she was 12 years old, Kamma did not know that she was a foster-child. Granted she had been teased at school, and had been taunted with "not having a real father and mother", her foster-parents had denied, that she was not their own child. When 12, she happened to play with a girl visiting a neighbouring farm. This girl was of the same age and strikingly resembled her. Kamma thus came to think that they might be related, and her foster-mother admitted that the girl was her twin sister, Ella. Kamma remembered vividly that this information altered her conception of life, and in the following years she went through what she called her "thoughtful time". Shortly after the twins had met, arrangements were made for Kamma to visit Ella and her father. She was told that if she desired so, she could stay with them permanently. Her foster-parents were greatly relieved when she, nevertheless, returned to them because she in no way had felt herself attracted to the conditions in her father's home. She only saw her father this once, and, contrary to Ella, never came into close contact with her natural family.

She spent seven years at a village school up to the age of 14 and there were no important problems. She stressed that she was trained not to prefer writing with her left hand and considered that she originally had been left-handed. Since leaving school she had used her right hand in a natural manner.

Already before leaving school she had had several positions as a maid at houses in the district. At the age of 21 she married her present husband,

who at that time was an apprenticed mechanic. They moved to their present house where she and her husband started a workshop. The first few years Kamma helped her husband; later the business was considerably extended and they had a good income. Generally speaking, they did not appear to have had important economic or domestic problems.

Her husband was two years older than Kamma. I spoke with him several times on visits to their home. He was slightly hard of hearing, somewhat reserved, but friendly, obliging, a typical product of his district, and in no way mentally unusual.

He and Kamma had always shared many interests, for example both were active members of the local rifle-club. Kamma was very good at shooting indeed, and competed equally with her husband in target and pidgeon competitions. The house, which they owned themselves, had two rooms and a kitchen on the ground floor and two rooms on the first floor. It was well kept, solidly built, respectably furnished, dominated by the many silver cups won in shooting competitions. They appeared to live a harmonious life with their six children.

Kamma continued to keep in contact with her foster-parents. Her foster-mother died at the age of 82 and had always been physically and mentally healthy. Her foster-father, who lived to be 84, lived with Kamma's foster-brother, who was a mechanic, married, and had several children. Kamma continued to feel attached to her foster-brother, who was in poor health, "very nervous", and had been operated upon for "a gastric ulcer".

Kamma could not remember anything about her own childhood illnesses, but thought that her physical and mental development had been normal. She was a quiet child and a happy one, had no nervous symptoms.

Menarche occurred at the age of 11. At about this time she started to have attacks of migraine and they had continued up to the time of our investigation. She described them as attacks of headache localized to the back of the head, but to some extent also to the forehead, diffused over the skull and never restricted to one side. The headache "pressed and throbbled", was accompanied by nausea and usually also vomiting, which, however, failed to ease the headache. There were no visual symptoms, but a tendency for the area round the eyes to swell and itch prior to the attacks. Normally she had to go to bed when the attacks came, they remitted after 3-4 days, and during this time she was incapable of any form of work. She believed that the attacks were to some extent provoked by "nervousness", they could be brought on by work and often occurred premenstrually; she had also noted that she always had attacks during thunderstorms. She had been treated by her family physician in various ways, mainly with pills, but for the most part without effect. She used "mixed headache-powders" with good effect. She had never received injections and particularly never ergotamine. The attacks had not

altered character and there had been no remission during pregnancy. Menstruation, which had been regular and natural, had during the past few years become less frequent and weaker, and there had been menostasis lasting about six months. She thought that this had reduced her tendency to attacks of headache. She took hormone pills on the advice of her physician but without definite effects. She stated that she had grown used to rationalize her work "to save strenght", and had more or less adjusted to her migraine. At the same time as her migraine started she also began to suffer from "car-sickness", and she had never since been able to stand to travel by car or train as she felt dizzy, and it provoked migraine.

During the past few years she had had "gallstone" attacks, but they had not been serious, and they only occurred if she ate fat foods. Her weight as an adult had always been fairly constant and her appetite normal. Since the age of 40 she had used a full upper denture; the teeth in the lower jaw were loose, there was severe paradentosis, and occasionally she removed a tooth manually. She had had strong spectacles for some years due to myopia. She had never been hospitalized.

The six births all proceeded normally; she had an abortion between the second and third. She had never been able to breast-feed her children for more than a few weeks or a couple of months. She seemed to be very fond of her children and was deeply moved when she talked about the two children she had lost.

Kamma's children. 1) *Son*, 36-year-old mechanic, living in the district. Had suffered from "car-sickness" since childhood, but was otherwise healthy, in particular he had never had migraine. 2) *Daughter*, 32, married to a fitter, lived in a nearby village. "Car-sickness" since childhood, but otherwise healthy. She had a daughter with serious congenital defects, no outer ears, blind, deaf, and mentally deficient. (Kamma thought that the child's defects were due to "atom dust" or to the mother having been vaccinated against poliomyelitis during pregnancy). 3) *Daughter*, 15, school-girl. During early childhood she had "very bad nerves, lived on a nerve-medicine, vomited if you spoke a word to her". At the age of five months admitted to hospital. *Case records:* colica abdominalis, tracheobronchitis, readmitted at the age of 10 months: dyspepsia. Kamma described the child as "still nervous", but very successful at school, industrious, ambitious, almost perfectionistic and wanting to be a teacher. She suffered from "car-sickness", but had never showed signs of migraine. 4) *Son*. Died at the age of 10 months. *Case records:* otitis media acuta suppurativa dextra, pneumonia croupsa. 5) *Daughter*. Died at the age of 8 months. *Case records:* meningitis purulenta (meningococci). 6) *Son*. 7 years old, had started school. Physically and mentally normal.

ELLA

During *the interviews* Ella told about her life with the twins' father in considerable detail.

The father was a good sawyer but it was difficult for him to keep the large family during the first year after his wife's death. Conditions were poor, partly because he had a housekeeper, who herself had four or five children; all the children were neglected and it was necessary to have assistance from the authorities and friends. Apart from Ella and her elder sister, who was soon out to work, all the children were sent to foster-homes.

Her father then obtained a new housekeeper of his own age. She had a daughter 9 months younger than Ella. This housekeeper stayed for several years and had sexual relationships with Ella's father. They lived in a reasonably good house and, thanks to the housekeeper, the economic circumstances were stable. There was little harmony in the house, however. It was dominated by the father, whom Ella described as a small, strongly built, blond, rather handsome man. He was lively and could be witty; he was usually friendly towards strangers, but at home he was exceptionally unsociable, "a forbidding, hard man with an evil character". He was often brutal and coarse to the housekeeper, and Ella recalled that he once threw her out of the house in the winter although she was only dressed in a nightgown. She threatened to leave several times and only remained because Ella used all her powers of persuasion.

The father always treated Ella roughly and he did not like her—"he might just as well have thrown me out too". She never understood why her father did not like her, although she thought it might be because the twins indirectly had been the cause of their mother's death. During one interview she hinted that the "poisoning" from which the mother died "perhaps was not a natural one". Even though she had only been punished corporally once, she was throughout her childhood afraid of the father, moved about quickly and always tried to avoid angering him; it was enough if he "just looked" at her. He, nevertheless, liked the housekeeper's daughter very much indeed and always treated the two children very differently; the foster-daughter was allowed to do as she pleased, whereas Ella was never given consideration.

The relationship between Ella and the housekeeper, on the other hand, was a pleasant one; she treated the two children equally and Ella as her own child. The two children also got along well together, helped each other, played with each other and never came into serious conflicts. Ella was at first the smallest and weakest, but gradually she came to dominate her foster-sister, who suffered from bronchitis and often stayed away from school. Ella wanted to help in the house "to show what I could do"; her foster-mother

praised her for it, but it meant that she had a lot to do and in fact took over most of the housework, while her foster-sister did nothing.

It had always meant a lot to Ella that she had originally been treated as a weakling but later became "strong and able to stand a lot". From her earliest years she wished she were a boy; she had always felt attracted to boys' pastimes and later always preferred rough, masculine work; "I liked to tinker with things", particularly machinery.

She went to school from seven to 14 in an ordinary village school together with her foster-sister. They received only a poor education; thus Ella never learned to write well. She was left-handed, was taught to write with her right hand but continued to prefer her left when for example she used an ax or saw, was rather clumsy in some types of work, and was quite certain that she was left-handed.

At the age of 12, she started housework in various neighbouring farms and when she left school at 14, she left home. At first she worked for a farmer's wife, spent a year with her eldest maternal aunt and then took another job near home until she married at the age of 19. She became acquainted with her husband when only 16 years old, was pregnant at 17 and gave birth to a child at the age of 18. Her husband was two years older than Ella and at that time managed a small farm for his mother. It was impossible for them to marry immediately, and Ella therefore while pregnant stayed with her father. Rather surprisingly she was accepted without direct animosity; this was no doubt, at least partly, due to the fact that Ella's foster-sister was at that time pregnant with the father's child. This was a great shock for the housekeeper and led to her breaking off relationships with the father. The father is reported to have offered to marry his foster-daughter, but the foster-mother opposed the idea energetically, and left together with her daughter, and the twins' father left for another district.

Ella and her husband were married 4-5 months after the birth of their first child. They settled in a market-town in the middle of Jutland, where her husband was employed as a labourer. They managed to save money enough to buy a house, but Ella's father persuaded her husband to invest some money in a sawmill, he was about to start, and Ella and her husband lost their money. After some time they were unable to pay their debts and had to sell their house to Ella's father. This episode led to her breaking off relationships with her father.

Her husband worked as a bricklayer's mate for a year until they moved to their present 14-acre smallholding. Her marriage was characterized by her having several children in quick succession, by economic problems and hard work cultivating the poor soil. She, in fact, worked almost like a farm labourer, and during World War II when her husband was employed at German air-fields, she managed the farm on her own. Up to a few years before our in-

vestigation, she had also worked for a long time in a nearby hosiery factory. but left on the advice of her physician. The marriage appeared to have been harmonious and apart from the economic problems had not presented serious difficulties. Both she and her husband had always been extremely fond of their children.

I had several conversations with her husband when visiting her. He was a calm, gentle Jutlander, apparently quite intelligent and without remarkable mental traits. He gave a detailed description of their hard work; although their economy was now stable, none of their children had wanted to take up farming, they had all started work in town where they managed well.

During the interviews Ella mentioned that she had been in contact with her father's second wife, who "had a hold on him". This woman was very religious and influenced him so much that she "even managed to get him to go to church". Ella never developed sympathy for her father as she considered that he was primarily responsible for the drudgery of her childhood.

Concerning her medical history, Ella stated that she was a slightly-built, underweight child. It was feared that she would not survive, and she explained in rather vague terms that her father put her in a room, where the windows were kept open summer and winter; whether this was to "harden" her, or because her father hoped that she would succumb, was left open. When the housekeeper came to live with her father, Ella was 12 months old. She was at that time very neglected, retarded developmentally and, she thought, only survived due to the housekeeper's care. She developed but slowly during the first few years; her nine months younger foster-sister was always six months ahead of her. According to her descriptions, Ella had "chronic dyspepsia and a large liver"; she did not learn to walk until she was three years old. She suffered from nocturnal enuresis up to the age of 16; the housekeeper was very sensible in this respect, whereas her father seemed to be uninterested. She showed other symptoms of "nervousness"; throughout her childhood she was anxious and afraid of the dark.

Menstruation commenced when she was 13. She had begun to have attacks of migraine two years previously. Her headache, localized to the back of her head, and less pronounced in her forehead, was experienced as a "throbbing, pressing" pain, diffuse and never unilateral. The attacks lasted 2-3 days; usually she was forced to go to bed and the headaches did not stop spontaneously until she had slept. There did not appear to be external provocation, although her attacks were related in some degree to menstruation, and had improved somewhat during later years since her menstruation had become more irregular, but had not been affected by pregnancy. During the year prior to our examination she had daily taken a tablet of estilbin. In the past she had been treated with various "tablets and powders", and once with ergotamine with good effects. She had also suffered from "car-sickness" since

childhood and described it in exactly the same way as Kamma, although Ella's case seemed to be more severe.

She had never had dyspepsia or "gallstone" attacks. During the past few years she had used spectacles because of "short-sightedness". Since about 40 she had had dentures.

Her seven pregnancies and births were all perfectly normal. She had not been able to breast-feed her first three children, the third and fourth child was breastfed for 13 months and her others for about a year.

Her strenuous work on the farm led to a ventral hernia; she used a bandage for about 10 years, had disliked the idea of being operated, but at the age of 49 she was admitted to hospital. The *case records* state:

Since the age of 10 a tendency to headache, apt to vomit on slight provocation; both have progressed in later years, particularly the past year. The attacks occur usually a couple of days after cessation of menstruation, commencing with fatigue and general indisposition lasting some days, after which there is nausea, fits of shivering and chills initiating the attacks which commence in the morning. The headaches are localized to the region of the neck and never confined to one side of the head. She vomits repeatedly, has photophobia and flickering vision, but no scotoma; she feels dizzy and "sees double". The attacks last a couple of days if she is not treated with ergotamine. Following these attacks she feels tired and sleeps. During the past month the attacks have been particularly severe, occurring about twice a week, and pills and injections have little effect. At home she has been treated with injections of hormones with little results.

Physically she appears to be quite healthy, although there have been palpitations a month ago, on which "heart drops" has had good effect. She also complains of having difficulties in remembering things, of fatigue, of finding it difficult to fall asleep and of interrupted sleep. She is generally happy, but has been depressed during the past month, has cried a lot and felt "nervous". She denies that there are domestic problems, but she has previously been forced to work in a factory, in order to supplement her husband's income. She has given up this employment on the advice of her physician, although she was quite satisfied with her work. Her husband owns a small-holding. She has had seven children and two abortions, only two of the children are still at home. She no longer works in the fields.

Objectively: red-cheeked, above average in weight. Gynaecological examination: the vagina is rather inflamed with a small cervical erosion.

A ventral hernia just below the umbilicus about the size of a walnut, could not be completely restored by taxis. Herniotomia was performed, and the post-operative course was uncomplicated.

She was examined by an otologist who diagnosed "hemicrania" and recommended ergotamine. Diagnosis: *cephalalgia, depressio mentis, hernia umbilicalis*.

Readmitted three and again four months later. Diagnosis: *excisio fistula cicatricis abdominalis*. She had had frequent attacks of migraine and had been treated with ergotamine with some effect.

During *the interviews* Ella added that when at hospital she had felt very depressed and exhausted. The physicians at the hospital had suggested psychiatric treatment and the possibility of electroshock. She still occasionally felt restless, found it difficult to adjust herself to a sedentary life, became depressed and had attacks of migraine. She had never liked housekeeping, had no special leisure time interests, and felt better when she worked in the open air.

Ella's children. 1) *Son*, 32-year-old, married mechanic, living in Copenhagen. Two children. Both he and the children were in normal health. 2) *Son*, 31, married labourer, living in a provincial town in Mid-Jutland. No children. Apart from "meningitis" at a young age always in good health. 3) *Son*, 30, unmarried labourer, living in Sweden. In childhood often ill due to recurring pneumonia and osteomyelitis; otherwise healthy. 4) *Daughter*, 22, married to a smallholder in Jutland. In good health. One child, also healthy. 5) *Daughter*, 20, married to a smallholder in Jutland. In good health. Two healthy children. 6) *Son*, 13, school-boy. In good health. 7) *Daughter*, 6 years old, healthy. All the children had a pronounced tendency to "car-sickness", but none had presented clear symptoms of migraine.

THE TWIN RELATIONSHIP

Although the twins never came into very close contact with each other, they had both had a feeling of strong solidarity since they met at the age of 12, and Ella's reaction to their meeting was the same as Kamma's. A photograph from when they met each other showed that they resembled each other closely; both were rather slightly built, Kamma being somewhat taller and stronger than Ella. Later they came to resemble each other even more and each had been several times mistaken for the other by close friends. They were always happy together but had little chance of seeing each other because of their participation in their husbands' work.

They thought they resembled each other in nearly all respects; neither felt that they differed in important physical or mental respects. On the other hand, they both stressed they did not resemble their siblings, and they agreed in their disapproval of their father. When examined they did not resemble each other as much as they had done, as Ella had lost weight during her illness, but they were still difficult to distinguish if one did not know them well.

They agreed that they had been brought up under very different conditions

and that Kamma's home had been the better one; both stated that they would have liked to have grown up together. They never criticized each other, used the expression "we", neither tried to dominate the other, and, generally speaking, they appeared to like being together.

CLINICAL EXAMINATIONS

Kamma was interviewed seven times and Ella six, and they were interviewed together twice. In addition, I had talks with their husbands and visited each of their homes several times; they were particularly cooperative and interested in the investigation.

Their physical resemblance was striking, and one might easily find it difficult to distinguish between them. Both wore spectacles (cf. the ophthalmological examination), they were about the same height and were similarly built. Kamma weighed 75.5 kg. and was 160 cm., Ella weighed 70.5 kg. and was 158 cm. Their hair was dark brown with slightly grey temples; it was of the same thickness, slightly waved and the hair-boundaries were identical. Both had their hair cut very short, parted in the middle, and dressed in a rather "boyish" fashion. Their hair whorls were clockwise. They had medium blue eyes and there was no important difference in the details of their iris. Their faces and ears were very similar both in general and in detail. There was little difference in their facial expression, both had denture in the upper jaw, and both had six teeth with severe paradentosis in the lower jaw.

Kamma's bloodpressure was 135/55, - 130/55, Ella's 155/100, - 155/95. Both were ambidextrous, Ella probably predominantly lefthanded. The examination failed to disclose cardiac or neurological symptoms.

They were strikingly similar in their behaviour, facial expressions, postures and gait. Their voices were very similar indeed and both spoke with a slight Jutlandish accent.

Both were of normal intelligence, apparently average. Ella's knowledge in general was perhaps somewhat less than Kamma's.

They also resembled each other as regards personality, and it was difficult to specify how they differed. Both appeared to be calm and well-balanced. It was relatively difficult to obtain emotional contact at the beginning of the investigation, but later they were occasionally talkative. Their descriptions of their attacks of migraine were similar, but Kamma seemed to be more occupied with illness than Ella. Contact was perhaps more genuine with Ella than with Kamma, as Kamma continued to be somewhat reserved.

Both appeared to be rustic and rather primitive, undifferentiated, with only slight neurotic symptoms, slightly more pronounced in Ella's case, but in both no definite pathological traits were disclosed.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Kamma

Solved 52 matrices in 29 minutes (Matrices D₁₀₋₁₂ and E₈₋₁₂ not employed). She worked quite quickly but rather superficially, talked rather a lot, exclaimed and made emotional remarks. She apparently did not understand the principle of the D and E sets of matrices. Score: 10+6+5+1+0=22. Distribution: unremarkable; discrepancies: 4. Group: 25-50 percentile. Conclusion: normal intelligence (probably below average).

Ella

Solved 52 matrices in 26 minutes (Matrices D₁₀₋₁₂ and E₈₋₁₂ not used). Worked comparatively quickly even when in doubt. Her insight into the nature of the problems was rather poor, and in sets B and C she soon started to employ analogies which she found difficult to explain. (After she had finished, some of the simpler matrices she had failed were presented again, but she was unable to better her performance in any important respect). Score: 9+4+3+2+0=18. Distribution: unremarkable; discrepancies: 2. Group: 5-25 percentile. (As the tables do not include such low scores for this age-group, it was necessary to extrapolate). Conclusion: normal intelligence (below average).

Wechsler-Bellevue

	Kamma				Ella			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	9	7	10	8	8	6	9	7
Comprehension	14	12	10	9	10	9	10	9
Digit Span	6+4 = 10	7	7+5 = 12	10	6+4 = 10	7	6+4 = 10	7
Arithmetic	3	3	4	4	4	4	5	6
Similarities	11	9	13	11	13	11	15	12
Vocabulary	(21)	(9)	(24)	(10)	(17)	(8)	(15)	(7)
Verbal Points		38		42		37		41
Picture Arrangement	10	10	14	12	7	7	10+1 = 11	10
Picture Completion	10	9	12	12	10	9	11	10
Block Design	15+2 = 17	8	15+4 = 19	9	12+1 = 13	7	15	7
Object Assembly	17+2 = 19	11	18+5 = 23	14	12	5	18+3 = 21	12
Digit Symbol	27/27	6	28/29	6	27/28	6	20/22	5
Performance Points		44		53		34		44
Total Points		82		95		71		85
Verbal IQ		94		98		93		99
Performance IQ	108+1 = 109		119+1 = 120		97+1 = 98			109
Total IQ		100		110		94		104

Kamma

She talked rather much and complained about the tests. She did show sure signs of intellectual deterioration. The results for Information and Arithmetic are poor, Vocabulary and Comprehension rather better. The results for the performance tests with the exception of the Digit Symbol test are all near average. Conclusion: normal intelligence, no important intellectual deficit. (Some results are strikingly poor, presumably due to emotional or characterological factors and lack of interest in extending her general knowledge). When *retested* (6 months later) the results on most tests were im-

proved, particularly on the performance tests where her IQ was higher than before. In general, however, the results for the first test appeared to correspond best to the immediate impression one had of her intellectual level. Conclusion: unchanged.

Ella

The pattern of verbal scores closely resembles Kamma's. This is particularly true of the low scores on Arithmetic and Information; she scored lower on the Performance tests than Kamma, and found Object Assembly particularly difficult. Conclusion: normal intelligence, no important intellectual deficit. (Appears to be little interested in intellectual pursuits and the poor test results are probably due to factors analogous with those affecting her sister). On *retest* (6 months later) slight alterations in her verbal scores, whereas there was considerable improvement in the performance scores (Picture Completion and Object Assembly). This gave an increase in the performance IQ, but the first test results agree better with the general impression of her intellectual level. Conclusion: unchanged.

Rorschach

		Kamma	
7 W	10 F+	2 Hd	6 P. 2 Orig (+/-)
8 D	3 F+/-	4 A	F+ 82 (extended 80)
1 DdD	1 F-	2 Ad	F = 100 - L = 83
1 Do	1 FC	4 Anat	A = 35
<hr/> Total: 17	1 CF	2 Bt	Affective ratio: 35
	1 FY	1 Cg	RT: 0.8 min. (I - VII)
		1 Obj	0.6 min. (VIII - X)
		1 Explosion	Seq: indeterminable
			Ap: W, D
			Exp.: 0/1 ½
			Colour shock? shading shock.

Tendency to self-criticism, preference for central areas, lowered "experience-awareness".

Complained and passed remarks that were apparently self-critical but which, together with her relatively low experience-awareness, rather seemed to express dissatisfaction with the possibilities offered by the test material. She nevertheless often provided an interpretation just after she had asserted: "I can't see head or tail in this".

Appeared to be of normal intelligence. Her interpretations were often rather primitive and vague; occasionally she attempted a conceptual interpretation which was above the level she really could manage and her answers were, therefore, apt to be haphazard. She seemed to be undifferentiated, but also anxious, hypochondriac, labile, predominantly extroverted. Her personal insight, imagination and sympathy appear to be but little developed. She is rather egocentric in her dealings with others. Her uncertainty usually expresses itself in criticism of her surroundings, but she is, perhaps, really uncertain about herself and her capabilities. The sexual and identification problems, together with the poor differentiation of her personality and her rare use of constructive defensive reactions, might indicate a tendency to hysterical reactions.

Double-blind test

Woman, presumably elderly. Probably below average in intelligence, but normal. There might be mild intellectual deficit in a normally intelligent person. She seems to let herself be provoked far more than she will admit, and presumably tries to cover her susceptibility and uncertainty by means of a very evasive attitude. The test suggests that this attitude might express itself in a constant irrelevant stream of talk. She seems

to be very careful about adopting a point of view, and one has the impression that she is apt to avoid demands in the tasks she attempts and in her contacts with others. She will presumably be rather dependent and appealing in her relationships with others. She seems to be emotionally labile, but lacks emotional intensity (due to age?). The lability might manifest itself in periodic, mild depressions. There seems to be manifest anxiety; she seems to be slightly restless and tense, and the test-pattern makes it likely that there will be psychosomatic reactions. Neurasthenic traits?

Retest (6 months later).

6+1 W	7 F+	7 A	5 P. 1 Orig. (+/-)
8 D	2+1 F+/-	2 Ad	F+ 67 (extended 56)
1 DdD	3 F-	5 Anat	F = 100 - L = 75
<hr/>	1 FC	1 Bt	A = 56
Total: 16+1	2 CF	1 Obj	Affective ratio: 37
	1 YF	+ 1 Explosion	RT: 0.6 min. (I-VII)
			0.5 min. (VIII-X)
			Seq: indeterminable
			Rej: VI
			Ap: W, D
			Exp.: 0/2½
			Colour shock, shading shock.

Tendency to self-criticism and lowered "experience-awareness".

Seemed to be more calm during this test, but still talked a lot in a rather stereotyped way, reminiscent of "jargon". When presented with Card VI she overcame her shock remarkably quickly and gave the same answer as in the first test. ("An atom bomb exploding"). Apart from this, 8-10 answers were the same as those she gave when first tested.

As the results of the two tests are similar, the description of the main characteristics of her personality remain unaltered. The differences between the results appear to express her ability and attempts to manage difficult situations and provocations by "tightening" her attitude and mode of behaviour. The quality of her reactions has, however, not improved and, taken together with her altered attitude, there may be a tendency to blocking. Her resources and tolerance for conflict are still poor; she seems to be rigid and too emotional to alter much.

Ella

6 W	12 F+	1 H	9 P. 1 Orig. (-)
8 D	3 F+/-	4 Fd	F+ 84 (extended 84)
1 Ds	1 F-	8 A	F = 100 - L = 100
1 Dd		2 Ad	A = 63
<hr/>		1 Obj	Affective ratio: 50
Total: 16			RT: 1.1 min. (I - VII)
			0.6 min. (VIII - X)
			Seq: indeterminable
			Ap: W, D
			Exp.: 0/0
			Colour shock

Tendency to self-criticism, perseveration, denial of answers and appeal to experimenter, preference for central areas, but low "experience-awareness".

She was obviously uninterested in the task and its possibilities. She said that she would probably obtain poor results and was "not good enough to manage it", although this did not seem to affect her very much; she talked a lot without saying much.

Judging from the results alone one must expect her to be below average in intelligence. Her lines of thought are banal and rigid, and her concepts often vague and undifferentiated. She is mainly extroverted. She appears to be emotionally undifferentiated. This is probably due to inhibition and other defensive mechanisms. The results nevertheless show signs of her being emotionally labile. In addition, there are signs of unusual, somewhat perverse thoughts and actions. She manifests some uncertainty which, formally speaking, usually expresses itself in subjective criticism, but which is probably also an expression of objective criticism. No signs indicating loss of anxiety- or mood-control.

Double-blind test

Woman, at least middle-aged and perhaps older. Difficult to estimate intellectually, presumably rather below average in intelligence (?). The results are characterized by a very evasive attitude, she is very passive indeed, weak and indecisive, and only dares take on the most immediate tasks. She totally lacks originality, impulsivity and spontaneity. Stereotyped answers and many automatic ones together with several remarks suggesting a feeling of insufficiency might indicate organic intellectual deficit. Her criticisms of herself seem, however, to lack conviction; they are, so to speak, brought out in relief as though she used them consciously to appeal to the examiner, and in this case the stereotyped answers express the evasiveness of her attitude. The number of interpretations is, however, too small to allow more detailed analysis of her personality. The impression one gains is that of an uncertain, dependent, undifferentiated personality, not unreactive but inhibited and depressive, apt to have a pessimistic and "injured" attitude toward things.

Retest (6 months later).

5 W	7+2 F+	1 H	7 P. 0 Orig
5+1 D	1 F+/-	1 Hd	F+ 94 (extended 96)
+1 Dd	1 M	5 A	F = 100 - L = 90
<hr/>	1 FC	2+2 Ad	A = 70
Total: 10+2		1 Cg	Affective ratio: 20
			RT: 0.8 min. (I-VII)
			0.9 min. (VIII-X)
			Rej: IX
			Ap: W, D, Dd
			Exp.: 0/½
			Colour shock

Tendency to self-criticism, perplexity, and low "experience-awareness".

She still does not appear to find the task positively interesting, although she is more collected. On the other hand, there was "Versagen", but when presented with the card again she gave two interpretations that were, however, integrated.

Many of the interpretations are repetitions and, as a result of this, she completes the test more quickly than when first tested. The most important result of the retest is that she is now more integrated than before and that she gives fewer interpretations and uses less time, without a corresponding reduction in the variability of her answers and her experiences. In this latter respect she is still banal, vague, and perseverating. It seems reasonable to assume emotional, perhaps neurotic factors, as her inhibition and manifest emotional reactions are the same as before.

Word Association Test (a. m. Rapaport)

Kamma

Due to an attack of migraine during our examinations this test was not carried out.

Ella

Appeared to be rather uncertain and tried to compensate by talking, using many words and incomplete explanations. Many of her reactions were a type of explanation of the stimulus word rather than free associations. She was clearly provoked by many stimuli.

Results: Her reaction times were rarely very long or very short. She gave up when presented with the two sexual words derived from foreign languages. Her tendency to give concrete, functional, emotional and evaluative answers was striking, and she developed rather stereotyped ways of reacting, presumably as an attempt to manage the test in spite of difficulties and to overcome the provocation she was exposed to. This corresponds to a rather emotional-hysterioform personality. She employs in particular simple repressions, some projection, and massive reaction-formation. She has many problems, though sexual and interpersonal problems are probably the most important. When presented with the list of words for the second time, her reaction times were somewhat shorter. The percentage of repetitions was only 47, but even so uncharacteristic, as many of the answers closely resembled the first ones or were merely shifted to other stimulus words.

Summary and comparison of the test results

Both twins must be taken to be of normal, but below average, intelligence. Their spontaneous interest in and tendency to work with the tests is slight. They work quickly but superficially in free situations (e. g., Raven's Progressive Matrices), but in more controlled situations they still fail to score above average. Their general knowledge is poor and they show dislike of certain tasks, particularly arithmetic. Both were on the defensive and seemed to be narrowminded, vague and banal. With regard to their emotional and characterological traits one must assume that the impression one gains is due to the tests being of an associative and verbal nature, which will lead to their appearing to be rather primitive and undifferentiated. There is, however, some difference, as Kamma appears to have more possibilities and resources than Ella, and at the same time she is more tense and manifestly neurotic. Both twins make use of reaction-formation, repression and some degree of projection as defensive mechanisms. There is a possibility of impulsive and emotional break-through (explosive?), just as one must assume, particularly in Kamma's case, that there may be hysterical symptoms (somatization?). The results for the retests nevertheless suggest that they are capable of compensating reasonably well, and their control of their moods and anxiety also appears to be quite well. Both appear to have important problems; in Ella's case the Word Association test seems to indicate oral and aggressive conflicts. Kamma sometimes functions almost as though she was backward; Ella is more neurotic. There does not appear to be reasonable grounds for designating either as psychopathological.

OTHER CLINICAL EXAMINATIONS

EEG. Both normal and without striking differences. Alpha-rhythm 8-9 hz for Kamma and 10 for Ella. No marked mirror-imaging, but the amplitude

was slightly larger over the right hemisphere than over the left in Kamma, while the reverse was the case in Ella. In both twins hyperventilation increased the amplitude and distribution of the alpha-waves. Conclusion: normal in both cases.

Ophthalmological examination (summary of report). Severe myopia in both. Vision in right eye: Kamma 6/6-0.75 cyl. 175°, Ella: 6/6-0.25 sph. - 0.75 cyl. 0°; left eye: Kamma: 6/6-0.25 - 1.5 cyl. 0°, Ella: 6/6-0.25 sph. - 0.75 cyl. 0°. Very close resemblance, especially for the right eye, in which ophthalmoscopy shows a very similar and characteristic pattern of the vessels.

ECG. Both normal and very similar.

EPICRISIS

Kamma and Ella were the youngest of ten children from a sawyer's home. Their birth was probably normal. They were not breast-fed. Their mother died when they were 10 weeks old.

They were separated the day after their birth and did not see each other until their 12th and 16th years, when they paid each other brief visits. Since then their mutual contacts have been sparse.

They were incorporated in this series of investigation when they were 50 years old, and we were in contact with them for almost three years.

Although both grew up in rural districts in Jutland, about 40 miles from each other, the environments can hardly be said to present any points of similarity, but rather a series of differences.

Kamma was boarded out with strangers, in the house of a game-keeper, and she grew up together with a foster-brother, four years older than herself. The home was poor, but stable, and she was closely attached to it.

Ella grew up with the twins' father, who was a widower, but for many years lived together with a house-keeper. She was brought up as the "pseudotwin" of a foster-sister, the daughter of her father's house-keeper. The home was disharmonious and her father seemed to have been deviating characterologically, and there was much that, undoubtedly, was psycho-traumatic.

In their later lives, there were several points of similarity between the twins. Both were married at a comparatively early age, Kamma married a mechanic when 21, Ella a smallholder when 19; both had six children. In comparison Ella's life was, undoubtedly, the harder.

In childhood Ella was retarded in her development, presented anxiety symptoms and had nocturnal enuresis, but otherwise their medical histories showed great resemblance.

When they were about 10 years old, both developed migraine, similar in symptomatology and course. In this connection, it should be borne in mind

that both grew up without close contacts with relatives suffering from this complaint, and that a pronounced hereditary disposition to this malady was found in the maternal family.

They also suffered from a similar tendency to "car-sickness", this tendency was found among their children. Both were myopic, used spectacles.

A clear difference was that Ella, due to her strenuous life as a farmer's wife, developed an umbilical hernia for which she was operated upon.

Such differences as were apparent in their personality development can be reasonably adduced to the differences in their childhood environment and later life.

The history of the twins' family is of special interest, containing as it does, almost every type of heredity-environment constellation imaginable.

On the clinical and psychometric examinations the twins were outstandingly similar.

Intellectually both were around average with no appreciable differences.

As regards personality, the similarities also outweigh the dissimilarities between the twins; both were rather rustic with an undifferentiated personality structure. Both presented neurotic traits, especially Ella, but neither of the twins can be described as definitely psychopathological.

They must therefore both be classified as: Normal personalities with only slight neurotic traits.

CASE VIII

SIGNE AND HANNE

This pair was included in 1954.

Signe, a 54-year-old labourer's wife was given electroshock treatment at the out-patient clinic of a State Hospital in Jutland.

Hanne, who was the widow of a labourer, lived on Funen. We approached her in her home.

The twins were illegitimate and had been born in a village in South-eastern Jutland. Their mother, a 26-year-old house-maid was engaged to their father, a 23-year-old baker, whom she did not marry.

The twins were separated when they were three weeks old.

Signe was looked after by her father's parents who were small-holders in a village in the middle of Jutland; Hanne was brought up among strangers, a beer vendor and his wife, in a harbour-town on Funen.

The twins first saw each other again when they were 20 years old. They came into contact with each other occasionally at year-long intervals, but, due to disagreement, had not seen each other during the four years previous to our investigation. As both were very cooperative it was possible to follow them over a period of three years.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

According to information from the twins, especially from Signe, the following could be stated:

The father

Although Signe was raised by her paternal grandparents, she never had much contact with her father as he had partially broken off his relationships with his parents. The twins' parents had been engaged but had ceased to see each other at the time of the twins' birth. The father would not marry the mother, probably because he did not feel convinced that he was the twins' father.

Signe said that the father would never accept her as his daughter, and she was forbidden to call him "father". After she became adult, she tried to con-

tact him, but he did not answer her letters and did not want her to visit him. The relationships between her father and his family had always been uneasy, and, for example, his parents had to take legal steps to make him contribute to Signe's keep.

He was a strongly built man of average height with thin dark-blond hair and blue eyes. Signe had a small photograph of him, which showed him to be an obvious pyknic type with a bowler on his head and a beer in his hand—though he was not a drunkard. As far as Signe knew, he was always in good health. When a young man he had various jobs as a baker, and married, when 28, a woman one year younger than himself; she had a small fortune and owned a boarding-house so that they were comfortably situated. When 66, Signe's father moved to Copenhagen where he lived as a widower in a suburban house. There were no children, but Signe thought that there probably was a foster-son.

Hanne had never known their father.

The father was the eldest of six children and the only boy; there was a pair of twin girls, the one twin died in infancy. The information which Signe could give about her paternal family, especially about her grandparents and her two youngest aunts, with whom she was brought up, will be presented under the description of her childhood environment.

The mother

The twins' paternal grandparents had been very fond of the mother. She was a "clever girl" and they continued to see her occasionally. Signe had written and visited her mother a few times both as a child and as an adult but she knew little about her. She knew that she, who remained unmarried, had yet another child a couple of years later and that this child was also brought up by foster-parents. Her mother then took a position as a house-keeper and, until she died at the age of 78, lived in a large market-town in North Jutland, the last few years in a home for the aged.

She was of average height, slightly built, with dark-blond hair and brown eyes. She was often ill and was hospitalized several times. "She had something the doctors could not discover, it was probably cancer".

Hanne had only once, when a child, visited her mother. She did not like her, as she could not forgive her that she had never been really interested in what became of the twins.

As regards the maternal family, Signe knew a sister to her mother. She had often been hospitalized, was very obese, "nervous" and perhaps suffered from "gastric ulcer".

Hanne knew a brother of the mother, a railway-worker, who died when 74. He was a small, weakly man, who was probably admitted to hospital several times due to "gastric ulcer".

The twins' maternal half-brother. He was 52 when our investigation of the twins

was carried out. Hanne had been in contact with him during her childhood, as he was born on Funen. Hanne did not know who his father was, (but he was probably not the twins' father). It seemed that at one time it was planned to bring him up together with Hanne, but he was instead sent to a farm. He worked as a farm-labourer, later as a commercial agent and finally owned a small tobacconist's shop in a market-town on Funen. He married twice; his first wife died of cancer. There were no children, but perhaps an illegitimate child. He resembled the twins in appearance, was blonde, blue-eyed and had a particularly prominent nose. During childhood he had suffered from "falling-sickness"; he lost an eye during harvestwork; apart from this he appears to have been healthy. Apart from letters exchanged at intervals of years Hanne had not been in contact with him since they became adults; Signe had only met their half-brother once.

The further supplementary information, which was collected on the twins' natural family, will be presented later.

THE SEPARATION

The twins' birth was said to have been normal. They were not breast-fed; no other information was available. The twins were separated when three weeks old, as their mother was unable to take care of them.

Before the case histories, as described by the twins during the interviews, are presented, their medical histories shall be summarized on the basis of their *case records* from various hospitals.

SIGNE

1) Admitted to hospital when 20: Diagnosis: *influenza, albuminuria*. 2) When 37: Unmarried, working at a mineral-water factory. Healthy as a child. Menstruated from the age of 14, regularly, occasionally severe premenstrual molimina menstrualis and some discharge. During the past years attacks of "cramp", lasting one to eight days, starting in the region of the right hip, spreading to the right side of her back. One month prior to admission: cystitis. Gynaecological examination: uterus enlarged. Excochleatio uteri was performed. (Microscopy: endometritis corporis et cervicis cum hyperplasia mucosae cervicis l. gr.). Cystoscopy: vesica somewhat enlarged, flabby, with suspicion of a diverticulum on the left side. X-ray examination of bladder: a shadow on the left side, perhaps a concretion in a diverticulum. Routine laboratory tests: normal results. Diagnosis: *endometritis*. 3) When 39: In good health for a year but had then started to have attacks of pain in the right side of her abdomen and in the right loin. Menstruations sparse. Has never been pregnant. Complains of having been "nervous" for many years, sleeps poorly, has a pronounced tendency to constipation, haemorrhoids with bleeding and pain, always uses laxatives. For the past six months "hot flushes". Gynaecological examination: uterus large and slightly

plump. X-ray of the vesica: small phlebolith-like shadows but no definite signs of concretions. Diagnosis *climacterium, nervositas*. 4) Admitted to a medical department when 42: When a child morbilli and tussis. Present complaints: "bad nerves", dizziness, poor sleep and appetite, frequent headaches, "a feeling of sand in her eyes, of having a lump in her throat, of being strangled", pressure in her chest and palpitations, pain in all joints and over her whole body; furthermore she has for some years had itching patches in her crutch. Dermatological examination shows patches diagnosed to be "fixed eruptions" localized to the medial side of the femora and the left axilla, believed to be due to medicamentation (probably bromide or iodine). Examinations did not disclose important data. Basal metabolism: 103-104 per cent. Diagnosis: *neurasthenia?*

5) When 45, admitted to the same department. Still single, lives alone, has worked at a mineral-water factory for 13 years but has often stayed away from work because of illness.

A mass of complaints commencing about the age of 35 and gradually increasing in number, they include: pains in all parts of the body, constantly present, of a "torturing" nature, particularly pronounced in arms, legs, knees and the joints of the feet, as well as in the back, neck and head ("Cannot carry her head"), a feeling of pressure in her abdomen which is occasionally of a pricking type, and which spread to her back; constant headache localized to her forehead and neck which she states has been present ever since she had "Spanish fever", when 18 years old; she is dizzy, there are "black stripes before her eyes, and her eyes torment her", she has used spectacles for reading for three years, uses "eye-drops" three times daily and is weekly examined by an ophthalmologist; poor appetite, has nausea but no vomiting ("I cannot get food down"), has the feeling that there is "a lump in the throat" and make repeated swallowing motions; during the last two months she has lost weight, felt tired and poorly, she is depressed, "everything looks black", she does not want to get up in the morning, cries easily, she also complains of frequent urination, has to get up four or five times every night; she has "lost her breath", has palpitations when she exerts herself, and her palpitations are felt to be of a pricking nature localized to the epigastric region and also felt as though her heart "turns summersaults"; a tendency to constipation is still present, she uses laxatives and takes a large amount of medicaments when at home.

Objectively: leptosome, mediumly well nourished, grey haired. No definite alterations in the size of the thyroid gland and no clinical symptoms of Graves' disease or thyrotoxicosis. Neurological examination disclosed universal analgesia; the plantar and the pharyngeal reflexes cannot be stimulated. She talks about her symptoms in an open, loquacious manner and details her multiple pains with a large smile without signs of anxiety. The usual examina-

tions, which included ECG, did not disclose anything abnormal. She was given estilbin. Diagnosis: *neurasthenia (sine morbus organicus)*.

6) When 54, treated as an out-patient at a medical clinic. Married seven years earlier; her husband, a labourer at a chocolate factory, was a widower with two adult children. She looks after the two-roomed flat and have no other work. Her husband is dissatisfied because she always complains about something or other.

Referred to the clinic because of symptoms in her joints, but she also applies details about a number of other uncharacteristic symptoms: she is easily frightened, irritable, finds it difficult to manage her home, perspires easily and then becomes cold so her teeth "chatter", is unable to sleep, "lays and shivers all over". Menstruation became irregular between the ages of 25 to 49, after which menopause intervened; during the last five years she has suffered from hot flushes and fits of perspiration. She states that she has always suffered from "thin blood" and has been treated with iron and vitamins. During later years she has often had pricking paraesthesia in the fingers and toes, a feeling that her cold feet have "gone to sleep"; she cannot stand putting her hands into cold water. During the last month she has also felt "skinless beneath the skin"; this symptom is localized to the left side, has commenced in "spots", not visible, and has then spread from her left arm to the rest of the left side of her body. Occasionally the paraesthesia is severe and "burning", no symptoms on the tongue. In addition, she has slight dyspeptic symptoms in the form of mild pressure in the epigastrium, nausea, belching, lack of appetite and dislike of food. Finally, she complains of headache localized behind her eyes, palpitations, anxiety, pronounced fatigue, lack of energy, pains over her whole body, stinging in her eyes, a bad taste in her mouth, a running nose and a feeling of having a rough throat. Examined at the tuberculosis clinic without result. During the past few months severe pains, "it creaks and groans in all the joints".

Objectively: appears to be somewhat pale but otherwise not marked by illness. Slight dextroconvex scoliosis of the lower part of the thoracic column, and a flat lumbar lordosis. No signs of abnormality in the joints but slight tenderness of the gluteal region and musculus trapezius. Gynaecological examination: normal external genitalia, portio small, regular, with a slight depression corresponding to the orifice, which is atresic; uterus normal in size, retroflected, slightly dextroverted. Rectoscopy: nothing abnormal. Mentally: very talkative, fabulates, definitely not depressed, many complaints described vaguely and uncertainly; states with a wide grin that she no longer wants to live.

The usual routine examinations failed to disclose anything abnormal, and in particular there were no abnormal haematological results. ECG, X-ray of the stomach, colon and thorax were likewise normal, Weight/height: 60 kg.

159 cm. Considered suitable for referral to psychiatric treatment. Diagnosis: *neurosis depressiva*.

The *case records* from the psychiatric out-patient clinic state: Since the age of 30 she has had a couple of short periods of "bad nerves" but apart from this never suffered from changes in mood. After the beginning of her climacterium she has had hot flushes and irregular menstruation, was irritable with a tendency to tears, headache and dyspeptic complaints. These symptoms have been particularly pronounced during the last six months, she is always tired, cannot manage anything at all, is sleepless, has pains in all her joints, is periodically bed-ridden, weeps on the slightest provocation, feels that there is no meaning in life, wishes she were dead but has not thought of committing suicide. The family in the flat above annoys her a lot, they tease her on the staircase. Her husband is irritated because she is always ill.

Objectively: seemed to be depressed but without self-reproaches. Her state was considered to be one of severe depressive neurosis, probably psychogenic, but including important endogenous traits. ECT was recommended, and she was given eight treatments in the out-patient ward. Some objective and subjective improvement; she was no longer deeply depressed but still liable to alterations in mood. Her husband affirmed that she had improved. (We came into contact with her when she was given the final chock-treatment).
Diagnosis: *neurosis depressiva*.

Signe was not hospitalized again. During the next one-and-a-half year I had regular interviews with her.

HANNE

1) Admitted to hospital for the first time when 36, "observation for salpingitis, cancrophobia and nervosismus". Had menstruated regularly since the age of 14, occasionally with strong premenstrual molimina. Married to a labourer, had given birth twice without complications; last birth six years ago; no abortions. During the past year vague sensations which are not actually painful in the right fossa iliaca spreading down the right leg. Occasionally there is frequent urination, has to get up two or three times during the night. During the past couple of months poor appetite and sleeplessness. Occasionally she has had slight paraesthesia in her fingers and the feeling of "a lump in the throat". A pronounced tendency to constipation has always been present and she has to use laxatives. She is also troubled by headache, feels tired and nervous, her mood fluctuates and she is easily depressed and brought to tears, is afraid that there is something serious the matter with her, will not believe what her physician tells her.

Gynaecological examination: erosion of the portio; collum and corpus uteri

enlarged, tenderness of the right side, where there is a thick salpinx and an ovarium about the size of a walnut. Treated by means of dilatatio canalis cervicalis cum excochleatio uteri. (Microscopy: hyperplasia glandularis simplex).

Objectively: neurasthenic, talkative, continues to complain of the symptoms mentioned above, is afraid of cancer. Treated with sedatives. Diagnosis: *endometritis simplex, neurasthenia*.

2) When 38, admitted to a university medical clinic. Widow of a labourer. Brought up as an adopted and only child by a beer-seller, apparently under good circumstances. Later she has worked as a housemaid until she married at the age of 22. Her husband died two years ago after having suffered for 10 years from the effects of severe scalding of the leg. During the last eight years her mother-in-law, who is 77 years old, has been living with her. She has her own house, comprising five rooms and a large garden, a small pension, and a small extra income earned by cleaning at the nearby nursing home. Two sons aged 16 and 8, respectively. She states that she is nervous due to her husband's illness and death and her difficult circumstances.

Approximately nine months prior to admittance menostasis lasting six weeks; premenstrually there are considerable molimina. During her last menstruation she has also had a severe epistaxis. Since her last parturition she has been apt to perspire and during the past 10 years she has felt tired and has pains in the right side of her abdomen and in the right breast spreading to her back, as well as headache behind her eyes, globulus sensations, paraesthesia in her fingers, difficulty in sleeping and she sometimes wakes up drenched in perspiration and with palpitations. In addition, she complains of itching and blisters on the right side of her body. No diarrhoea, on the contrary pronounced tendency to obstipation, and she uses laxatives. Her physician has found a high blood-pressure, and examination in the out-patient clinic has shown that her basal metabolism was 127 per cent.

Objectively: her appearance corresponds to her age, though she is rather overweight 66.8 kg./160 cm. Her skin is rather warm and damp. Occasionally there is tremor of the hands. No definite ocular symptoms of Graves' disease. The thyroid gland is perhaps somewhat enlarged, otherwise no significant findings. She seems to be very anxious and nervous when she is to be examined and her pulse was decidedly increased in the laboratory compared to the pulse noted in the clinic. She is occupied with her neurasthenic complaints but is otherwise calm. ECG and X-ray of the chest and neck did not disclose anything abnormal. Blood-pressure normal. Basal metabolism: 130-125-120-121-125 per cent. She was given X-ray and iodine treatment, was hospitalized for six weeks and discharged for continued iodine treatment. Diagnosis: *Graves' disease*.

3) Admitted six months later for routine control. Has managed her work,

is less tired, less apt to tremors and less apt to perspire. Her weight has increased. Her appetite is good and defecation and urination is normal.

Objectively: one notes that her face is reddish in colour, her eyes rather bright and shining but without definite signs of Graves' disease. No definite thyroid enlargement and no tremor of the hands. X-ray of cor and ECG: normal. Basal metabolism: 130-112-120 per cent. Ophthalmological examination: slight opacities of the lens, otherwise normal conditions. Treatment with iodine continued. Diagnosis: *as before*.

4) Admitted when 49. An inguinal hernia has been present for a year and is sometimes as large as an egg. Complains of palpitations, nervousness, fits of perspiring, frequent urination, menostasis (has not menstruated for eight months). Cynaecological examination: the orifice is somewhat oblique, the uterus slightly distended and antelected. ECG: left-sided dominance. Basal metabolism: 103-105 per cent. (She had discontinued iodine treatment on the advice of her physician). Diagnosis: *hernia inguinalis sinistra*. Herniotomy was performed.

5) Readmitted when 52: Menopause has occurred a year ago; she had hot flushes and fits of perspiring. Three months ago a small vaginal bleeding. Has been treated in an out-patient clinic with massage due to pains in her groin. Complaints: pain diffusely localized to the lower part of the chest, spreading to the back, shoulders, groin and the right leg, also pain in her abdomen, in her buttocks and spreading toward the symphysis pubis. She also mentions frequent nocturnal urination, loss of breath, difficulties in defecating, loss of weight and "bad nerves". For the past year tendency to eczema on both palms. "She is very absorbed in her symptoms". Cystoscopy, X-ray of the stomach and colon, of the hepatic ducts, chest and lungs as well as intravenous pyelography: nothing abnormal. Diagnosis: *eczema manuum*.

6) Eight months later admitted to a university dermatological clinic: No known disposition to eczema or allergic reactions. After X-ray and iodine therapy her metabolism has been repeatedly controlled; the last examination gave normal results. Since menopause she has been taking estilbin. She herself thinks that there is "something wrong with the gall bladder".

Her skin disease commenced two years ago with a patch of eczema in each palm. It disappeared but reappeared later. She was treated at the local hospital, amongst other things with penicillin, without obvious effect. Apart from looking after her house she has a job as a charwoman, where she uses liquid soap, ammonia and soappowder. Due to fatigue and anemia she takes various tonics (which do not include arsenic or phenemal), otherwise no drugs.

Objectively: clearly defined, massive keratosis on the palms and fingers; in the right palm a plaque about the size of a plum. No plaque in the left palm but a slight reddish inflammation on the hypothenar. The tips of

the fingers, especially on the left hand, show several fissures which bleed easily; the nails seem to be affected severely by immersion in water. On the medial side of the right heel there is, what appears to be a small fissure, but there is no definite hyperkeratosis; otherwise the skin is normal. Endocrinological examination: nothing abnormal. Metabolism: 102-103 per cent. The massive rectangular, single-layered squamation, which could be lifted off the underlying normal skin and the presence in several places of oval keratosis were judged to be characteristic of a climacterial keratoderma. Diagnosis: *keratoderma climacterialis*.

During this admission she was examined by a neuro-psychiatrist who stated: "The complaints are various: pains spreading from the chest and to the back, she has pain in her abdomen and there are disturbances all over her body. These sensations have lasted the past couple of years and seem to have started when she was in climacterium and after she lost her husband. She was left alone with her children and had to manage on a small pension. At this time symptoms commenced which suggested Graves' disease. There was increased metabolism but no exophthalmus. She was not operated but was treated with X-ray and iodine. Her condition improved, but she has nevertheless not yet regained her full health. She has no energy, is depressed and restless and has the sensation described above. Objectively, she seems healthy and well-nourished without signs of neurological disorder. Mentally she is rather primitive, absorbed and fixed in her symptoms and undoubtedly neurotic. Conclusion: The patient thus shows a depressive neurosis with various undefinable somatic complaints. There does not appear to be symptoms of a psychosis. It is possible, that she might benefit by treatment at a sanatorium. There is probably no current conflict".

She was treated with testex, and her skin disease improved. She was advised to continue treatment via her own physician and discharged. She had not been hospitalized since, but was treated at an out-patient clinic when 55 for arthrosis of the knee and hip.

SIGNE

During *the interviews* Signe provided an exceptionally rich mass of material about her childhood environment and her "life of sorrows".

Her grand-parents and foster-parents had a small-holding in Jutland. "It was a poor home but a good one". Her grandfather was 52 and her grandmother 48 years old, when Signe was put into their care. She was brought up as she was one of their own children. They were very fond of her, kind and loving, but also fussed over her, overprotected her; apparently they were very simple and rather primitive. They were members of "Indre-Mission", attended church every Sunday and took part in the religious meetings held

by their sect; she never heard them quarrel. They trained her to be "industrious, frugal, thrifty, and honest".

Her foster-father was son of a smallholder from the same district. He was a slightly built man of a calm and easy-going nature, in good health until he died suddenly at the age of 70 (*death certificate*: marasmus senilis, appendicitis). Signe's grandfather's mother also lived on the smallholding until she died.

Signe's foster-mother was the daughter of a smallholder from the same district. When young she had often been ill and was apparently neurasthenic and a hypochondriac; she always took "arsenic pills". When older she was in good health apart from erysipelas and died at the age of 97.

When Signe entered her foster-home, her two youngest paternal aunts were still there; they were eleven and eight years older than Signe. She became very closely attached to them, particularly the elder, whom she always called "sister" during the interviews. This aunt was "like a second mother", and when she married and settled in the nearby village, Signe often visited her. She suffered from "bad nerves" which accentuated the difficulties of her climacterium. Signe became even more attached to her when the aunt's husband died of cancer.

Between seven and 14 years of age Signe attended the local village school every other day. She always found it difficult to keep up with the others in arithmetic but otherwise managed normally well.

From the age of 15 she had various jobs in the district. She was at a dairy for a year, and then for a year with a butcher, a policeman and at a home for the aged as a cook. When 20, she worked as a house-maid for a barrister in a market-town in East-Funen, and later in the East of Jutland for a manufacturer, an engineer and a grocer, in all cases as a domestic servant. When 33, she took a job at a mineral-water factory where she stayed, for 13 years; the work was strenuous piece-work, but well paid.

At the age of 25 she had been engaged to a porter, but he left her for another, and she had adjusted herself to the idea of remaining single, but when she was 43, she met her present husband and married at the age of 47. They had both felt lonely; he was a widower, and Signe, who at that time had been hospitalized several times, hoped that she would get well if she could give up her work. At first they lived in a small one-roomed flat but later moved into a good two-roomed flat.

I visited them repeatedly in their home, which was exceptionally clean and well kept, and I had several conversations with Signe's husband. He was two years older than Signe and appeared to be neurotic, self-centered and ego-centric, of average intelligence or perhaps less. He came from a poor home, his father had been a drunkard, he was the eldest of several children and his mother relied upon him for support. He did not get on well at school, was

twice kept two years in the same class, did not learn a trade, took a job as a labourer at a chocolate factory and married for the first time at the age of 24. His wife died after a ten year lasting "Australian sleeping sickness". They had two children; a son was backward, had been in an institution for mentally defectives and was now in family care; a daughter was of normal intelligence but very "nervous".

He said that in many ways their marriage had disappointed both him and Signe. When younger Signe had been lively and, in his eyes "experienced" ("she had quickly said that she was incapable of having a child"). He thought she was "clever, neat, good with her hands", and as they got along well together, he suggested that they should marry. Since then she had become increasingly sensitive, very complaining, obsessed by her illness, occasionally misinterpreting. He admitted that he was tired of listening to her, and he was particularly unhappy because she was no longer able to take part in his fishing trips, which seemed to be the main content of his life.

Signe talked about her sexual life quite freely. When she became engaged she had been sexually intimate with her fiancé. During the first couple of years both she and her husband had been sexually satisfied, but neither was particularly interested in this aspect of life; during later years she had for the most part accepted coitus for his sake. She had never been afraid of becoming pregnant as she was fully convinced that "only one of a pair of twins could have children, and my sister already had children". She had consequently never employed anticonceptual techniques, and one year after she married, she entered her menopause.

When Signe talked about her case-history, she spontaneously gave very detailed descriptions of her childhood experiences. One of her earliest memories was of her great grandmother, who died of "cancer of the stomach". She remembered that the physician had instructed her grandparents to give the old woman a special set of eating utensils ("as one otherwise risked infection"), and it was always kept separately and scalded after use. When she was three years old, however, her great grandmother gave Signe something from her spoon. When her grandparents came home this gave rise to a "terrific fuss", and they continued to believe throughout her childhood, that she had been "infected" and therefore would die at an early age; a matter which they often discussed when Signe was present.

When a child Signe had measles without complications, but apart from this she apparently did not have any of the usual childhood diseases. She had a pronounced tendency to bleed at the nose and without particular provocation sometimes awoke at night with severe haemorrhage, which sometimes also occurred when she was playing. Therefore she was forbidden to take part in gymnastics and the like, and her grandparents stressed that she always bled from the left side of the nose—"the heart side".

Signe was very slightly built as a child—almost “a skeleton”—and “weak”. Her back was somewhat deformed, which she believed was due to the hard work, she had to do on her grandparents’ farm. About the age of 11 or 12 she had “a large gland on the neck, a long sausage hanging down on my breast”; it perforated and then disappeared. She was anxious and very frightened of the dark as a child, but nevertheless thought that during early childhood she had been lively and gay, glad to work and able to get through a lot in a short time.

When at the mineral-water factory she was overworked. She worked together with a divorced woman who was very spiteful. This affected her considerably and she often stayed away from work and was finally discharged. She stated that her various symptoms commenced during this period, about the age of 35, and that they were accentuated during her climacterium. She had always been more easily fatigued than other people, but since then she was constantly tired to such a degree that she could not do much at all except “sit and feel poorly and weak”. She felt tired even in the morning, whereas she often was quite energetic in the evenings. It was difficult for her to keep pace with her work at home; her husband and the step-children did not show sufficient consideration, heaped work upon her, demanded that she washed for them all, etc. She also suffered from insomnia, lay and “thought” all the time while the clock struck and her husband kept her awake by snoring. When she finally managed to fall asleep, she was restless, woke often, “my brain works the whole time”. She had attacks of anxiousness, felt that her heart stopped beating, thought she was about to die. During the day she was tired, and when faced with the weekly wash or cleaning could not do a thing.

She was subject to uncharacteristic dizziness and an almost constant headache localized to the neck and forehead, which she said had begun about the age of 20 when she had “Spanish fever”. She also had pain behind her eyes which she believed started at the age of 25, when she had had the “mumps” which had “gone into the eyes”; no abdominal symptoms at this juncture. Her “eye catarrh” was most pronounced in the right eye; she had used spectacles for reading for some years.

She complained of pains all over her body—“They are first one place, then another, even in my thighs”. They kept her awake at nights and were mostly localized to her chest, abdomen, loins, and extremities. She rarely referred to them as “pain” but used the expression “ache”, and thought it was probably “gout”. Her abdominal pains were apt to occur after she had eaten; her abdomen became “round like a ball and made noises . . . stomach catarrh”. “I have such trouble with my stomach, the most awful fits going up to my chest, out under my shoulder-blades and up to my gums and up

under the back of my eye (pointed to the right side of her body) like something leaving tracks after itself". She had always had difficulties in defecating and had used laxatives. "I cannot get it out, it sticks in lumps so it won't move, when a lump does come out I feel so poorly that it is almost as if it pulls all my bowels out. I am made of bad material". She often had nausea and often belched and "sometimes it runs right up into my throat", She then had to drink water or eat biscuit to calm herself. Her pains in her loins and back might, she thought, stem from her lungs, whereas the pains localized under her left breast came from her heart; at one time she had been afraid that her liver "was on the wrong side". While in hospital she had often been told that there was nothing wrong with her heart, but her symptoms remained unchanged. She frequently had the feeling that "now it is going to happen", "it is an obsession", "my heart is going to stop beating and then I shall die"; something was "throttling" her, she had "a lump" in her throat or "everything goes black"; if she talked a lot or was emotionally upset she became "hoarse".

From about 35 years of age she had been afraid that she had "cancer". She referred to the physician, who in her childhood had stated that cancer was infectious, and it was obvious that although she tried intellectually to accept that this was not likely, she could not rid herself of the idea; she instead criticized her various physicians, who only wrote prescriptions but never examined her. She was afraid that she had cancer of the throat and thought that one would be able to see it by means of blood-samples. She was especially afraid that cancer was in some way related to her tendency to bleed at the nose, and meant that these attacks of bleeding, which had continued into adulthood, had several times saved her from "cerebral haemorrhage". She knew many people who had died of cancer, apart from her great grandmother, she mentioned the aunt's husband and some of the people she had worked with. She had been examined several times by an ophthalmologist and had asked him whether there might not be a tumour behind her eyes ("I look black around my eyes") because her eyes were often "veiled" and she "looked hanged". When first admitted to hospital she was afraid that she had an abdominal tumour, and she took some time to gain courage enough to go to hospital; she thought that she had either had appendicitis or that she had been "infected with cancer", and she mentioned in this connection her grandfather's "neglected" appendicitis. At least no one could convince her that she would not *later* have cancer.

During later years her appetite had been poor, she "did not like cold food", ate very little and lost weight. She had always been slightly less than average weight, but when young she had weighed the same as her twin sister.

Throughout the years she had taken many pills of varying shapes, sizes

and colours in various doses and at one time also had injections of hormones. Due to these drugs she had suffered from itching of the skin as well as a mild tendency to "eczema".

She had many sensations localized to her skin. Often her skin felt warm; "it burns like a fire under it". She was especially embarrassed by the "oval spots that swell up", which were mostly localized to the volar side of the extremities.

During later years she had reduced her consumption of medicaments after her physician had restricted her prescriptions, and at the time of our investigation she only took up to five or six tablets of coffiplex a day and one tablet of pentymal in the evening.

She had never had anything against drinking alcohol but rarely did so. If she drank, it was restricted to a glass of beer or wine, and she felt stimulated by it. She had smoked cigarettes since her youth, later cheroots, but had been forced to abstain for various periods due to her condition.

HANNE

During *the interviews* Hanne said that she did not know why she had been sent to a foster-home on Funen, but she thought it might perhaps have been because her mother had worked in a restaurant for a short time in the town where Hanne was brought up.

She stayed in her first foster-home for three years and remembered nothing about it apart from that she had been removed, because the home was "not a good one".

She was then placed in another foster-home and cared for by a beer-vendor, who also had a boarding house. She was the only child. Her foster-father was 31 and her foster-mother 28 years old. They had previously during brief periods had other foster-children, including some deaf-mutes, in their care, and they took Hanne mostly for economic reasons, and this is probably why she was never formally adopted. She had known that she was a foster-child for as long as she could remember, and also that she was an illegitimate child.

Her foster-father, who had been raised on Funen, had originally worked on a farm; later he drove a car delivering beer. He was "a simple man but good enough".

Her foster-mother, who managed the boarding-house, was the domineering figure in the home. She was a fat, very energetic, thrifty, industrious, and rather strict woman.

The foster-parents were not religiously inclined. They lived peacefully together, and Hanne had a good material background and did not want for anything, but she never felt emotionally attached to her foster-parents. "I

have not had a real father and mother". She was taught to work hard, to behave "properly" and that "work always comes before play". Throughout her youth, especially during puberty, her foster-parents were very vigilant; she had to be home precisely at the time decided. They seemed to be particularly afraid that she might "get into difficulties" like her mother, and on one occasion she was told that she "had been picked up out of the gutter".

Hanne attended a good private school from seven to fourteen years of age. She was about average, had some difficulty in learning arithmetic, but otherwise did not encounter important problems while at school.

After leaving school she stayed with her foster-parents, partly helping in the boarding-house and partly working in half day positions outside her home; at one time she was a cook for a manufacturer.

She met her husband when she was only 15; he was a bricklayer, who had his meals at the boarding-house, and they were engaged when she was 16 and married when she was 22. Her husband obtained a post as a guard in a prison, but left to take a job in the railway engine sheds. During the first few years they lived in a flat in the boarding-house; later they purchased their own house. They got along well together and seem to have been well adjusted sexually.

When they had been married for four years, her husband was seriously injured in an accident at his working place; his leg was scalded and he was hospitalized for nine months and completely unable to work for a year. He never got over this, and, according to Hanne, this was why he became "senile" and died when only 38 years old; he collapsed suddenly while at work, the cause of death being stated to be cardiac disease.

Hanne was 36 when her husband died. Her two children were then 14 and 6 years old. Her pension was small and she was forced to work as a char-woman. She had for some years had her mother-in-law living with her because she was disabled with frequent attacks of epilepsy. She continued to keep in contact with her foster-parents, but they did not offer her important assistance of any type. Her foster-mother died at the age of 78 of "cancer of the stomach". Her foster-father, who died when 86, spent the last months of his life in bed in Hanne's home due to fracture of the thigh.

At the time of our investigation Hanne was living alone in her own house in beautiful surroundings overlooking an inlet. It was well equipped, practical and very neatly kept. Almost her main interest was her children and grandchildren, who were living in the same town. Generally speaking, her conditions seemed to be excellent. She had given up working outside her home because of her many symptoms, and she did not have serious economic problems.

As regards her psychological development she had when a child had a "hap-

py mind", but she was also very anxious, afraid of the dark, often had nightmares—especially if she was at home alone. It was easy for her to mix her peers, she was accepted as "the beer-man's little girl", did not feel she was an outsider, but even so did not stand on an intimate footing with anyone. She did not think that she had been a "problem-child", and, although she had lacked parental love, she felt that her upbringing had, generally speaking, been favourable.

She was a healthy child; apart from mumps and whooping-cough she did not remember anything about childhood diseases. Since early childhood, she had a pronounced tendency to nose-bleeding. She had "Spanish fever" at the beginning of puberty and there was violent nasal haemorrhage, which "had helped her to get over her illness quickly". Beginning at puberty she had been "crooked in her shoulder" and because of this she wore for some time a bandage.

Up to a few years before her husband's death she had been in good health. The births had been normal, and she was able to breast-feed her children for some months. She felt well during her pregnancies, and, in fact, asserted that she had never felt as well before or since. Due to an increased appetite she did gain in weight, however, and had been somewhat overweight ever since.

From about the age of 35 she started to manifest various symptoms, primarily a feeling of being overtired, about which she remarked, that she "had always been anaemic". She developed insomnia and had nocturnal attacks of indisposition accompanied by anxiousness, was afraid that she "was about to go". She had always suffered from a tendency to constipation and was now forced to take laxatives. At the same time she started to have uncharacteristic abdominal pains. "I have always had a restless stomach and when I go to bed I lie and have so many thoughts and think it might be dangerous, it might be cancer". She slept badly, often she could not fall asleep, had to get up several times during the night to urinate; afterwards she lay and thought about things, was afraid of dying while alone.

Her fear of cancer first appeared, when she was admitted to hospital when 36 years old, and had never since completely disappeared; she thought it had something to do with her climacterium. One of her foster-mother's aunts had died from cancer, and Hanne clearly remembered her foster-mother saying that it was "the 'dead cancer', the legs were separated from her body, she went to pieces when they moved her, and when I started to have my pains in my left hip, I thought 'I hope it is not cancer'". She still had such thoughts from time to time, and they were accentuated when she was X-rayed because of pains in her left hip and was told that the hip was "thin and spoilt".

As an adult she had often bled from the nose and had headaches, a pressing or throbbing pain, localized around the left eye and in the neck.

She was also apt to have pains in her back and joints; her wrists hurt, she "had no strength", and her knees were painful and swollen. She regularly had a feeling of pressure in the left side of her chest, was afraid that her heart was going to stop. Sometimes she felt strangled "as if something rises up in my throat"; she was frequently hoarse and had at times her throat swabbed. Finally she stressed that physicians had said that her uterus was "too big".

During one period she took ovex and estilbin, apparently without effect; she also took phenemal as sleeping pills. She had always had a good appetite and did not bother about being somewhat obese. She smoked two cheroots daily, drank alcoholic beverages only on special occasions.

She had consulted several neurologists. "But they all said I am healthy and do not look ill, and I cannot understand why I can be so poorly at the same time".

Hanne's children: 1) *Son*, 31 years old, married, barber. One child. Physically and mentally healthy. Resembled Hanne in appearance and mentality. 2) *Son*, 24 years old, unmarried, mechanic. Physically and mentally healthy.

THE TWIN RELATIONSHIP

The twins had known about each other's existence from about the age of 14 years. They corresponded with each other during the next few years, but did not meet until they were 20, when Hanne visited her paternal grandparents. At that time they resembled each other very closely indeed. Photographs show them as slim, leptosome women, remarkably alike in appearance and in clothing; it is easy to understand that they were often misidentified even by people who knew them well.

They met each other at intervals of some years, but both stated that they did not get on well together. They felt themselves to be different, and they were apt to arguing. Signe said that Hanne's husband while he was still her fiancée "made eyes at" Signe and wrote letters to her. She also said that Hanne, when her husband had died and she had visited Signe, had made obvious approaches to Signe's husband. When judged, also according to Hanne's statements, it at least appears that both husbands apparently found it amusing that the twins looked so much alike and often made jokes about how easy it was to "confuse" them.

When their mother died, the twins broke off their relationship with each other. Signe said that it was because she had not been told that her mother had died before the funeral had taken place, and her mother's possessions were divided by Hanne and the twins' half-brother, while Signe was only given a few small articles of little value. The twins exchanged some letters about this and finally stopped seeing each other. At the time the investigation

took place, they had not seen each other for four years, but both of them nevertheless seemed content to meet each other again.

The twins did not know much about each other's illnesses, and Signe was obviously very surprised that Hanne had for several years had the same symptoms, as she felt that Hanne had always been uninterested when she had told her about her fear of cancer.

They agreed that they had been brought up under very different conditions, Signe by "poor but loving" foster-parents and Hanne in "a cold but economically well-placed" home. They also agreed that their personality had developed differently due to this.

Signe thought that she had always been more "soft" and Hanne "hard", and she found it difficult to accept that Hanne had had similar difficulties. Signe had always been very sensitive, was easily worn down, whereas Hanne managed better. She also felt that Hanne was too critical about their mother, whom she often tried to defend.

Hanne, on the other hand, thought that Signe was difficult to deal with, "peculiar, egoistic, cleaning-mad", and marked by having been alone for so long. The fact that Signe had no children also made it difficult for them to talk to each other. "We have never really sympathized with each other, we have been strangers. I think we are very different indeed. I have deferred to her but she is stubborn. I think I have got more out of life, I have two fine boys and a grandchild".

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

A considerable amount of supplementary information concerning the twins' natural parents and their families could be collected from various *official records*:

The father

According to information from *the national registration office* he was, at the time of our investigation, 77, a widower, living in his own house on the outskirts of Copenhagen.

His physician, who had known him for about 10 years, stated: "He has lost his wife, who died from cancer, when 37. No children. He is talkative, calm, well-balanced, rather stubborn, but without abnormal mental traits, especially without tendency to hypochondria. He is a pyknic, almost balded, with a large moustache, sometimes rather slovenly but in good health for his age".

Apart from some sleeping-pills he took no drugs and was not known to have been fond of alcohol.

(Blood-grouping: A₁, Ns, P+, R₁r, Le(a-), Fy(a+), K-).

He had been hospitalized twice. *The case records state*: 1) At the age of

71: pneumonia dextra. Apart from pneumonia at the age of 50 and erysipelas faciei, a month before he was admitted, previously healthy. Objectively: obese (78 kg.); an elongated, subcutaneous lipoma about the size of a cocoon on the right side of the spinal column, very flat-footed, otherwise no abnormalities. 2) When 76: Herniotomy of a left inguinal hernia was performed.

The father's siblings. 2) *Sister*, 75 years old, married to a smith, living in Jutland. Four children. Hospitalized several times. *Case records*: diabetes mellitus since the age of 51, extremely obese, suffering from obstipation, palpitations, hypertension, varicose veins and "poor vision". Treated on a diet, and not received insulin. 3) *Sister*, 70, married to a smith (a brother to the above mentioned sister's husband), living in Jutland. Since the age of 50 hospitalized repeatedly. *Case records*: hyperplasia irregularis endometrii, prolapsus uteri. She also suffered from oedema of the ankles, dyspnoe, obstipation and haemorrhoids and was a small fat woman with a pronounced hypertension. 4) *Sister*, 67, widow of a bricklayer, living in Jutland. Had never been hospitalized. According to her physician she was "afraid of doctors", had been "nervous" during her climacterium. One of her daughters was also "very nervous". 5) *Sister* (twin), died when 39. Married to a fisherman. Hospitalized 38 years old. *Case records*: ischias; had previously suffered from "nervousness and headaches". When 39, pneumonia, empyema pleurae. Typical course, very obese, died shortly after admission. 6) *Sister* (twin), died in infancy from unknown causes.

The mother

She had been in hospital repeatedly, and as her medical history resembles the twins', her *case records* will be reported in greater detail.

1) Admitted to hospital when 55 years old. "Stomach catarrh" when young. Menopause when 51, accompanied by "hot flushes", insomnia, depression and headache. Following this there was lack of appetite, a feeling of pressure across the epigastrium without relationship to intake of food, a feeling of distension, "sounds and noises". Obstipation, uses laxatives. Routine examinations: no abnormalities besides achylia. Height: 156 cm; weight: 49 kg. Blood-pressure: 145/80. Diagnosis: obstipatio chronica, achylia gastrica. 2) When 58: Had been admitted to a private clinic twice for "colitis", was on a diet, took paraffin oil, had had diarrhoea for a week. On admission tired, careworn, "black rings under her eyes", less than average in nutritional state, complains of fatigue and pain in the right hypochondrium. X-ray of the stomach and colon, and rectoscopy: nothing abnormal. Diagnosis: colitis, obstipatio chronica, achylia gastrica. 3) When 63: Has suffered from dyspeptic symptoms as already described, also complains of "bad nerves, loss of weight, rheumatism in her legs, fatigue in the back, sensations throughout the whole of her body", and paraesthesia in her finger-tips and dry tonguetip. There is still achylia; X-ray examination of the stomach: a clover-like "niche". X-ray of the colon: no abnormalities apart from "spasms". Objectively: wasted, fatigued, neurasthenic; the skin is light yellow, the tip of the tongue is reddish. Usual routine examinations including haematological

examination: nothing abnormal. Diagnosis: achylia gastrica, obstipatio chronica. 4) When 65: Complaints unaltered. Repeated X-ray examination: signs suggesting an ulcer. Diagnosis: ulcus ventriculi, obstipatio chronica. 5) When 69: During the six months prior to admission fatigued; periodically "ill over her whole body". Has a poor appetite, headache, has lost in weight. Pronounced tendency to perspiration and palpitation, and defecation is now frequent. She has "cramps" in her legs and hands as well as itching skin. Has been treated for some months with iodine. Objectively: nervous without clinical signs of perspiration or tremor. There is an adenomatous goitre with enlargement of the right lobe and the isthmus. ECG: arhythmia perpetua. While in hospital she complains of pains in her neck, across the sacral region and diffusely spread over the abdomen. Basal metabolism: 147, 142, 144, 155, 139, 134, 144, and 141 per cent. Blood-pressure: 170/80. X-ray of the chest: enlargement of the cor (mitral form). Treated with digitalis and iodine. Diagnosis: hyperthyroidismus, fibrillatio atrium, hypertensio arterialis. 6) When 70: In spite of continued treatment still "nervous", perspiring, apt to tremble, palpitations and dyspnoe. The examinations and ECG did not disclose new features. Diagnosis: as previously. 7) When 71: Complaints as previously. Objectively: thin, restless, fidgety, perspired slightly. Basal metabolism: still above normal. ECG: as before. Diagnosis: Graves' disease, morbus cordis (arhythmia perpetua). Was given seven X-ray treatments in the out-patients' department as well as iodine and digitalis. 8) and 9) When still 71 years old readmitted twice; treated with X-ray, iodine and digitalis. 10) When 72: Basal metabolism: 121, 116 and 107 per cent. 11) When 74: Same diagnosis, to which was added pruritus senilis. 12) When 76: During the previous two years she has been living in a home for the aged. She has been tremulous, easily startled, plagued by headache, "boils" and poor appetite. Weight: 48 kg. Has been kept on a diet, mostly milk foods, white bread and boiled meat, and sedatives for her "nerves". She no longer takes iodine or digitalis. Ophthalmological examination: pronounced opacities of the lens of the eye on both sides, and retinal arteriosclerosis. Basal metabolism: 111 per cent. When 77 and 78 years old admitted three times to the hospital ward attached to the old age home: 13) colica abdominalis, 14) neurasthenia, 15) cerebral haemorrhage. Last time admitted after having fallen into the floor during the night, when she was trying to urinate, had lain there for hours before she was found, was confused and complaining. No paresis or wounds. Became calmer during the following week, but fell down again during the night, her state deteriorated and she finally died after a few days. (No autopsy).

The twins' maternal half-brother. According to the national register he was a 52 years old, married tobacconist in a town on Funen. He was an illegitimate child; his father was probably a railway worker. Had been brought up by foster-parents on a farm. Mar-

ried twice, without children apart from an illegitimate child. *Legal documents* state: When 25 years old, charged with spreading venereal disease but released. The same year sentenced to 20 days in prison for theft. When 27, sentenced to 30 days prison for spreading venereal disease; he was at that time a commercial traveller, and had infected his fiancé and a hotel maid with gonorrhoea. When 32 arrested and questioned concerning breach of licensing laws but not charged. When 40 questioned concerning pimping but not charged. The same year twice charged with selling spirits after closing-time and fined. No information available concerning his health.

The maternal grandfather was an illegitimate child of a sailor and a maid. He was an upholsterer in a medium-sized town in North Jutland. He married twice, had four children in the first marriage, five in the second; the twins' mother was the second child in the second marriage. *The paternal grandmother* was also illegitimate; her father was a gardener and her mother a maid. She was 25 years younger than her husband, was at first housekeeper for him. She had a child prior to her marriage.

The mother's siblings. 1) *Brother*, married railway-worker, died when 74 from unknown causes. Was probably admitted to hospital several times, but it was impossible to obtain further information. He married twice, and divorced his second wife when 40. He had three daughters and a son in the first marriage; no children in the second. *A daughter*, married, was admitted to hospital when 44. Diagnosis: haemorrhagia subarachnoidalis; typical case-history. When 47 admitted to a neurological clinic. Diagnosis: (meningomyelitis?), morbus cordis, hypertensio arterialis. Transferred to a medical clinic: Diagnosis: radiculitis, hypertensio arterialis, neurasthenia, climacterium. Basal metabolism: 111 per cent. Very talkative, restless, tremulous, preoccupied with her illness, slightly-built with tremor of the left hand, lively patellar reflexes with extended zones, clonus of the foot; otherwise no signs of neurological disease. Heavy growth of hair in the arms and legs, slight signs of virilism. Psychiatric examination: neurotic, brought up in a home where the parents were divorced. Sensitive, perfectionistic. No children, Discord between her husband and herself, for some years extramatrimonial sexual relations with a married man. Periodic feelings of guilt; considers that her illness might be a punishment for her double life. Treated with hormones. A month after her discharge admitted to a neurosis sanatorium: Diagnosis: neurosis fysiogenes et psychogenes, seqv. haemorrhagia subarachnoidales, seqv. polyradiculitis, degeneratio myocardii, hypertensio arterialis l. gr. *Another daughter*, married to an office-worker. When 18 she had an illegitimate child, which was sent to a foster-home. Married when 19 and divorced after two years, was domiciled in South America. No children. When 28 admitted to a psychiatric clinic. Always moody, hot-tempered and "hysterical". Erotic conflict and repeated arguments with her husband whom she had rejoined. Diagnosis: tentamen suicidii (tetraponi).

3) *Sister*, widow after a labourer in a town in North Jutland. Died at the age of 72. Three children, all believed to be well. Hospitalized repeatedly: 1) 58 years old. Poor social conditions. Menopause when 45. Tendency to obstipation for many years, occasional diarrhoea. For some years "nervousness" and insomnia in spite of extensive use of sleeping-pills. When young slightly built, but gradually she became obese. Periodically bed-ridden with vomiting, dyspnoe and attacks of pains in hands and knees. Objectively: obese (72 kg/162 cm), neurasthenic, preoccupied with her illness. Extensive subcutaneous infiltrations. Routine examinations and X-ray of the stomach: nothing abnormal. Diagnosis: neurasthenia, infiltrations subcutanea diffusa. 2) When 58: Same symptoms which had, however, progressed in severity. Objectively: nervous, perspiring, slight tremor of the hands, lively dermatographism, slight exophthalmus and diffusely enlarged thyroid gland. Basal metabolism: 159-120 per cent. Treated with iodine, X-ray and physiotherapy. Diagnosis: Graves' disease. 3) When 59: Iodine treatment had been discontinued. Two months prior to admission "kidney bleeding". Basal metabolism: 128-129 per cent. Iodine treatment was recommended. Diagnosis: as previously. 4) When 59 (one month later): palpitations, dyspnoe, tendency to perspiration and hot flushes, often depressed. Basal metabolism: 130-132 per cent. Diagnosis: as previously. 5) When 61. Weight (61 kg.). Diagnosis: as before and hypertensio arterialis. 6) When

71: For some years abdominal pains. X-ray of the stomach: juxtapyloric ulcer. Rectoscopy: mild colitis. X-ray of the colon: nothing abnormal. Diagnosis: ulcus duodeni. 7) When 71 (two months later): Diffuse pain in the abdomen, the stools occasionally dark. Diagnosis: ulcus duodeni. 8) When 72: Diagnosis: cancer coli, adipositas, degeneratio myocardi, bronchitis chronica. Discharged to her home where she died shortly afterwards.

4) *Sister*, 74 years old, married to a labourer. No children. Apparently never hospitalized.

The mother's half-siblings. No information was available concerning three half-brothers and one half-sister on her father's side, or one half-brother on her mother's side.

Summary of the supplementary information

The data which have been collected indicate that there is a rather massive, familial predisposition towards various psychosomatic manifestations, primarily obesity, gastrointestinal and cardio-vascular disorders, and towards neurotic disorders.

The medical histories of the twins' mother and their maternal aunt, who both were classified as suffering from Graves' disease, are no doubt of special relevance when discussing the case-histories of the twins.

In their paternal family, cases of twins were registered.

CLINICAL EXAMINATIONS

The examinations comprised 26 interviews with Signe, 10 with Hanne, and two with both twins together. The interviews with Signe took on the character of supportive psychotherapy. I visited their homes several times and had detailed interviews with Signe's husband and also with her step-daughter.

The twins were easy to distinguish as Signe spoke in a pronounced Jutlandish dialect, whereas Hanne spoke a typical Funen dialect; Signe weighed 58.5 kg. and was very slim, whereas Hanne, who weighed 69.0 kg. was moderately obese and gave the immediate impression of a more syntonic and "easy going" type. They were exactly the same height, 160.0 cm and, apart from the differences mentioned above, they resembled each other remarkably. The shape and details of their faces, in spite of differences in fat, were very similar indeed; both had a relatively large, prominent nose and mouth, and their resemblance was especially striking in profile. The shape of the skull, the position and the details of the ears, and the free lobes did not differ. Both had full upper and lower dentures. Their hair was dark blonde, tending to brown, slightly diffused with grey, somewhat more pronounced in Signe than in Hanne. The hair was of the same quality and slightly curly, both parted it on the right side and dressed it in the same way. The hair whorls were clockwise. Their eyes were medium blue and showed great resemblance (cf. the ophthalmological report).

Routine examination disclosed that both twins had a tendency to perspire on the palms of the hands. There was a slight tremor manuum. There was lively vasomotion of the skin but no definite signs of thyrotoxicosis, in particular no ocular signs or struma. The pulse varied between 60 and 80. Blood-pressure: Signe 155/85–155/90, Hanne 155/100–155/95.

Apart from the fact that Hanne's hands were typical "charwoman's" hands and that she had a patch of squamous eczema about the size of a shilling near the top of crena ani, there were no differences between the twins. Both showed slight clinical signs of arthrosis deformans in both knees. Both were right-handed.

Their gait, posture, movements and facial expressions, especially their smiles, were very similar. Their voices were identical, and it was characteristic of them both that after some time, especially if the interview had touched upon emotional matters, their voices became aphonic and hoarse. They dressed quite alike and both used a small amount of make-up.

Both were very cooperative, and it was easy to establish emotional contact with them. They had a great desire to talk about themselves, but in a rather stereotyped fashion, and it was characteristic that both used many standard expressions and clichés. It was also typical that they described their symptoms in a peculiar, persevering manner and often ended quite gloomy statements with a high snigger.

They appeared to be of average intelligence, Hanne definitely seemed to be the more efficient. Neither showed clear signs of intellectual impairment, but both seemed "narrow" and to have interests solely directed towards their closest environment.

They both appeared to be uncertain of themselves, rather restless and tense, clearly more pronounced in Signe. Both were self-centered, introspective without much insight and marked by an obviously naive and primitive attitude towards their problems. They were apt to criticize each other, and this critical attitude was perhaps most pronounced in Signe.

They appeared to be neurotic, obvious hypochondriacs, cancrophobic, with hysterical, asthenic and occasionally depressive traits. Signe was clearly more neurotic than Hanne, who seemed more well-balanced, but the observation disclosed that the difference was primarily one of degree.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Signe

Attempted to solve 55 matrices in 36 minutes (matrices E₈₋₁₂ were excluded). Co-operative but worked irregularly and was somewhat despairing. The test could, nevertheless, be carried out satisfactorily. Score: 10+6+4+3+0=23. Distribution: normal; discrepancies: 4. Group: 25–50 percentile. Conclusion: normal intelligence.

Hanne

Attempted 55 matrices in 28 minutes (matrices E₈₋₁₂ were excluded). (Her behaviour closely resembled her sister's). Score: 9+6+4+2+0=21. Distribution: normal: discrepancies: 6. Group: 25-50 percentile. Conclusion: normal intelligence.

Wechsler-Bellevue

	Signe				Hanne			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	9	7	12	9	10	8	11	8
Comprehension	8	7	9	8	11	10	11	10
Digit Span	4+3 = 7	3	4+3 = 7	3	5+3 = 8	4	4+3 = 7	3
Arithmetic	5	6	4	4	4	4	5	6
Similarities	7	6	11	9	9	8	10	8
Vocabulary	(20)	(9)	(23)	(10)	(25)	(11)	(22)	(10)
Verbal Points		29		33		34		35
Picture Arrangement	4	4	7	7	7	7	5	6
Picture Completion	10	9	9	8	10	9	10	9
Block Design	9+2 = 11	6	9+1 = 10	5	15+1 = 16	8	15+2 = 17	8
Object Assembly	15+1 = 16	8	13+4 = 17	9	14+1 = 15	7	18+2 = 20	15
Digit Symbol	28 ^{1/2} /29	6	25/25	6	30/30	7	29 ^{1/2} /30	7
Performance Points		33		35		38		42
Total Points		62		68		72		77
Verbal IQ		86		92		93		94
Performance IQ	96+4 = 100		98+4 = 102		101+4 = 105		106+4 = 110	
Total IQ		91		96		98		101

Signe

Her cooperation was mediocre. Expressed herself particularly badly. During ordinary conversation she almost appeared to be pseudo-dement (had been treated with ECT ten weeks prior to the examination). The low scores on Digit Span and Picture Arrangement are striking. She did not do her best on Arithmetic, and on Block Design her way of working was peculiar. Conclusion: normal intelligence. (It cannot be excluded that there may be a relatively severe intellectual reduction compared to her age; her methods were somewhat peculiar, probably due to emotional factors). On *retest* (7 months later) most scores did not alter much. Conclusion: as previously. (It should be noted that signs of possible organic deterioration persisted).

Hanne

She worked more efficiently than on Raven's Matrices. The low scores on Digit span and Arithmetic are interesting, whereas the variations in the performance tests are insignificant. Similarities, Block Design and Object Assembly show unusual qualitative traits (but they are less pronounced than in Signe's case). Conclusion: normal intelligence. (The score-profile is rather striking, and resembles the profile for Signe; both twins are particularly poor in verbal abstraction). On *retest* (6 months later) no important alterations in the scores. The increase in Performance IQ is solely due to better results on Object Assembly. Conclusion: as previously.

Rorschach

			Signe	
7 W	10 F+	0 H	5 P. 0? Orig.	

11 D	6 F—	0 Hd	P+ 63 (extended 68)
1 DdD	1 FC	9 A	F = 100 - L = 84
Total: 19	2 FY	9 Ad	A = 95
		1 Anat	Affective ratio: 37
			RT: 0.9 min. (I - VII)
			0.9 min. (VIII - X)
			Ap: W - D - DdD
			Exp: 0/1/2
			Colour shock, shading shock.

Tendency to self-criticism, and object-criticism, perseveration and low "experience-awareness"; impotence, perplexity, stereotypes in speech.

There was strong perseveration. Appeared to be almost "impotent" on this task, seemed to feel so, and suggested that the intention of this test was to "confuse" people.

Psychogram: Her line of thought was clumsy, she was concrete and naive in her attitude, perseverated in her mode of speech. The obvious dissatisfaction she shows towards herself did not, however, hinder her in offering poor and vague interpretations. Her subjective world seems marked by stereotypes, but rarely by the more usual attitudes. She manages best when working on restricted, concrete tasks, is possibly rather perfectionistic. Emotionally she is rather repressed with slight insight into her own problems and little aptitude to react in her relationships with others. Has difficulties in manifesting her emotions in an adequate manner; this is especially striking because she indirectly shows many signs of being naive, egocentric, and easily aroused. The picture corresponds to a rather hysterical and immature personality. There are important neurotic traits, undoubtedly sexually conditioned. There are manifest signs of repression and a tendency towards depression, and one must expect anxiety (perhaps phobic) phenomena. Some of the results might indicate an organic state; this would agree with her "impotence" and concrete attitude. The results suggest that her state needs treatment, but she is probably not suitable for psychotherapy.

Double-blind test

Woman, elderly? middle-aged? Her line of thought is primitive, there is pronounced stereotypy and perseveration, but without knowledge of her age it is difficult to judge whether she is of poor intelligence (dull-normal) or whether it is intellectual deterioration in a person who originally was probably not more than average in intelligence. According to the test results she works hesitantly and uncertainly, is concrete, keeps to the same ideas and has great difficulties in adopting a new attitude. She will probably function adequately if restricted to routine work. She appears to realize her restrictions, but probably tries to hide them by means of rationalization, evasiveness and a rather forced and unnatural attitude. Characterologically she appears to be rather primitive, torpid, and ambivalent, probably does not trust others very much (defensive?). The results might suggest neurasthenia.

Retest (7 months later)

5 W	13 F+	1 H	8-9 P. 2 Orig (+/-)
2 DW	3 F—	2 Hd	F+ 82 (extended 85)
9 D	1 M	8 A	F = 100 - L = 85
1 DdD	1 FM	9 Ad	Affective ratio: 30
3 Do	1 FC		RT: 0.9 min. (I - VII)
Total: 20	1 FY		0.9 min. (VIII - X)
			Seq.: indeterminable

Ap: (W) — (D) — DW — Do! —
 DdD
 Exp: 1¹/₂
 Colour shock, shading shock.

Tendency to perseveration and low "experience-awareness" impotence, perplexity, appeal.

Her behaviour resembled that during the first test, but it was less unusual, trembling and uncertain. It seemed that her state had improved since the first test.

Psychogram: Although some of the answers (6–8) are repeats, there is a considerable difference between the two tests. Corresponding to her general behaviour she seems to have improved since the first test. She manifests intellectual possibilities that were not apparent during the first test, and the flat and vague tinge of the first test is no longer so obvious. Her attitude is clearly ambivalent; on the one side she tends towards cautious, detailed interpretations, but on the other side she is apt to give rather "loose" interpretations. Her interest in and ability to contact with other people also appear to be stronger, although they are still modest. There is still emotional inhibition, and the deeper-lying neurotic features and problems (sexual, anxious) persist, and the personality structure is unaltered in the main features.

		Hanne		
7 W	10 F+	1 H	6 P. 1 Orig (+)	
10 D	3 F+/-	9 A	F+ 89 (extended 81)	
1 Ds	1 M	3 Ad	F = 100 — L = 68	
1 Dds	2 FC	1 Bt	A = 63	
<hr/>	1 C	1 Cl	Affective ratio: 26	
Total: 19	1 FY	1 Fire	RT: 0.7 min. (I — VII)	
	1 YF	1 Vulcano	0.7 min. (VIII — X)	
		2 Crater	Seq: indeterminable	
			Ap: W — D — etc.	
			Exp.: 1/2 ¹ / ₂	
			Colour shock? shading shock?	

Tendency to self-criticism, low "experience-awareness", anxiety, talkativeness, restlessness.

Her behaviour was characterized by restlessness, she sighed, laughed in an embarrassed manner several times, acted and chattered.

Psychogram: Appears to be of normal intelligence with a certain breadth of view and good contact with accepted points of view. Her ideas are sometimes quite lively, emotionally-toned, even though her attitude remains somewhat naive. Emotionally she is characterized by conflict, and although her ability to establish contact with others appears to be good on the surface, there is a tendency to deeper-lying anxiety and aversion. She is extroverted with possibilities for emotionally-determined experiences and actions (aggressive, "contrary?"). Her interpretations suggest sexual and impulsive-anxious problems, as well as vague ideas of insufficiency, "there is something or other wrong or lacking" (sexually-determined?). Her relatively good compensation is striking, especially when compared to her twin sister's.

Double-blind test

Woman, elderly? Normal intelligence. Rather unsure of herself, but employs her abilities reasonably well, at least as long as she is in familiar surroundings and engaged upon usual tasks. In situations where she has to take the initiative, she will probably not be particularly productive. Her interests appear to be restricted. There seems to be

some superficial emotionality, but she seems to be afraid to engage herself emotionally; one may expect sporadic emotional outbursts. She is perhaps apt to be oppositional, and her interest in others does not appear to be particularly pronounced. Her ability to establish contact with others also seems to be mediocre. Her control of her anxiety seems to be effective.

Retest (20 months later)

5 W	7 F+	1 H	7 P. 2 Orig (-)
1 DW	1 F+/-	1 Hd	F+ 75 (extended 73)
7 D	2 F-	8 A	F = 100 - L = 77
<hr/>	1 M	2 Ad	A = 77
Total: 13	1 CF	1 Vulcano	Affective ratio: 46
	+ C		RT: 1.7 min. (I - VII)
	1 FY		1.0 min. (VIII - X)
			Seq.: indeterminable
			Ap: W - (D) - DW
			Exp.: 1/1
			Colour shock? shading shock?

Tendency to self-criticism, impotence, denials of own interpretations.

More vague and averse to the test than when first tested. Seemed to have more "control" over the situation now, but, on the other hand, was less lively and spontaneous.

Psychogram: Some of the answers (7-9) are repeats. She still appears to be of normal intelligence. Her attitude towards the test appears to have altered a little. She is now more reserved but nevertheless still gives impulsive interpretations and a few unusual ones. Her basic personality structure, as in the first test, is characterized by conflicts and problems, but her ability to compensate is quite effective. Pronounced depression and manifest anxiety seem to be improbable.

Word Association Test (a. m. Rapaport)

Signe

Appeared to be strongly provoked by the test. Her reactions were for the most part restricted to definitions, synonyms or generalizations. It was, however, possible to obtain responses to all words apart from two words of sexual content and foreign derivation. The reaction-times were generally short. Her problems appear to be especially concerned with interpersonal matters ("parents", and "husband") and sexual subjects. Her reactions to less personal matters were rather flat, concrete and common.

The second test included 80 per cent repetitions. The reaction-times were shorter on the average. Her problems were the same.

Hanne

Appeared to be less provoked than her sister, and also seemed to be able to compensate better. Was apt to talk much without saying much indeed. The sexual words of foreign derivation were unknown to her. Her reaction times were usually within normal limits or slightly longer, exceeded 10 seconds only when presented with "mother" and "bite". Her responses were rarely intellectual in type but were marked by an emotional, concrete basic attitude. Her problems were similar to her sister's (parents", and "husband"), and she also manifested sexual problems. There were signs of anxiety, and she appeared to employ repression, reaction-formation and fixation. The reaction-times were in several cases shorter during the second test, but a considerable number were prolonged; 80 per cent of the responses were repetitions. Three words were first responded to after more than 10 seconds ("love", "accident", and "suicide"), presumably reflecting problems related to anxiety and aggression.

Summary and comparison of the test results

Both twins are of normal intelligence. According to their manifest ability they must be ranged about or just below the average. They adopt the same basic attitude (defence, uncertainty, "looseness"). They also partly share the same intellectual structure, being better able to cope with practical and detailed tasks than with verbal or abstract ones; both manifest a peculiar tinge for "pseudo-dementia", especially in the profiles for the Wechsler-Bellevue Scale (Digit Span, Arithmetic, and Block Design). Neither appear to have intellectual ambitions; they have narrow, emotionally-determined interests.

Signe is especially characterized by her lack of self-assurance and her asthenic-depressive traits; she is emotionally inhibited, possesses little insight into her own problems, and is presumably also rather perfectionistic. This is partly an attempt to neutralize her considerable emotional responsiveness and impulsiveness. She shows both somatic (hypochondriac) and phobic traits. Her ability to establish contact is poor; she is both egocentric and anxious. Her state nevertheless appears to alter according to whether she is feeling well or not.

Hanne differs from Signe in various respects. She is less inhibited and stereotyped, rather more sthenic and compensates more actively. Her superficial contact with others is better and her ability to repress anxiety is more effective. Detailed analysis shows, however, that she shares several features with her sister, particularly the emotional attitude, the naive and the hysterical traits. Her mechanisms of defence (fixation, repression and isolation) do not appear to differ much from her sister's. She has the same interpersonal and sexual problems.

Both have difficulties in identifying themselves with their adult and feminine roles. Both have attempted rather infantile solutions, though Hanne seems to have reached the best solutions. They are both predominantly extroverted. Generally speaking Signe is obviously neurotic whereas Hanne, in spite of neurotic features and important conflicts, does not seem to be definitely pathological.

OTHER SPECIAL EXAMINATIONS

EEG. The alpha-frequency was 10 hz, with a maximum amplitude of 75 μ v. The distribution in time of the dominant activity was 50 per cent for Signe and 100 per cent for Hanne. Both manifested occasional 8-hz paroxysms bilaterally. Hyperventilation showed no alterations. Conclusion: normal curves in both cases. (Signe had been subjected to ECT treatment 10-6 weeks before the examinations).

Ophthalmological examination. (Summary of report): Both twins use spectacles, Signe -2.25 and Hanne -3.25. Examinations of the cornea, visus

and refraction, iris and the ophthalmoscopic examinations showed close resemblance in all details. Conclusion: normal results in both cases.

ECG. Both graphs show low Q_1 , but within the normal limits. Conclusion: normal results in both cases.

EPICRISIS

Signe and Hanne were born out of wedlock. Their birth was probably normal.

They were separated when they were three weeks old. From their 14th year they had been aware of each other's existence, but they did not see each other until they were 20. In the course of the years that followed, they had occasional contacts which were never particularly intense, and were always marked by a mutually vacillating attitude. When they were 50, there was a rupture in their relations which ceased from then on.

They were incorporated in this series of investigations when they were 54 years old; their contact was resumed and we kept up the connection with both of them for about three years.

Both were brought up in foster-homes. Apart from this the outer circumstances of their lives, both during their childhood and later on, can hardly be said to show points of similarity.

Signe grew up in a village in Mid-Jutland with her paternal grandparents. They were elderly, and rather simple small-holders, poor and religious, and she was, undoubtedly, somewhat overprotected during her childhood. She was brought up together with two older step-sisters.

Hanne was brought up by strangers in a sea-port in East Funen. Her foster-parents were beer-vendors and ran a boarding house. Their financial circumstances were comfortable, and she grew up as an only child in a rather materialistic and loveless atmosphere.

Signe's schooling, at a village school, has, probably, been inferior to that of Hanne, who was sent to a grammar school.

There are striking differences in the circumstances of their later lives also. Both were given a domestic training, but Signe left home at an early age, moved around a good deal, had an unhappy engagement, which was broken off, and did not marry until she was 47; her husband being a widowed labourer with two children, she herself remaining childless.

Hanne, on the other hand, remained at home until her marriage at the age of 22, to a prison warder, who later became an engine labourer, with whom she had two children and from whom she was widowed at the age of 36. While Signe stopped working after her marriage, Hanne had to resume it on her husband's death, but there is no doubt that Hanne's social and economic circumstances in later life were considerably better and more stable than Signe's.

The different attitudes of the twins to the questions of sexual and material relations and children may be related to the fact that they are twins, since both were under the impression that only one of a pair of twins could ever have children.

Both have evinced a desire to establish contact with their natural family, but Signe is the only one who attempted to contact their parents, and her attitude has been marked by vacillation.

The physical and psychological development of the twins, and their medical histories particularly, run parallel and have many points that are remarkably similar.

Both have, since childhood, presented slight asthenic and anxiety symptoms, but have functioned reasonably well during their early adulthood. From about the age of 35, and accentuated during the menopause, there have been marked and continuous symptoms of neurotic and psychosomatic disorders. Both have suffered from fatigue, sleeplessness, headaches, diffuse pains and sensations, and a marked increase in sensitivity to somatic aversion partly related to the gastro-intestinal system, partly to the urinary system, to the genital organs and to the cardiovascular system. The clinical pictures are dominated by asthenic, anxious, vegetative, and psycho-somatic symptoms with, at times, hysteriform and depressive traits. Both are rather "stubborn" hypochondriacs with cancrophobia. On the whole, the symptoms have been more manifest and the course more invalidating in Signe's than in Hanne's case, but both have needed psychiatric treatment.

There are some outstanding dissimilarities. Signe had never shown any tendency to overweight, while Hanne, presumably by reason of her rather larger eating habits together with her pregnancies and her confinements, has become somewhat obese and stout.

Moreover, Hanne's symptom complex has been classified and treated as a case of Graves' disease. There is a familial disposition to this disease on the twins' maternal side, both the twins' mother and her sister were treated for it, but it seems doubtful whether the diagnosis can be sustained in Hanne's case. It rests, primarily, on the dubious demonstration of an increased basal metabolism, while a number of cardinal clinical symptoms have not been noted. Her clinical symptoms do not differ qualitatively from those of Signe, for whom, at any rate, the diagnosis of Graves' disease cannot be substantiated. On the other hand, they both seem to belong to a reaction-type, which might be described as "thyrotropic" or "thyropathic".

The twins, thus, present similar pictures of a syndrome which must, predominately, be conditioned by their hereditary endowment. The differences that are observed, especially regarding their personality development, defence mechanisms and neurotic symptoms, seem capable of easy explanation by the differences in their childhood environments and in the later

course of their lives, the chief of them being manifested in the difference in their sexual and marital circumstances.

When due consideration is paid to these differences of upbringing and circumstances, the differences which have been disclosed in the twins' case histories must be said to be slight.

Both have been classified as: Neurotic.

CASE IX

KARIN AND KRISTINE

These twins were 64 years old when our investigation of them commenced in 1957. They were included in the twin register at the Institute of Human Genetics, and contact was established with them in the course of a case (Kristine's daughter) where genetic counselling was required.

Karin was the widow of a smallholder and lived in a village in South-East Zealand. She was the first, we approached, and she was cooperative right from the start.

Kristine, who was married to day-labourer and lived on the outskirts of a market-town in central Zealand, did not agree to participate until after several visits to her home—but then she was very cooperative indeed and became even more interested in the investigation than her sister.

The twins had been born in a village in South-East Zealand. They were born out of wedlock. The father, a 30-year-old married decorator, had five children by his marriage and there was no talk of his marrying the twins' mother, a 16-year-old domestic servant.

The twins were separated when three weeks old and placed in different foster-homes.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The twins could give but little information. Kristine had seen her father occasionally when she was a child, but neither of the twins had ever been in close contact with him, and they had never seen their mother.

The father

The twins only knew that he was a dark-haired man with blue eyes, who was said to have been healthy until he died at the age of 77. He was an illegitimate child.

The paternal grandfather was unknown. *The paternal grandmother* later married a day-labourer and had another son by this marriage. She was a twin; photographs indicate that she and her sister were probably monozygotic twins. She is said to have been normal, physically and mentally. She died at the age of 77.

The twins' paternal half-siblings. A half-sister, who had married a labourer and lived in the same town as Kristine, had many children and resembled the twins considerably as regards physical appearance. Otherwise no information was available.

Kristine had been brought up partly by the grandmother and partly by the father's half-brother (cf. the information presented in the description of Kristine's childhood).

The mother

She was the next oldest of five children from a day-labourer's home. After the twins had been born, she placed them in foster-homes and went to Copenhagen, where she married a man on the staff of the tram-company. She had been described to the twins as a small, plump, blonde, blue-eyed woman, who, as far as they knew, was in good health until she died at the age of 70. She had at least two children by her marriage. She had never shown any interest in the twins. No other information was available about her mentality.

The twins' maternal half-siblings: As far as the twins knew, a half-brother died after an accident when adult. Apart from that no information.

No further information could be collected from various official records and files.

Summary of the supplementary information

There was only sparse information and none indicating a predisposition to mental or somatic illnesses. One case of, presumably monozygotic, twins was found in the twins' paternal family.

THE SEPARATION

The twins were born at home, and the birth is said to have been uncomplicated. Karin was born first and weighed most; apart from this no information was available, especially none concerning weight and afterbirth. Neither of the twins had been breast-fed as far as known.

Apparently their paternal grandmother was responsible for the twins being sent to separate foster-homes, when three weeks old. They saw each other again at the age of six. During later childhood they attended different schools and only saw each other once a year, and during adulthood they saw even less of each other.

KARIN

During *the interviews* Karin stated that she had been in two foster homes.

In her first home, where she stayed until three years old, conditions were poor and she was neglected, dirty and shabby.

She was then cared for by friends of the family, a couple of 50-year-old smallholders. The home was poor and the main source of income seems to have been the remittance they had for caring for Karin. Her foster-parents were childless, but they have previously had no less than 11 children in their care, the last of which left when Karin arrived.

Karin thought that, compared with other foster-homes, she had been "lucky", had been well cared for and was not in want. Although she would not equate her home with a normal upbringing, she nevertheless considered that it would have been impossible to find a better foster-home, and she had always felt that she "belonged" there.

Her foster-father was a calm, quiet man to whom she was devoted. Her foster-mother domineered the home; she was rather authoritative, firm, very tidy and hardworking, and she laid great stress on Karin learning these virtues. After having left home Karin continued to keep in close contact with her foster-father and -mother, who died when 91 and 85 years old after always having been in good health.

Her foster-parents ensured that she did not neglect her education; she attended a village school every other day from the age of six to fourteen and apparently the school was average in standard.

From the age of 14 Karin was employed at various places as a domestic servant and later as a housekeeper. During the first interviews she gave only vague information about her youth, although she quite soon informed me that she had given birth to an illegitimate child when young. When she later discovered that her twin sister had said that "Karin has been unlucky", she corrected her statement and now said that before marrying, she had had in all three children by three different fathers.

When 20, she had a child by a forester; they were engaged but he left her and let his parents manage the matter. Karin kept the child, a boy, for four years and then placed him in the care of the parents of the child's father.

One of the reasons for her renouncing the child was that she had another child, a girl, when 24; the father was a soldier to whom she thought she was engaged until she discovered that he was already married and had children. She put this child into the care of strangers.

In both cases she had since only been in indirect contact with her children.

At the age of 26 she had her 3rd child—a girl; the father was a farm-labourer who worked at the same place as Karin for a time. His parents would not allow him to marry Karin. She retained this child.

During the next few years she worked at various places as a domestic servant and was housekeeper for an elderly smallholder, who had lost his wife and who had seven children. They married and Karin's child grew up together with her husband's children, of which two, however, died when still very young. In addition, they had three children of their own. Karin said that none of the children were ever told that they were not true siblings.

She and her husband at first had a smallholding of a few acres. Her life during the first few years of marriage seems to have been very onerous, but relationships with her husband and with her children were harmonious, and she stressed that although she had been brought up in a good home and had been "unlucky" when on her own, conditions improved considerably when she married.

When her husband got "bad nerves" and later attacks of angina pectoris, they were forced to sell the house, about 10 years prior to our investigation, and to move to the house where Karin still lived. Her husband's heart disease made him an invalid and he died at the age of 65 (*death certificate*: coronary occlusion) when Karin was 59. Her children were by now all adults, and she had since lived under well-ordered conditions together with an unmarried son. She received old-age pension, and on the whole her present life was a secure one. She owned the house herself; I visited her several times there; it was well-kept outside and in. She still remained in close contact with her four youngest children and many grandchildren.

Concerning her medical history, Karin stated that she had no serious illness while a child and did not remember anything about the usual childhood diseases.

Menstruation commenced when she was 13 and had always been regular and normal. Climacterium commenced when she was 51 and had not caused discomfort. She had had six births between the age of 20 and 34; the first birth was difficult and protracted and forceps were used, but her pregnancies and other births all progressed normally. She had never been able to suckle her children. When 40, she had an abrasio mucosae uteri performed, but had otherwise never been admitted to hospital.

During her first pregnancy she had varicose veins, which became more severe during the succeeding pregnancies, and she had since had tendency to phlebitis and crural ulcers, treated by injections and elastic stockings.

While younger she was quite slim and at least not overweight, but she gained considerably in weight during her pregnancies (had weighed 66 kg.), and therefore consulted an "American natural healer", who prescribed a vegetarian diet after which she lost a good deal in weight. The diet was, however, too difficult and costly to continue with and she had since then only partly kept to it, although she still was interested in remaining slim. She had never smoked and did not like alcoholic drinks.

During the past few years she had had "muscle rheumatism and infiltrations" and was for some time treated at an out-patient clinic. She used dentures in the upper jaw from the age of 35 and in the lower jaw from the age of 55. During the past couple of years she had used spectacles for "long-sightedness".

She summarized by saying that she, on the whole, had been in good health, and that she had never shown symptoms of nervousness when young, but as an adult she had perhaps been "what you might call nervous", although she had always been "jolly and optimistic".

Karin's children. 1) *Son*, (illegitimate) 44 years old, married, horticultural consultant in Jutland. Said to have been in good health. A seven-year-old daughter, healthy. 2) *Daughter*, (illegitimate) 39, married to a factory worker in Copenhagen. In good health. A three-year-old daughter, healthy. 3) *Daughter*, (illegitimate) 37, married to a farm-labourer in North Zealand. Healthy. Three sons, all healthy.

(These children had, as mentioned, three different fathers).

In marriage: 4) *Son*, 35, unmarried, baker, living with Karin. Healthy. 5) *Son*, 34, married, farm-labourer in the same district as Karin. In hospital when 30. Case records: *ulcus duodeni*. Three healthy children. 6) *Daughter*, 31, married to a haulage-contractor in a neighbouring village. Healthy. Two healthy children.

KRISTINE

During *the interviews* Kristine said that she had been in four foster-homes.

Up to the age of four she was in two different homes, in both cases with strangers. She did not remember anything about them apart from the fact that she had been very unhappy there.

Her paternal grandmother took her away and looked after her herself. The twins' father had never taken an interest in her; although she had grown up in his childhood home, she only saw him a few times and never established close relationships with him.

The paternal grandmother was married to a smallholder and was almost 50 years old, when she gave Kristine a home. She had a son in her marriage and apart from Kristine she had another foster-child, a boy, four years older than Kristine. The children never became fond of each other and had never met since they left their foster-home. Kristine's foster-home was poor; already at the age of eight she had a job looking after children.

When she was 10, her grandmother died and she then moved to her above mentioned paternal uncle (the half-brother to her father), who was at that time 23 years old. He was married and had five children, and Kristine thought that the main reason for him giving her a home was that she could

look after his children and also because he needed the money he received for taking her in. She stayed here until 14 and since then, she had looked after herself and had not been in close contact with her family.

She had thus led an unsettled childhood life, had been in two village schools, her education was neglected because she had to work hard, and due to her frail built she found it difficult to overcome her work. She summarized by saying: "I have never had a real home".

From the age of 14 she had various jobs as a domestic servant in the district. She married when 18 because she was pregnant. Her husband was 24 years old, a labourer, who was addicted to alcohol. Their marriage was not harmonious, marked by poverty, toil and children; she quickly had five.

She was widowed already when 25, when her husband died suddenly of "a tumour of the brain". At the same time two of her youngest children died of "consumption" and "influenza". Kristine then had to work as a housekeeper. The eldest child was taken care of by a brother-in-law, the next by a sister-in-law and she retained the youngest.

When 27 she married a smallholder who was 12 years older. He had just lost his wife and had three children. The four children and the six Kristine had by this marriage grew up together. The first few years they had a smallholding, her husband then worked as a labourer in the market-town on Zealand where they still lived. They built their own house, but they had always had few means, and their life was marked by economic troubles and children, as well as the fact that Kristine also had to look after her many grandchildren. She and her husband received old-age pension.

Her husband had always treated her and the children well. During later years he had suffered from atypical giddiness and Kristine therefore still had to manage everything. I once spoke to the husband who was 76 years old; he seemed "worn out", arteriosclerotic and demented with tremor of the hands.

Kristine had thus had an unsettled life as a house-wife, and a poverty-stricken, hard-working life with many children. She had never been able to "come out on top", but she did not feel that she had ever been particularly nervous, "had had no time to be so". She felt that she had managed because she always had been "jolly and optimistic" and fond of children.

Concerning her medical history, she stated that when a child she was never severely ill and she did not remember anything about the usual childhood diseases. She menstruated when 11, always regular and normal.

When 12, she had an accident: her foot was caught in a harvester, and the tendons at the front of her ankle were severed; she was taken to hospital but she had not suffered from after-effects. Otherwise she had never been hospitalized.

From 18 to 38 she gave birth to 11 children. The pregnancies and births were all normal apart from the last one where forceps-delivery was necessary.

She had never been able to suckle any of the children. Climacterium commenced when she was 51, without serious discomfort.

While she was almost frail and under-weight as a child, and when 23 weighed only 48 kg., she gained a lot in weight during her pregnancies. Since she had been obese to a medium degree and she had never tried to slim. During her pregnancies she developed varicose veins but they were never very pronounced. She had had "rheumatism" in her knees during recent years, and like Karin she had also been treated for "muscle rheumatism and infiltrations". For a short time she had had a slight increase in blood-pressure, but she had never had subjective symptoms. Her teeth had always been poor, and when nearing 30, she used an upper denture and shortly afterwards also a lower denture. During the past few years she had used spectacles due to "long-sightedness".

Kristine's children. (First marriage). 1) *Son*, 54 years old, married, labourer, previously seaman. As a child "water in the lungs, nocturnal enuresis and nail-biting" until 16, since then slight attacks of "giddiness". "Rather dissipated". No children. 2) *Daughter*, 43, married to decorator, lived in Copenhagen. In good health. Two healthy children. (As mentioned 1) and 2) were sent to foster-homes and Kristine's later contact with them had been sporadic). 3) *Son*, 43, married, welder. Admitted to hospital twice. Diagnosis: Menière's disease. (The *case records for his wife*, who had been admitted for observation for a legal abortion, stated that he was "of poor intelligence, hot-tempered, a mental deviant, psychopathic"). 4) and 5) *Sons*, died when infants.

(Second marriage). 6) *Son*, 36, married, labourer. When a child "convulsions", which he had now "grown out of". "Nervous, quick-tempered, sensitive and hot-headed". Never hospitalized. One daughter, healthy. 7) *Son*, 35, married labourer, living with Kristine. Described as "nervous", had "a breakdown" when his son had severe poliomyelitis. 8) *Daughter*, 34, married to a tanner. Had "bad nerves". She had two children by her husband, both healthy, and an illegitimate child, which Kristine took care at home. 9) *Daughter*, 32, married to a labourer. Had "bad nerves" and due to this she had a legal abortion performed. Two sons, the oldest in good health, the youngest, who was 11 had been admitted to hospital repeatedly. *Case records*: myxoedema. Mentally deviant, difficult, violent and aggressive, was recommended for supervision by the mental deficiency authorities. 10) *Daughter*, 31, married to a labourer. Healthy. Six children of which one son showed severe behavioural maladjustment, attended a school for dull children. 11) *Daughter*, 26, married to a labourer. I had an interview with her in connection with the counseling case mentioned in the introduction. She had "bad nerves", had had four abortions, was restless, sensitive, emotionally labile, afraid of being alone and therefore mostly spent her time in Kristine's home.

As her husband was addicted to alcohol, their relationships were not harmonious, they had been separated several times and were about to be divorced. She had a daughter, who was "nervous".

THE TWIN RELATIONSHIP

The twins never saw each other from the age of three weeks, when they were separated, until the age of six years. During later childhood they saw each other exactly once a year at a school-outing.

They resembled each other closely and were often misidentified. When they had jobs near to each other, they often met at dances and the like. Later they only saw each other on rare occasions as they both moved frequently. They were still confused with each other as adults, and Karin, shortly after Kristine had married, was misidentified by Kristine's husband. They had resembled each other more when younger as Karin had remained comparatively slim, whereas Kristine became obese. They had always felt that they both mentally and physically were "the same". On the other hand, their children did not think they were very much alike. Kristine's children thought that the twins' half-sister resembled Kristine just as much as Kristine resembled Karin, and they stressed that Kristine was "far more natural and mother-like", whereas Karin was "superficial and probably not quite trustworthy".

The twins themselves considered that even though their foster-homes had resembled each other in some respects, there was no doubt that Karin had had a far better upbringing than Kristine.

Their attitude towards each other was rather ambivalent. They both expressed mutual sympathy and solidarity "we think alike about most things", but both were also rather critical; Karin said that she, who had been trained to be clean and tidy, found it difficult to accept the disorder in Kristine's home, and this was one of the reasons why they did not see each other more often; Kristine, for her part, stressed that she had not had such a pleasant life as Karin and was apt to disassociate herself from Karin's youthful escapades. Both felt that it was typical that they always had "a good humour and good health".

CLINICAL EXAMINATIONS

Each twin was interviewed five times and once together. I also visited each twin three times and talked with Kristine's husband and several of the twins' children. The twins were very cooperative. Karin was easier to establish contact with, but at the beginning of the interviews her information

was not quite trustworthy, whereas Kristine, who was always reserved, seemed to be more reliable.

They resembled each other closely in spite of the difference in weight, although one would never confuse them. Karin, who was 163 cm and weighed 58.0 kg., was comparatively slim, whereas Kristine, 161 cm 68.5 kg. was definitely obese. Karin looked her age but Kristine looked worn out and older. Karin's face seemed a little longer than Kristine's which undoubtedly was due to the latter being more plump and wrinkled. Their hair was brown with a slight tendency to greying. The hair-boundaries were identical, and the hair was thin and waved slightly. Karin parted her hair on the left and Kristine on the right; the whorls were clockwise. The shape of their heads, foreheads and the surroundings of their eyes, their noses and the details of the ears did not differ. Both had full dentures.

The general somatic examination disclosed varicose veins, rather more pronounced in Karin, who also had pigmented spots dispersed over her legs. Otherwise there were no differences. Both twins were right-handed. Blood-pressure: normal.

There were no obvious differences in their facial expression, stance and gait, but neither did they resemble each other strikingly. Their voices, however, were exceptionally much alike; both talked a Zealand dialect; they said that their dialects differed slightly but typically, but I could not evaluate this.

Both were mainly extroverted; both seemed to be normal in intelligence; probably a little above average without clear difference in level.

Both seemed to be in good humour, but Karin appeared to be rather hypochondriacal and slightly hysterical, and also more obsessional than Kristine, who did not seem to be neurotic but primarily rather resigned and worn-out. Both seemed to have a mild degree of intellectual deficit corresponding to the age, Kristine perhaps more so than Karin.

Clinically neither manifested definitely pathological features, and they were classified as normal personalities.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Karin

Attempted 44 matrices in 30 minutes (matrices C₁₀₋₁₂, B₉₋₁₂ and E₄₋₁₂ were excluded). She was resigned and querulous, did not really accept the task, had difficulties in transferring to new principles. Score: 10+6+3+6+0=25. Distribution: abnormal; discrepancies: 6. Group: about the 50th percentile. Conclusion: normal.

Kristine

Attempted 41 matrices in 30 minutes (matrices C₈₋₁₂, D₈₋₁₂ and E₄₋₁₂ not used). She was also resigned, querulous and did not really accept the task. Her explanations were vague and poor. Score: 8+6+3+3+0=20. Distribution: normal; discrepancies: 2. Group: 25-50 percentile. Conclusion: normal.

Wechsler-Bellevue

	Karin				Kristine			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	10	8	11	8	12	9	12	9
Comprehension	10	9	11	10	11	10	8	7
Digit Span	6+5 = 11	9	6+3 = 9	6	6+4 = 10	7	6+4 = 10	7
Arithmetic	4	4	5	6	4	4	6	7
Similarities	13	11	6	5	14	11	13	11
Vocabulary								
Verbal Points		41		35		41		41
Picture Arrangement	10	9	7	7	6	6	8	7
Picture Completion	7	6	9	8	9	8	10	9
Block Design	9	5	9+3 = 12	6	9+1 = 10	5	6	4
Object Assembly	18+1 = 19	11	17+3 = 20	12	16+1 = 17	9	18+1 = 19	11
Digit Symbol	24/24	6	26/26	6	29/29	7	34/34	8
Performance Points		37		39		35		39
Total Points		78		74		76		80
Verbal IQ	100+1 = 101		94+2 = 96		100+1 = 101		100+1 = 101	
Performance IQ	100+8 = 108		103+9 = 112		98+8 = 106		103+9 = 112	
Total IQ	102+2 = 104		100+2 = 102		101+2 = 103		103+2 = 105	

Karin

Reasonably cooperative, but occasionally apt to be rejective. There were signs of some degree of intellectual deficit. After some encouragement and pressure it was possible to carry out the test satisfactorily. Information showed difficulties in mobilization, on Similarities there were difficulties in abstraction and on Block Design in analysis. On other tests there were signs of diffuse evasiveness. The Digit Span was usual but Arithmetic was very poor, probably not solely due to her difficulties in concentrating but also partly due to emotional factors. Conclusion: normal intelligence (intellectual deficit corresponding to her age). When *retested* (8 months later) (recorded by A. T., evaluated by A. M.), she was not absolutely positive in her attitude towards the test. She was resigned, rather querulous and evasive in her explanations to a greater extent than one would expect from the degree of intellectual deficit due to her age. Compared with the first test the reduction in reversed Digit Span and Similarities is striking. The slight increase in her score on Arithmetic suggests that the degree of intellectual deficit is not significantly greater than in the first test. The scores in the performance tests vary, but the general result is a slight increase, so that her Performance IQ seems to be rather too high compared with one's general impression of her ability. Conclusion: unaltered.

Kristine

Her attitude, like her sister's, was remarkable as there was the same tendency toward evasiveness, slight unwillingness, complaints about the duration and demands of the tests; she also complained of slight headache. The test was, however, completed, but she probably did not do her best. Her results, both quantitatively and qualitatively, lie near to her sister's; there are similar signs of slight intellectual deficit (Block Design, Similarities, Arithmetic?). In addition there is the same tendency toward unusual distribution in some of the sub-tests (Information, Comprehension and Similarities). Conclusion: normal intelligence (intellectual deficit corresponding to her age). When *retested* (8 months later) (recorded by A. T., evaluated by A. M.), her attitude toward the test was still poor, she was slightly resigned, felt that the test was too long, and difficult.

In the verbal tests there are two quite large fluctuations in the scores compared with the first test, a decrease in Similarities and an increase in her score on Arithmetic. In the performance tests there were only slight variations, for the most part an increase in scores. Conclusion: unaltered. (The differences in scores do not appear to be due to increased intellectual deficit but more probably due to emotional factors).

Rorschach

		Karin	
11+2 W	6 F+	2 (H)	6 P. 1 Orig (-)
7 D	3+1 F+/-	1 Hd	F+ 75 (extended 58)
1 Ds	1 F-	4 A	F = 100 - L = 53
<hr/>	1 + M	5 Bt	A = 21
Total: 19+2	1 FC	1 Cg	Affective ratio: 26
	3 CF	1 Cl	RT: 1.0 min. (I - VII)
	1+1 V	4 Obj	0.9 min. (VIII - X)
	2+1 YF	1 Light	Seq: indeterminable (+reversed)
	1 (Y)	1 Ls	Rej: VII
		1 Shadow	Ap: W (D) Ds
			Colour shock, shading shock.

Tendency to perseveration and denied answers.

She several times expressed her dislike, often in a rather exaggerated manner, preferred rather vague responses. She manifested lack of self-confidence, and also a rather evasive attitude, but occasionally she seemed rather aggressive. On the other hand, the task seemed to appeal to her and there was only one, rather doubtful "Versagen" response.

Psychogram: Normal intelligence, probably a little above average. There is a pronounced attempt to generalize, though often in the form of vague perception or concepts. She is rather careful, which, however, is broken by her clear tendency to give constellations, often obviously emotionally tinged. Occasionally her intellectual dissociation succeeds quite well. With regard to contact with others one finds similar features: on the one hand signs of extroversion and sensitiveness and on the other a tendency to evasiveness, and poor ability to establish contact, particularly intimate contact. There are some signs of anxiety and dysphoria. One must expect that her compensation (repression, denial) is more efficient if she is allowed to approach things in her own rather hysterical way. (Ixo-thymic features?). The contents of her responses seem to point to deep-lying problems in establishing contact with others and sexual problems.

Double-blind test

Woman?, presumably elderly. Probably of normal intelligence. Is very vague and imprecise, dislikes taking a definite stand. Seems to be a master in keeping to uninformative and dismissive responses. She poses rather hysterically, perhaps stresses her naiveté a little, but is not as credulous as she makes out. She is easily influenced, extroverted, perhaps apt to feel badly treated, although this probably does not hinder her in establishing contact with others quite easily, or in showing a superficial charm, but she seems to lack intensity in her feelings and deepest down she is probably afraid of strong emotion and of relationships with others that lead to obligations. There is manifest anxiety and lack of confidence. Possible mild depressions? The test results make it probable that there are psychosomatic symptoms.

Retest (8 months later) (recorded by A. T., evaluated by A. M.)

5 W	14 F+	2 H	6 P. 0 orig.
15 D	1 F-	4 Hd	F+ 93 (extended 91)

1 Ds	1 M	2 A	F = 100 - L = 68
1 Do?	2 FC	1 Ad	A = 14
<hr/> Total: 22	1 V	5 Bt	Affective ratio: 23
	2 FY	1 Cg	RT: 0.6 min. (I - VII)
	1 (Y)	1 Ls	0.9 min. (VIII - X)
		3 Obj.	Seq: indeterminable (+ orderly)
		1 Light	Apt: W, D, etc.
		1 Darkness	Exp: 1/1
			Colour shock, shading shock.

Tendency to perseveration and criticism, impotence and appeal to experimenter, low "experience awareness".

Her behaviour was almost the same as before: vagueness, resignation and appeal, often in a rather demonstrative and fluctuating manner. It was again noteworthy that she, in spite of her ambivalent attitude, toward the task nevertheless responded to all the plates.

Psychogram: The number of responses was almost the same as before; over half of them (11) were repetitions and there were two partial repetitions. The difference compared to the first test mainly consists in her attitude being more rigid and compensatory. This is probably not only an expression of a considerable provocation during the first test, but also that she has considerable resources for compensation. Apart from this the main structure of the results is unchanged.

Rorschach

		Kristine		
6 W	9+1 F+	1 H	7 P. 2 Orig (+/-)	
1 DW?	2 F+/-	2 Hd	F+ 85 (extended 74)	
10+2 D	2 F-	7 A	F = 100 - L = 62	
1 Ds	1 M	2+2 Ad	A = 43	
1 Dd	2 FC	4 Bt	Affective ratio: 28	
1 Dds	2 CF	1 Cl	RT: 0.7 min. (I-VII)	
<hr/> Total: 21+1	1 C	1 Ls	0.8 min. (VIII-X)	
	1 V	1 Obj	Seq: indeterminable (+ reversed).	
	1+1 FY	1 Light	Rej: VI	
		1 Sun	Ap: W, D.	
			Exp: 1/4½	
			Colour shock, shading shock.	

Tendency to perseveration, denied answers, central areas preferred.

Resembled her sister in her behaviour, but she was probably better integrated in her evasiveness, which occasionally developed into unwillingness. At the same time she was very interested in the task, and there was only an uncertain case of "Versagen".

Psychogram: Normal intelligence. Her attitude toward the task, compared with her sister's, is perhaps not quite as emotional and ambitious, but otherwise their attitude was very similar, which, however, she is probably better able to compensate for than Karin. Her interest in establishing contact with others and her ability to do so is not really convincing; she is too immature, with only little tolerance of conflict and little insight into herself. The "sthenic" traits probably manifest themselves among other ways in a pronounced intrapunitive tendency, and she is also sensitive, approaching sentimentality. Both hysterical and ixothymic traits also appear. The contents of her responses suggest that she has sexual problems and problems in her relationships with other.

Double-blind test

Woman?, middle-aged? Intelligence normal. She seems unsure of herself in the test situation, rather evasive and apt to give up when she encounters difficulties, although when pressed she manages quite well. There is a rather negative and oppositional quality about the test, which seems to illustrate a tendency to put the blame on others for her own defects. She seems to appeal in a rather injured way. She seems to be easily aroused emotionally, but rather anxious of her own emotionality, and she will presumably disassociate herself from and have difficulty in expressing deep feelings. She probably is incapable of really understanding or sympathizing with others. Her ability to control her anxiety seems quite effective. It seems probable that there are psychosomatic symptoms.

Retest (8 months later) (recorded by A. T., evaluated by A. M.)

7 W	15 F+	3 Hd	6 P. 1 Orig. (+)
14 D	1 F+/-	7 A	F+ 91 (extended 79)
1 Do	1 F--	2 Ad	F = 100 - L = 71
2 Dd	1 M	2 Anat	A = 37
<hr/>	1 FC	6 Bt	Affective ratio: 37
Total: 24	3 CF	2 Cl	RT: 0.8 min. (I - VII)
	1 FY	1 Obj	0.8 min. (VIII - X)
		1 Sun	Seq: orderly - reversed?
			Ap: W, D
			Exp: 1/3½
			Colour shocks, shading shock.

Tendency to criticism, appeal to experimenter, impotence, denied answers, low "experience-awareness".

Her behaviour was unaltered.

Psychogram: The number of responses almost the same. The structure is for the most part unchanged, but her attitude alters in the same way as did her sister's, and must probably be interpreted in the same way.

Word Association Test (not carried out)

Summary and comparison of the test results

The twins' intellectual functions resemble each other closely not only with regard to their actual results but also as regards their attitude toward the test-situation. Both seemed to feel that it was a strain and showed this openly. Kristine is probably more apt to react in a sthenic manner, aggressively and extrapunitively, but not to any great extent, and both are emotional and defensive. Their manifest moderate signs of intellectual deficit correspond to their age. As regards their personalities the resemblances are more striking than the differences and both are mainly extroverted, emotional and easily influenced, and one must expect manifest neurotic traits, possibly in the form of typical psychoneurotic phenomena (hysterical, somatic). Both seem to be unstable in mood, and dysphoria, probably most pronounced in Karin's case, seems likely. Their repression of anxiety is probably not effective and there is perhaps some difference between the twins in this respect

as Kristine appears to be more repressive than Karin, who is apt to dissociate herself and to project. On the whole, their differences are not obvious and seem to be mere differences in degree. Both are rather immature in their ability to establish contact, and the type of relationships they have with others is egocentric, and their ambivalent attitude will probably also manifest itself here in form of alternation between kindness and interest on the one hand and defensiveness, evasiveness and insecurity on the other. Their main problems seem to be sexual and identification as well as problems of accepting and controlling their emotions in general. Apart from the extroverted and hysterical features it is noteworthy that there are also ixothymic features. The latter, in connection with the features mentioned first, may perhaps to some extent lead to perseveration of the somatic symptoms.

OTHER SPECIAL EXAMINATIONS

EEG and ECG (not carried out)

EPICRISIS

Karin and Kristine were born out of wedlock. Their birth was probably normal. They were not breast-fed. They were separated when they were three weeks old. The separation was complete until they reached the age of six years, when they were given the opportunity of meeting each other exactly once a year all through their childhood. Since then, several years could pass without their meeting.

They were examined when they were 64 years, and we followed them for about one year.

Their childhood environments and the later courses of their lives show some similarities. Both, since they were born out of wedlock, were farmed out, and the socio-economic circumstances of their foster-homes can hardly have differed very much.

They both went into domestic service, both married smallholders, who, in each case, were widowers with children. The lives of both have been marked by drudgery, worry and child-bearing, six and eleven children, respectively.

Otherwise there were considerable differences between their childhood environments.

Karin spent her childhood in two different foster-homes, but most of the time was spent at a foster-home which appears to have been favourable. She was brought up as an only child, and all through her childhood as well as later in life, she retained a close affection for her foster-parents.

Kristine's life as a foster child suffered many vicissitudes. She had four different foster-homes, spending most of the time with paternal relatives;

from her 4th to her 10th years, she lived with her paternal grandmother, after which she lived with a paternal uncle until her 14th year. In contrast to Karin, despite the fact that she grew up with her father's family, Kristine did not keep up the connection with her foster family in her later life. She toiled even as a child and, unlike Karin, she was in service while she was still at school; she attended two different schools, and her schooling, by comparison with Karin's, was undoubtedly very poor.

After leaving their respective foster-homes, the lives of the twins followed a markedly different course.

Karin had, between the ages of 22 and 26 years, had three illegitimate children by three different men, before she married, when 26. She became a widow at the age of 59.

Kristine was married when she was 18, because she was expecting a child. Her husband was an alcoholic labourer. They got five children in rapid succession; two died in infancy. She became a widow when she was 25, and two years later she married her present husband.

The twins were alike in that neither of them had been able to tackle the problems of their first children, who were adopted by others. Furthermore, they both took care of children of different beds, partly their own children, partly their husbands' and partly children of their marriages.

Whereas the lives of both, to start with, were those of hard working small-holders, a considerable difference in their circumstances occurred later. Karin was at the time of our investigation leading a comparatively well-ordered and comfortable life, but Kristine's home was still marked by drudgery and want.

Their medical histories have been very similar, since both have, practically speaking, always been healthy. Both have, during their many pregnancies, developed a marked tendency to overweight, which Karin energetically combated by dieting; she was, therefore, fairly slim, whereas Kristine was decidedly obese. Both have, on account of their pregnancies, developed varicose veins, and in their later years, they have been bothered with various, slight psychosomatic symptoms.

Both were intellectually normally endowed, about average, without certain differences, both only slightly reduced corresponding to their age.

As regards personality, they have developed rather differently, although there are also marked resemblances. It was characteristic for them both that they had always had a bright and optimistic outlook and had, on the whole, never given in to their troubles. It is difficult to say for which of them their childhood experiences and subsequent lives have been the more psycho-traumatic.

Karin seems to have been from a child possessed by a sense of order and a desire for cleanliness, possibly bordering on an obsessional behavior; Kri-

stine appeared more worn, resigned and less occupied with herself, but on the whole, the differences in personality appeared to be small.

The information, that is forthcoming from the psychometric investigation, may throw some light on the development of their personalities and on their defence mechanisms, but in this connection, it must be pointed out, that the twins, on the psychometric investigation were evaluated as being more neurotic than on the general clinical examination.

They were classified as: Normal personalities.

CASE X

PETRINE AND DORTHE

Contact was established with this pair of twins in 1955, when they were 70 years old, via the twin register kept by the Institute of Human Genetics. We approached them in their homes; both were cooperative and our investigation lasted three years.

Petrine, who had married a salesman, lived in a small town in the middle of Zealand. She had been adopted by a childless couple and grew up as the only child in a rich home on the coast of Western Jutland.

Dorthe, who was the widow of a shipmaster, lived in a harbour-town on Zealand. She had been brought up in poor circumstances by the twins' mother.

The twins were the youngest of nine children, born in a village in North Zealand. Their father was a butcher, who died when the twins were four months old. The twins were separated when 12 months old.

They never saw each other again before they were 16 years old and even then only for one day. When 18 they lived together with their mother for six months but separated again, although they still kept in touch with each other.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The twins' family, both on their father's and mother's side, came from farming families that had lived in the district where the twins were born, as far back as it is possible to trace the family.

The father

He was 35 when the twins were born. He was the eldest of seven children from a smallholding. He was sent out to work when still young and took a job as a travelling butcher. When 23, he married the twins' mother. Their home was poor and they had many children, but they were said to have lived very happily together.

He was a tall, strongly built man with dark hair and blue eyes, calm and

well-balanced. He had always been in good health until he at the age of 35 died suddenly from a cerebral apoplexy (*death-certificate*).

The paternal grandfather died when still young from "cancer". *The paternal grandmother* was a rather unusual type of woman. She was an illegitimate child of a "fine, noble" family, had been given into the care of a farmer, but even as a child she differed in appearance and behaviour from her rural environment; she was slim, had reddish-blonde hair, had "an aristocratic look and carriage, was refined, finical and very intelligent"; people where she lived called her "strutting Mary". She was much worshipped by her children and grandchildren, and she continued to play an important role in the twins' lives, especially Dorte's, up to her death at the age of 70.

The father's siblings. No information available apart from the fact that three of them died when children from unknown causes. The other three lived to old age, and, as far as was known, they had always been in good health.

The mother

She was 35 when the twins were born. She was eldest of three children. She had worked as a domestic servant until she married when 23. From the age of 24 to 36 she gave birth to nine children; one died in infancy. When she was 36, her husband died, leaving her eight children all of whom still attended school or were younger. She was given public assistance but was forced to take in sewing, work as a nurse or assist at births in order to keep her home going, and the eldest children were sent out to work. Her poverty was the reason for her being persuaded to let Petrine go to foster-parents.

The mother's personality and later life are described together with Dorte's childhood environment.

The maternal grandfather, who had a smallholding and who was a butcher, lived to a ripe old age and had always been in good health. *The maternal grandmother* was a frail, ailing woman, who died from "apoplexy" at the age of 45.

The mother's siblings: No information apart from that they probably did not suffer from serious diseases.

The twins siblings

1) *Brother*, died as an infant of unknown cause. 2) *Brother*, married, tramway official, died when 70 of "bladder and kidney disease". He was confirmed the same day his father was buried. At first he worked as a farm-labourer but left for Copenhagen. He was said to have resembled his father strikingly in appearance. One daughter, healthy. 3) *Sister*, 84-year-old widow after a shipbuilder from a harbour-town in North Zealand. As the eldest girl she was her mother's confidant and "right hand", and among other things looked after the twins. Contrary to her siblings she had always been "melancholic" but apparently did not manifest pathological symptoms until she about the age of 70 became "senile", no longer orientated in place or time, and unable to recognize her family; she, nevertheless, still clearly remembered the twins, although she took both of them to be Dorte. She lived

with her son, a married, well-to-do shipowner, but the twins thought that she really ought to have been placed in a psychiatric institution. 4) *Brother*, married, labourer, died at the age of 63, (*death-certificate*: tuberculosis miliaris). When working at an asphalt factory he contracted pneumoconiosis and his wife infected him with tuberculosis. Five children, a son died when 35 from "tumour on the brain", (*death-certificate*: tuberculoma), the other children were in good health. 5) *Sister*, married to a butcher, died 45 years old (*death-certificate*: cancer mammae). Dorte was very fond of this sister throughout her youth. She had an unhappy life; her husband was a drunkard, brutal and violent toward her and their 12 children. She lost three children, two of which were twins of opposite sex, in a drowning accident. Dorte thought that her cancer had been caused by the husband often hitting her on her breasts when he was drunk; (after her death her husband was committed to a mental hospital following arson, where he since had been under the diagnosis: schizophrenia paranoides). The nine remaining children were all in good physical and mental health. 6) *Sister*, married to a well-situated shoemaker, lived in the same town as Dorte. Died at the age of 68. (*Death-certificate*: cancer coeci perforata, peritonitis). According to *case records* she had previously been admitted to hospital for nephrolithiasis, hypertensio arterialis and adipositas, and was described as pyknic, red-faced, neurasthenic, complaining of "rheumatism". One daughter, healthy. 7) *Sister*, married to a well-situated carpenter, living in a market-town in Zealand. No children. Died when 69 (*death-certificate*: thrombosis arteriae coronariae). *Case records*: obese, with arthrosis of the knee, and hypertension. ECG (just before death): nothing abnormal. (Probably it was a case of pulmonary embolus).

Summary of the supplementary information

The twins' family seemed to have a certain predisposition to cardiovascular disorders, obesity, to cancer and perhaps to tuberculosis.

No predisposition to mental illness was disclosed.

There was a case of opposite-sexed twins in their maternal family.

THE SEPARATION

The twins were born at home. The *midwife's records* state: Petrine was born in a cephalic and Dorte in footling presentation. Both were fully developed and alive. Petrine was born first, 5-10 minutes before Dorte, and weighed 2500 grams, Dorte weighed a little less. No information regarding the afterbirth.

Just after birth Dorte had "convulsions", and throughout her childhood was regarded as the weaker of the twins. Both were suckled by their mother, probably for some months, with a supplementary diet.

They both had rickets when infants; this was said to be the explanation for their still having "weak legs". During the year they were together, they developed normally; Petrine was always a little ahead of Dorte and had begun to walk just before she was sent to her foster-home at the age of 12 months. They closely resembled each other, and only their mother and their eldest sister were able to distinguish between them without difficulty; they differed in mentality, by Petrine being the "mild", Dorte "the little sour one".

The background for their separation was as follows: As it seemed likely that the twins might die, they were christened at home by the local teacher, who was also their godmother. She later went to Jutland and there came into contact with Petrine's foster-parents. After the twin's father's death they contacted the twins' mother, who let herself be persuaded to give them Petrine. They chose Petrine because she was thought to be the one most likely to survive. The twins were completely separated until they saw each other again at the age of 16.

PETRINE

During *the interviews* Petrine gave a rather detailed description of her childhood. Her foster-father was 34 and her foster-mother 27 years old when they started to take care of her. They adopted her shortly afterwards. They lived in a large fishing-village in North-West Jutland and were very well-to-do.

Petrine's adoptive father owned his own cutter and fished lobsters in the North Sea. He was the only son of a rich grocer from the same district and had quite a large fortune from his father, who owned several farms, had a hotel and some ships sailing between Denmark and Norway to where he exported livestock. Contrary to his father, Petrine's adoptive father had never been really interested in business but had at an early age gone to sea and was only at home for short periods while Petrine was a child. According to her description, he was "quiet, weak, very retiring and under his wife's thumb". He never decided any question, even the economic ones. He was given "pocket-money" and had absolutely no authority in the house whatsoever. He never dared openly oppose his wife but tried to help Petrine in secret, but this usually only resulted in the adoptive mother being more unpleasant toward them both. "He was the best person in the world".

Petrine's adoptive mother domineered the home completely. She was the daughter of a chandler from the same district; her mother died when she was a couple of years old and her father married a divorced woman, who had two children and who later gave birth to four. Petrine's mother thus

grew up in a mixed group of children, and she felt that her stepmother, who had been born and brought up in a religious Norwegian home, had neglected her. Ever since her childhood Petrine's adoptive mother seems to have been "peculiar, egocentric and unfeeling". She married Petrine's adoptive father at the age of 19, apparently because she wanted to leave home and because he was a wealthy man.

It was Petrine's adoptive mother, who wished to adopt a child, and according to Petrine's statement the reason for this was solely economical; according to the law at the time, if her husband did not have a child or adopted one, then his fortune would revert to his family, and his widow would only be given a small part.

Her adoptive mother had been told that she would never be able to have a child. She had been examined several times by gynaecologists in Copenhagen as she had never menstruated. She was slim, almost infantile in her build; but according to the descriptions she does not seem to have manifested clinical signs of endocrine dysfunction. She was "an unusual person, undoubtedly intelligent, but quite without feelings, never showed any signs of fondness for other people, was hard, stern, domineering, and cowed her surroundings, pathologically suspicious, jealous, could be violently angry and was difficult to associate with even when together with strangers". In particular, she would not stand others expressing fondness or love, especially not that Petrine and her adoptive father kissed or fondled each other. Petrine doubted that her adoptive parents had ever had sexual intercourse.

Petrine's development was completely dominated by her adoptive mother, and she characterized it as "a life of prohibitions". She was brought up by means of admonitions, threats, rebukes and often corporal punishment. Her adoptive mother treated her like a "doll, or plaything" and photographs showed that when a child she had always been overdressed and decorated. The adoptive mother told her how she should behave, how she ought to sit and move, what she should and should not do, for example that it was impolite to show one's teeth when one smiled, that one should be retiring, only speak when spoken to, never get dirty, etc. Her adoptive mother kept her active all the time; she was quickly given duties in the home, learnt to embroider, play the piano, to dance, but was rarely allowed to enjoy herself or to play, and then only with certain children. She could not remember ever having had a party, and conditions in the home meant that children were rarely invited.

The adoptive mother was extremely meticulous about cleanliness in the house, "nearly always had a duster in her hand". She sometimes spring-cleaned for months at a time, made everyone uneasy, and when she had finished, no one was allowed into the rooms; when the adoptive father was at home, he was sent into a small room where he was allowed to smoke his pipe.

Petrine had first understood that her adoptive mother in fact was ill after she had become an adult, but she still did not understand that "such a little woman had been able to cow her surroundings so completely". Her adoptive mother had "given her complexes for life"; she was cowed, inhibited, unfree and this, she thought, was against her real nature. Petrine said that her childhood had "really been horrible", her upbringing "bungled" and she thought that the reason why she had managed to get through her childhood and had not "ended in a madhouse" was that "I must have had a good portion of common sense to resist with".

At school, when freed from the influence of her adoptive mother, she was lively, energetic and developed as a glad young girl, which often gave rise to critical comments from the teachers, and her adoptive mother took these comments very seriously. She attended school from the age of 7 to 14; it was a good one—a private school for girls—and she had no difficulties in her work; apart from the usual subjects she also learned languages. She would have liked to have continued school, but her adoptive mother considered that it was improper for her to go to school together with boys.

When Petrine was 12–13 years old, two events occurred which Petrine thought was decisive for her relationships with the adoptive mother and thereby for her later mental development.

At school her friends had said to her that she did not resemble her parents and probably was adopted. Her adoptive mother had, however, denied this as "foolishness". When she was 12, this matter was brought up again. Her true mother had demanded that as a condition for the adoption Petrine was to be told about her natural family as soon as she could understand it. Petrine's adoptive mother had been able to postpone the problem, but the twins' mother sent Petrine a picture of a girl, which Petrine thought must be a picture of herself. Her adoptive mother was forced to admit that Petrine was an adopted child and that the girl in the picture was her twin sister, but the adoptive mother mainly used the situation to stress how thankful Petrine should be for not having been forced to grow up in her poor family. This information made a deep impression on Petrine, and she had a period where she speculated a lot about the matter. Her relationship with her adoptive mother altered, and she tried to oppose her regime in a "mutiny". This led to conflicts and as she had no one to whom she could talk in confidence, she felt even more lonely than before. Sharp words were often used, and during the interviews she often returned to a sentence, she had said to her adoptive mother: "When God has not given You children, then I don't think You ought to have been given permission to have me". She thought that it had undoubtedly been very "unlucky" that she "broke out of the tyranny" when she was in puberty and her adoptive mother in "a type of climacterium".

When Petrine was 13 years old, she menstruated for the first time. She was completely unprepared as her adoptive mother had never mentioned that such could happen. She clearly remembered that she had run into her adoptive mother, who with every sign of disgust had said that she "would not have anything to do with such dirt" and that Petrine was "an abnormal and disgusting thing". Petrine was very affected by this episode, was bewildered and unhappy and did not know what she should do; for about six months she suffered from infection in the genital region. According to her description, she at this time had a severe psychogenic depression, was suicidal, thought about drowning herself in the sea, and for several months kept some tablets of arsenic on her person which she had stolen from her adoptive mother's medicine-cabinet. The situation altered when one of her adoptive mother's aunts visited the home and discovered what was wrong; she criticized Petrine's adoptive mother, accused her of "harming the child". Since then Petrine's adoptive mother had never shown her feelings about Petrine's menstruation, but she had often difficulty in hiding them.

These episodes, thought Petrine, were the reason for her leaving her adoptive parents a few years later.

When Petrine was 15, her adoptive mother decided to sell the house and move to Copenhagen and "live on the money". Although her adoptive father was unhappy about this, he did not dare to oppose his wife's decision. They obtained a large flat, but both Petrine and her adoptive father found it difficult to adjust to life in the city. Her adoptive father hated not having work to do and soon obtained a post as a harbourmaster. Petrine missed her friends, spent her time alone at home with her adoptive mother and felt lonely. She was given permission to attend a school for domestic science and also worked as a domestic servant. During this period her adoptive mother was almost constantly bedridden. The physician is said to have called her illness "imagination", but Petrine thought that the adoptive mother was "undoubtedly mad"; she had hysterical fits, hectored her surroundings, had a large number of private nurses, and gradually she started to abuse both drugs and alcohol.

Petrine established contact with her natural family when she was 16 years old after having being told about them by one of the twins' elder sisters, who happened to work as a maid in the house of a relative to Petrine's adoptive mother. A meeting was arranged in secret and the twins were together for an evening in "Tivoli". They resembled each other strikingly and immediately felt mutual sympathy—"held each other by the hand the whole evening".

Petrine thought a lot about how she could leave her adoptive parents, and after a series of arguments with her adoptive mother, she decided to run away. She was then 18. She and her elder sister were just about to get into the train when her adoptive mother turned up, which Petrine felt was

typical, as her adoptive mother always had had an exceptional ability to sense if Petrine was hiding something from her. Petrine was brought back and confined to her room. During the next few months the problem was negotiated with Petrine's family until finally her adoptive mother agreed to go with Petrine to her twin sister and mother. Her adoptive mother hoped that Petrine would yield once she had seen what the home looked like. Petrine, nevertheless, insisted that she wanted to stay with her family. Her adoptive mother tried both to persuade and threaten her to return with her, and it was a long time before her adoptive mother finally sent her her clothes and personal effects, and she never sent any money.

Petrine lived for six months with her mother and Dorte in their two-roomed flat. The reunion was a great disappointment. Petrine found it difficult to become used to the rather poor conditions, and felt that she, due to her upbringing, reacted differently from her mother, although she still was very fond of her twin sister.

She was, however, incapable of feeling fond of her mother, who tried hard to bind Petrine to her and in this way achieved almost the opposite. Petrine felt that she had to balance between the two homes. She found this situation very difficult, and especially mentioned that direct physical contact with her mother was unpleasant; ever since childhood Dorte had been used to sleeping in a double bed with her mother, and when Dorte the first night suggested that Petrine should sleep with her mother, Petrine had "gooseflesh all over her body", could not fall asleep, felt disgusted by such close contact with another human, whom she was incapable of feeling was anything but a "stranger". "I have never felt the ties of blood".

She obtained a post in a firm in the town and decided to live in lodgings. During the next few years she remained in the town and retained contact with her twin. They resembled each other closely, were often misidentified. Dorte had been engaged since she was 16 and this led to a clash of interests and, according to Petrine, Dorte had thought of breaking it off, but shortly afterwards Petrine met her later husband, they became engaged when Petrine was 22 and married after six months.

Petrine's husband was at that time a grocer's assistant. They purchased a shop in a village in central Zealand, moved from there to a town in the same district, and here Petrine had remained. Shortly before she married she became reconciled with her adoptive mother, after she had been asked to return home. During the reconciliation her adoptive mother expressed her regret for the way she had treated Petrine, and their relationship altered. Her adoptive mother became more easy to deal with and indulgent, but she never altered her behaviour toward Petrine's adoptive father.

Petrine's husband gave her a good social standing. He was a representative for various wholesalers, and they were well-situated, had their own house,

a car, and were able to give their six children a good education. Petrine took part in her husband's work, among other things looked after his accounts. They had periodic economic difficulties, but otherwise they had never had important problems. When her adoptive father was pensioned Petrine arranged that the adoptive parents came to live in a boarding-house in the town where she lived; her adoptive mother died a year later at the age of 64. Her adoptive father then came to stay with Petrine until he died at the age of 82. She inherited what she called "a small fortune", but this was partly lost because of unlucky dispositions.

Her husband, who was 5 years older, was at the time of our investigation retired on a pension. He was described by Petrine as "a typical business-man, who had always been absorbed in his work". He had always earlier been in good health but had gradually become "old, hypochondriac, with 'heart-nerves'". According to Petrine their marriage seems to have been harmonious on the whole. They had interests in common, but were mentally very different and her husband had never been able to understand what he called Petrine's "unnaturalness", as he considered that she ever since youth had been far too retiring and modest, shy and inhibited, and had had many difficulties in her relationships with other people.

Regarding her medical history, Petrine stated that when she was adopted she was small and frail, had rickets, but under her adoptive mother's strict treatment she soon became "fat and bulging". She developed normally, began to talk and was continent at the normal times. She did not remember anything about her usual childhood diseases.

After being vaccinated for smallpox she had "sun-eczema", localized to her hands and neck; it reappeared every summer until she was 40 and then this tendency suddenly terminated. When 12 she had "severe influenza with pneumonia", treated at home, and she thought she had been about to die. Ever since childhood she had been "oversensitive" or "allergic", especially as regards primula; this plant made the surroundings of her eyes swell and redden.

Menstruation commenced when she was 13, had always been regular and natural, never accompanied by molimina. She gave normal birth to six children between the ages of 26 and 36; no stillbirths. Apart from the first child she had been able to suckle them all. Menopause occurred when she was 42 without distressing symptoms.

As a child she ate relatively well, had "a very good appetite", but she was never overweight. During her pregnancies she gained considerable weight and had since been moderately obese, but she tried hard to keep slim.

As an adult she had had periodical, mild dyspeptic symptoms because of "too much acid", kept a diet but had otherwise not been treated and neither had she been examined in detail. From about the age of 40 she

started to have attacks of abdominal pain. She described these attacks as follows: "It begins with a smart in my navel and spreads as if it was "reflex pains" and then I become warm and cold in stripes and finally ice-cold over my whole body and at the same time the pains are so severe that I become afraid and feel death nearby, and then I usually faint". The attacks occurred without known cause and without prodromal symptoms apart from a certain "emptiness" in her head; she stressed that she had never had attacks outside her home and that it was possible that the attacks were "allergic". As the attacks never lasted more than a few minutes, she never managed to call a physician, and neither her husband nor her children had ever seen an attack. There were no definite post-paroxysmal symptoms, especially none indicating epilepsy. Occasionally, the attacks were accompanied by a strong desire to defecate or diarrhoea. On a few occasions she had hurt herself when she fainted and had once been slightly concussed and once had a luxation of the shoulder. Her attacks ceased after she had her appendix removed when 59, but during the past couple of years she had noticed a tendency to renewed attacks, although she was apt to think that they were disappearing again.

She had been admitted to hospital twice. The *case records* stated:

1) When 38: Two years ago abrasio mucosae uteri. Apart from "lumbago" always in good health. A month before admission without known cause pains in the right side of her back, which progressed downwards along the back of her right leg, stretching from the buttocks out to the foot. Objectively: obese (80 kg.). There was slight hyperreflexia on the right side. Laseque's sign was positive. There was a painful region round the nervus ischiaticus, hypoaesthesia on her calf and ankle, but otherwise no neurological symptoms. ECG: nothing abnormal. Blood-pressure: 180/80. The symptoms disappeared during conservative treatment. Diagnosis: *ischias, hypertensio arterialis*. 2) Readmitted when 59: Diagnosis: *acute appendicitis*. The case was typical. The appendix was removed; it was adherent to the surroundings.

She had not been in hospital since, but had been treated in an out-patient department due to "arthrosis" in both knees.

Her oversensitiveness to primula continued. Six to seven years before the investigation she had been seriously "poisoned" by primula; the right side of her face was swollen, and this lasted about a year. During this period she started to have "tics" or "spasms" in the lower right eyelid gradually spreading to the surroundings of her eye. They occurred in attacks and were sometimes very pronounced; they were very dependent upon mental factors and as they mostly occurred when she talked to people she did not know, she felt very distressed by them. She had been treated by a neurologist and still attended for control examinations; at one time she had been afraid that she had a "tumour on the brain".

Four years before our investigation she had had a "clot on the heart". When cleaning she had pains in the left side of her chest, had to go to bed, was examined as an out-patient, but nothing abnormal was disclosed. She nevertheless seems to have been rather worried and had since had dyspnoea. She had never had headaches, giddiness or visual symptoms. Since the age of 50 she had used spectacles due to "longsightedness". She used full dentures.

She said that ever since childhood, she had been "nervous", but she had always been able to control herself. During the last couple of years she had been more sensitive to noise than before, was easily irritated by sharp, unpleasant voices and her husband's "humming and various sounds" affected her so much that she often had to find an excuse for going out. Apart from these symptoms she had on the whole always felt well and mentally healthy.

Petrine's children. 1) *Son*, 44-year-old married grocer. Three healthy children. As a child hospitalized for a surgical tuberculosis; he was very "allergic" toward various substances but otherwise in good health. 2) *Son*, 42 married, plantation-owner. Healthy. Three healthy children. 3) *Son*, died at the age of 1 year (*death-certificate*: causa ignota, febris). According to Petrine he had had "convulsions"; she did not react much to his death as she was pregnant at the time. 4) *Daughter*, 39, divorced, nurse, living in New York. No children. Always in good health, but she was "allergic" like her eldest brother. 5) *Daughter*, 36, married to a Danish-American businessman, lived on Long Island. No children. Always in good health. 6) *Son*, 34, married, representative. Three healthy children. During the War active in the Danish resistance movement, was in a German concentration camp, since then "nervous", but otherwise healthy.

DORTHE

During *the interviews* Dorte stressed that she was brought up together with her four siblings, who were 7 to 13 years older than she. In spite of their poverty and especially the lack of a father, she had a "happy" childhood, marked by strong family feeling and solidarity; her siblings left home to work when still young, but she continued to retain close contact with them throughout her life.

From the age of 12 she was the only child at home with her mother and this led to their becoming very attached to each other. She always spoke of her mother in warm terms, and described her as a small, frailly-built, blonde woman with blue eyes, an unsophisticated, very hard-working woman, who sacrificed herself for her children and brought them up with a loving hand to be industrious and thrifty. She was a calm person, who never expressed bitterness about her fate, apparently very realistic and unneurotic.

Dorthe attended a normal village school from 7 to 14 years of age, but only every other day, and she only learned the elementary subjects, Bible and Danish history.

After this she worked at the local vicarage, but at the age of 15 she and her mother moved to a nearby town, partly because her mother found it easier to obtain temporary work there, and expected to receive old-age pension, partly because two of Dorthe's siblings had married and settled there. Dorthe worked as a shop-assistant, and her mother continued to take in sewing and function as midwife. They lived in a small two-roomed flat. As mentioned, Petrine stayed there for six months, when the twins were 18 years old.

When 19, Dorthe married after having been engaged for some years. Her husband was 12 years older than Dorthe and was a shipmaster. They obtained a small but well-kept house near the harbour where Dorthe had lived ever since. Her husband owned a cutter and during the first few years Dorthe sailed with him, but when she had children, she had to stay at home. After some years Dorthe's mother came to stay with them and helped to look after the children.

Her mother was in good health both mentally and physically until she at the age of 61 was admitted to hospital (*case records: gangraena pedis arteriosclerotica*). Her leg was amputated at the thigh, but she continued to be active with the aid of a wheel-chair and remained mentally intact until she died at the age of 87.

Economic conditions were moderate but stable and the family life was quiet and harmonious, but, as Dorthe was often alone, she was forced to manage the home alone quite early, became independent and used to taking life as it came.

Her husband died at 63 (death-certificate: *cancer coli*). Up to this time he had always been in good health. Mentally he was said to have been a quiet, calm man.

Dorthe was at this time 48 years old, her children 16 to 20 years old. She encountered considerable economic problems, and the first two years after her husband's death had been "the hardest in my life", among other things because her eldest daughter died of tuberculosis. She sold the cutter; this just managed to cover their debts, and she was able to keep the house. At first she tried to take over a kiosk, but later was given the post of collector for the official lotteries, which "had saved her". She had since had a satisfactory income, lived alone, looked after herself, but was very closely attached to her children and grandchildren. Yet another of her daughters died of tuberculosis, but in spite of these sorrows she was on the whole satisfied with her life.

Concerning her medical history, Dorthe said that she had rickets as a child but otherwise developed normally; she walked and talked at the normal time

and was continent at an early age. She did not remember anything about the usual childhood diseases.

She believed that she had been left-handed as a child and preferred using her left hand, but at school she was forced to use her right hand. She still wrote with her right hand but used her left hand when working with a hammer or throwing, and she felt that if she lost her right hand, she "would quickly be able to use the left".

She had been "allergic" to primula ever since childhood; this manifested itself by oedema and reddening of the face. Her oversensitiveness had continued in adulthood, but, as opposed to Petrine, she had never had serious symptoms.

She began to menstruate at the age of 12. Menstruation had always been regular, normal and never accompanied by molimina. Between 20 and 30 she had four normal pregnancies and deliveries. No stillbirths. She had suckled her children for about four months. Menopause occurred when she was 43 without distressing symptoms.

She had always had a good appetite and like Petrine, she gained considerably in weight during her pregnancies, but her obesity was less pronounced, perhaps because after having been left alone she took her meals at irregular times and never really bothered much about preparing food for herself.

She had had rather distressing dyspeptic symptoms, especially during the past couple of years. She described them as pressing pains in her diaphragm, occasionally she had a feeling of "cold" in the body. Her symptoms varied considerably according to the season and were most pronounced in the autumn, when she had typical hunger-pains which were relieved when she ate. She thought that she had "too much acid". For some years ago she had been X-rayed, and she said that this showed "two small ulcers in my stomach". She was treated with various drugs with some effect. Her physician had said "that is was probably nervous", but Dorte could not accept this as she had never felt "nervous" and did not feel that her life had ever given her reason to do so.

About the age of 30, probably after her last pregnancy, she started to have attacks of abdominal pain. She described these attacks as follows: "They occur without any real reason, begin with sensations around my navel and then I am ice-cold in my head, feel cold all over, have colic that gets insufferable. I am afraid of dying and then I usually faint. The attacks last a few minutes". There were no definite post-paroxysmal symptoms; occasionally she had a tendency to diarrhoea or defecation. The attacks occurred with varying frequency and were particularly liable to occur at night. During the past couple of years she had been able to terminate the attacks by means of abdominal massage, and the attacks seemed to have become less frequent.

Since 30 she had also had mild attacks of "lumbago". During our investi-

gations she had an attack without known cause; she was very distressed, called in a physician, but he did not give treatments, and she therefore approached a chiropractor, who gave her manipulation-therapy, but during this her symptoms developed to "ischias" in the form of pain in the back of the right leg; she was in great pain, could not sleep, had to snooze in a chair as she could not lie down. The symptoms disappeared gradually. She was very inconvenienced by her sleeplessness during this period and felt that she was far less tolerant of noise than before, could not stand strong light or voices.

She stressed that, on the whole, she had been in good health. She had used spectacles for some years because of "long-sightedness" but otherwise there were no sensory defects. She had used full dentures since the age of 50. During later years she had been incommoded to some extent by arthrosis in both knees, but she had never sought medical assistance.

Addendum. Dorte died when 75, two years after our last contact with the twins. The *death-certificate* states the cause of death as *cancer*, but as no autopsy was performed the localization of the cancer (probably gastric, colonic or ovarian) could not be verified.

Dorte's children. 1) *Son*, 50-year-old, married, mechanic, always in good health. Two healthy children. 2) *Daughter*, married to a draper. Died when 30 from tuberculosis. The *case records* state: admitted to hospital three times; was pregnant on the last occasion. One had considered legal abortion but had decided that it was more dangerous than if she gave birth and one attempted to provoke premature birth. During the parturition it was discovered that she had twins. The first twin was delivered by forceps. The twins, both boys, were stillborn. The placenta and chorion were single with numerous infarcts. She was weak after parturition and died shortly afterwards. Diagnosis: tuberculosis pulmonum et laryngis, partus difficilis (gemelli, monozygotic). 3) *Daughter*, unmarried shop-assistant. Died when 37. *Case records*: Since 23 years old admitted to hospital several times, treated with thoracoplasty. Diagnosis: tuberculosis pulmonis cavernosus. 4) *Daughter*, 38, married to an insurance-agent. Exceptionally allergic to rubber and nickel, but had otherwise always been well. Three children, of which two were twin boys, who seem to be dizygotic; all were well.

THE TWIN RELATIONSHIP

Since the twins first met, they had often been misidentified, even by their siblings. They also seem to have resembled each other closely in mental respects and they had always felt very much attached to each other. Their similarity when young is confirmed by photographs taken when they were 24

years old: they are fashionably dressed in high-necked lace frocks with exactly the same hair-style, both very pretty girls, who look intelligent and resemble each other exceptionally; their profiles are particularly characteristic and uniform.

They never became very intimate, however, they were rather like good friends, and they differed in certain respects. Petrine was very dependent, always paid great attention to others' opinions, whereas Dorte was more self-sufficient, "said what she meant, and behaved more natural".

Petrine felt that she was more "nervous" than Dorte, but otherwise she did not think that they differed in important respects, and they both felt that had they grown up together, they would have resembled each other even more. Common to both was their optimism.

Dorte thought that their differences were comparatively unimportant, and that Petrine had been "spoilt" by her upbringing. She described Petrine's adoptive mother as an unusually egoistic, tyrannical and self-interested woman, and believed that this explained why Petrine had always lacked self-confidence. Whereas Petrine had always had someone else, who decided things for her—first her adoptive mother and then her husband—Dorte had early had to help her mother and, perhaps particularly when she lost her husband, had been forced to become independent. Dorte did not directly criticize Petrine, but nevertheless said that she often felt that Petrine was "false" in her behaviour, was apt to "pose" and very interested in "decorating" herself.

The twins agreed that there had been important differences between their childhood homes in social and economic respects, and that Petrine's life in this respect had always been more protected. When the twins compared themselves with their siblings, they agreed that although they had grown up in different surroundings, they resembled each other far more than they resembled their siblings, who had developed into very different personalities.

CLINICAL EXAMINATIONS

Each twin was interviewed seven times and the twins were interviewed together twice. I visited each of the twins' home once. Both were cooperative, positively interested and also seemed to show some understanding of the intentions behind our investigations.

Outwardly they resembled each other. Both were of medium height, rather obese; Petrine was 159 cm and weighed 85.0 kg; Dorte was 157.5 and 80.0. Their obesity was mainly of a truncular type. Both were grey-haired, beginning to be white-haired (had previously been dark blonde). Their hair was straight, apart from a slight wave; both parted their hair on the

right and the whorls were clock-wise. The boundaries of their hair were identical. Their eyes were bluish grey and identical in colour; both showed slight arcus senilis. Their faces were very similar; both had comparatively deep-lying eyes and strikingly deep naso-labial furrows. Petrine's nose deviated slightly to the right (a sequel of a fracture in childhood). The position and details of their ears and the unusually large lobes were identical. Apart from moderate arthrosis deformans in both knees the somatic examination disclosed nothing abnormal and no obvious differences. Their blood-pressures were rather labile: Petrine 185/80-130/75, Dorte 170/70-130/75. Petrine was right-handed, Dorte ambidextrous, probably originally left-handed.

In spite of their having strikingly similar stance, gait and movements, their behaviour nevertheless differed. Both were nice, elderly ladies, tastefully dressed, but Petrine was rather more apt to finery than Dorte and as a whole more "ladylike". Their facial expressions were also rather different, undoubtedly because Petrine used cosmetics and therefore looked younger. Both were well-preserved and both looked younger than their age.

Another difference was that Petrine had facial tics; they were frequently present during the interviews, especially when she seemed to be emotionally engaged. They were localized around the right eye and were sometimes quite violent and diffused. She was clearly embarrassed and usually tried to hide them by placing her right forefinger in a "thoughtful" position.

Both seemed to be extroverted, energetic, lively, clearly above average intelligence and apparently equally well endowed. Neither appeared to show more severe intellectual deficit than one would expect from their age.

They likewise resembled each other in character and emotional reactions. Both were stable and trustworthy.

Petrine, who was easiest to establish emotional contact with, seemed clearly more neurotic than Dorte, lacking self-confidence to some extent, but at the same time also more ambitious. Sometimes she seemed to want to establish contact, and sometimes she was evasive and vague, talked in a lively and spontaneous way but also rather unsystematically, for instance, about her adoptive mother and childhood experiences. Her speech was more cultivated and her choice of words more elegant than Dorte's and she spoke without trace of local dialect.

Dorte seemed to be less complex, more straightforward, very realistic in her attitude but also more reserved. She rarely made spontaneous remarks and it was rather difficult to establish contact with her verbally, but occasionally one, nevertheless, was in better emotional contact with her than with Petrine. She then spoke freely and spontaneously about episodes in her life, especially about her travels abroad with her husband, and showed warmth of feeling and adequate emotional variations when she spoke of the problems she encountered when her husband and children died.

The twins were tactful toward each other and showed mutual sympathy and respect, and they did not try to domineer each other.

Neither of the twins showed definite psychopathological traits, and must be classified as normal personalities with only slight neurotic traits which were more pronounced in Petrine than in Dorte.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Petrine

Attempted 55 matrices in 41 minutes (matrices E₈₋₁₂ were excluded). Seemed labile and impatient but not really uncertain of herself. Did not accept the test well, especially not the latter part of it, but cooperated satisfactorily. Score: 10+9+8+5+1=33. Distribution: normal; discrepancies: 4. Group: approximately 75-90 percentile (extrapolated). Conclusion: above average in intelligence.

Dorte

Attempted 55 matrices in 42 minutes (matrices E₈₋₁₂ were excluded). Seemed unsure of herself, occasionally corrected her solutions, was rather apt to appeal to the psychologist and was interrogative. One also had the impression that she did not really mind how well she did the test. Taking her age into consideration she cooperated satisfactorily. Score: 10+9+6+6+1=32. Distribution: normal; discrepancies: 4. Group: approximately the 50th percentile (extrapolated). Conclusion: above average in intelligence.

Wechsler-Bellevue

	Petrine				Dorte			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	15	11	17	12	15	11	15	11
Comprehension	16	14	13	11	9	8	10	9
Digit Span	7+5 = 12	10	7+4 = 11	9	7+3 = 10	7	7+3 = 10	7
Arithmetic	7	9	4	4	7	9	7	9
Similarities	16	13	17	14	15	12	13	11
Vocabulary								
Verbal Points		57		50		47		47
Picture Arrangement	7	7	10	9	9	8	9	8
Picture Completion	14	14	13	13	11	10	12	12
Block Design	18+2 = 20	10	15+2 = 17	8	10	5	12+2 = 14	7
Object Assembly	17+3 = 20	12	17+3 = 20	12	17+1 = 18	10	17+3 = 20	12
Digit Symbol	38/39	9	47/47	11	24/24	6	32/32	7
Performance Points		52		53		39		46
Total Points		109		103		86		93
Verbal IQ	116+3 = 119		109+3 = 112		106+3 = 109		106+3 = 109	
Performance IQ	118+9 = 127		119+10 = 129		103+12 = 115		111+13 = 124	
Total IQ	121+4 = 125		117+5 = 122		107+4 = 111		111+5 = 116	

Petrine

Seemed confident. It was striking that she had a low score on Picture Arrangement and a relatively low score on Arithmetic (both presumably being emotionally-deter-

mined), as well as on Block Design where she worked quickly and in a qualitatively unusual (almost "organically") manner. Conclusion: about average in intelligence (slight "organic" signs but less than one would expect according to her age). When *retested* (17 months later) her behaviour was in the main unchanged, but her dislike of Arithmetic was far more pronounced. Her verbal scores were somewhat lower than before, but her scores on the performance tests were almost unaltered. (Her score on Block Design was possibly too low, as item number 7 was not used; one should probably not have done this, as she had solved it during the first examination). Conclusion: On the whole no change. (The small decline in her total score is probably due to her attitude; there at least does not appear to be any important progression in her dementia).

Dorthe

Seemed rather nervous during this test and was fidgety. The most noteworthy scores were on Arithmetic, Digit Span and Block Design, and these also showed qualitatively striking features. Conclusion: above average in intelligence ("organic" features, hardly more, probably less pronounced, than one would expect from her age, but they are more clear than her sister's). When *retested* (17 months later) she appeared to be less nervous, but otherwise her attitude was unchanged. (The twins had in the meantime discussed some of the tests, and this is perhaps the reason why she managed better on some items, but as she did worse on others, her verbal scores remained unaltered). Her scores on the Performance tests, however, improved somewhat. Whether this improvement is due to her previous experience on the Block Design and Assembly tests, or due to her being less nervous is difficult to ascertain. She still manifests the low scores on Digit Symbol and reversed Digit Span. Conclusion: no change.

Rorschach

		Petrine		
9 W	9+1 F+	2 H	7+1 P. 2 Orig (---/+)	
11+2 D	1 F+/-	1 Hd	F+ 79 (extended 68)	
<hr/> Total: 20+2	1 F-	6 A	F = 100 - L = 60	
	1 M	1+1 Ad	A = 35	
	1 FM-	4 Anat	Affective ratio: 45	
	1 FC	2 Bt	RT: 0.7 min. (I-VII)	
	2 CF	1 Cl	0.4 min. (VIII-X)	
	1 C	+1 Obj	Seq.: indeterminable .	
	2+1 FY	3 Others	Rej: VI	
	1 YF		Ap: W - D	
	+ Y?		Exp: 1/4	

Criticism, taking notice of symmetry, blot-mentioning without giving interpretations.

Her behaviour corresponded to that on the intelligence tests. The material seemed to appeal more to her, but her attitude was ambivalent and fluctuating, as also were her responses, qualitatively as well as quantitatively.

Psychogram: Quite intelligent. Shows ability to survey the situation and appreciation of the practical; she is, however, rarely very accurate or detailed. There are obvious emotional difficulties due to complexes, leading to fluctuating production, shifting quickly from reservation and inhibition to impulsiveness and emotional responses. Some role is played by a certain degree of intellectual deficit, which manifests itself in vagueness, difficulty in associating and difficulty in mobilizing words. Her dementia is, however, not particularly pronounced. One must assume that there are important emotional causes behind her ambivalence which gives rise to for example uncertainty and banal responses on the one hand, and on the other hand desire to express herself. Her normal mood is probably neutral, but presumably she can become agitated, dysphoric or anxious. She is,

however, mainly extroverted and her self-insight is probably rather inhibited. In addition one must presume that she is occupied with somatic phenomena and that there are some hysterical features. There does not appear to be manifest anxiety, but there are varying defence-mechanisms. She seems rather egocentric, and there must be important sexual and identification problems. When judging her results one must take into consideration that she nevertheless manages quite well without showing obvious signs of pathological reactions. She can presumably compensate quite well, and thus she possesses on the whole a certain degree of effectiveness.

Double-blind test

Woman? Probably not young. Her intellectual potential seems quite good, but she is presumably too apt to engage herself emotionally in situations, which do not normally demand such reactions, and this will hinder proficient use of her potentialities. Anxiety seems occasionally to become so strong that she will block completely, but most often her control will be effective enough for her to manage quite quickly. There is a tendency toward projection, but this interpretative attitude seems to be marked by cautiousness. Presumably she is a little afraid that her imagination might run away with her. She seems mainly introspective, very sensitive and with poor possibilities for adequate emotional expression. There is manifest anxiety, and she is emotionally tense. There is probably tendency to somatization. Mood lowered?

Retest (17 months later)

5+1 W	4 F+	1 H	5 P. 0 Orig.
5 D	1 M	4 A	F+ 100 (extended 90)
<hr/> Total: 10+1	1 FM	2 AD	F = 100 - L = ca. 50
	1 FC	1 Anat	A = 60
	+1 C	1 Bt	Affective ratio: ca. 30
	2 FY	1 Cl	RT: 0.9 min. (I-VII)
	1 YF	1 Other	1.1 min. (VIII-X)
			Seq.: indeterminable
			Rej: (XI)
			Ap: W - D
			Exp.: 1/1 1/2
			Colour shock, shading shock?

Tendency to object-criticism, preference of central areas and to guarded answer-formulations.

Her behaviour was different from her behaviour during the first test. She was considerably more reserved and the emotional contact with her was not quite as good as earlier; however, she cooperated satisfactorily.

Psychoqram: The number of answers is almost halved and her efficiency thus very restricted. This change in attitude is probably due to her afraidness of disclosing herself. It seems unlikely that this change is the result of a progressing intellectual reduction.

		Dorthe	
7+1 W	7 F+	2 H	6+1 P. Orig. (?)
1 W cut	1 F+/-	3+1 A	F+ 80 (extended 90)
1 D	1 F-	1 Ad	F = 100 - L = ca. 75
2 Ds	2+1 M	1 Anat	A = 35
1 Dd	+ CF	1 Bt	Affective ratio: ca. 25
<hr/> Total: 12+1	1 FY	2 Obj	RT: 1.2 min. (I-VII)
		1 Scene	1.5 min. (VIII-X)
		1 Other	Seq: indeterminable

Rej: IV and X
 Ap: W - (D) - Ds - Dd
 Exp: 2 - 3/(1)
 Colour shock, shading shock.

Tendency to self-criticism, questions and questioning answers; impotence and "low-interpretation-awareness".

Her behaviour was a mixture of indifference and impotence, but was sometimes critical.

Psychogram: Although there are relatively few responses, part of the structure is quite consistent. Her intelligence coupled with her imagination and her obvious emotional sensitivity probably result in her being able to experience things in a strikingly lively and original manner. She seems to be mainly integrative, but can also tend toward contrariness. She seems to place great demands on herself, and probably also on her surroundings. This will probably lead to severe blocking-tendencies on a neurotic basis. One must also expect a certain degree of ambivalence in the emotional and social spheres, alternating between neurotic inhibition and impulsiveness and lability. She seems to have a rather narcissistic personality, and the neurotic symptoms she is assumed to have are probably either phobic or perhaps hypochondriac. There is little free, manifest emotion. (Problems related to authoritative persons, sexual problems of long standing?). Her compensation must be assumed to be quite good. She seems to possess excellent resources and some effectiveness.

Double-blind test

Woman? Not young. Probably normal intelligence, but there are such clear signs of anxiety and uncertainty that one must expect that she does not make use of her ability consistently. She will probably not be able to work properly and carefully, except under calm and familiar situations. Emotionally provocative situations will probably easily bring her out of balance, and her productiveness and the level of her performance will probably suffer in consequence. She seems introspective and sensitive, but afraid of emotional aspects—afraid of disgracing herself. Neither does she appear able to express her aggressive impulses openly and adequately. They will most likely give rise to a passive, provocative attitude. She seems to have greater need of contact with others than ability to achieve it. There is manifest anxiety; she seems to be very inhibited and tense; psychosomatic symptoms are very probable.

Retest (17 months later)

5 W	7 F+	0 H	4 P. 1 Orig (+/-)
1 W cut	1 F+/-	2 Hd	F± 95 (extended 90)
3 D	1 M	3 A	F = 100 - L = 60
1 Ds	2 FC	3 Ad	A = ca. 40
2 Dd	+ CF	1 Bt	Affective ratio: 30
1 Dds	2 FY	1 Cl	RT: 1.0 min. (I - VII)
1 Do	1 YF	3 Obj	1.5 min. (VIII - X)
Total: 14		1 Scene	Seq: indeterminable
			Ap: W - (D) - etc.
			Exp.: 1/1-2
			Colour shock, shading shock.

Tendency to appeal, perplexity, and impotence, denied and questioning answers.

The structure of the results has altered considerably, but it is difficult to decide whether this is due to a change in her state or to alteration in her attitude toward the test, perhaps as a reaction to the first test. Her personality seems to be even more

marked by attempt at control, and the inhibiting mechanisms noted before now appears even more clearly, whereas her desire to express herself and her impulsiveness are less pronounced. Apart from this, however, the two tests resemble each other quite closely. The signs of intellectual deficit present (but not commented upon) in the first test are perhaps more obvious, and there is now difficulty in mobilizing words and possibly also concepts. Perhaps her tendency toward a more detailed perception is related to this, but if so, it is striking that so many responses are vague and impulsive.

Word Association Test (a. m. Rapaport)

Petrine

Seemed tense and rather provoked by the situation; tried to some extent to overcompensate, managed more or less satisfactorily and responded to all the words. The reaction-times varied; most were average and there were only a few short or prolonged reaction-times (over 10 seconds: "father", "party", "vagina", and "woman"). Her reactions were often marked by immediate emotional experiences; occasionally her attempts to give "nice" answers led to rather affected responses. This (pseudo-) intellectualization is, one must suppose, part of her defence, but presumably also related to more immediate tendencies (a type of "exhibitionism"). Her problems are: sexual, identification, interpersonal. Her main defence—apart from that mentioned above—is rather primitive (denial, repression and reaction-formation). Partly she tries to employ certain of her problems and weaknesses to attract attention and to dominate. (Severe problems in relation to parental images?).

When retested, the number of repetitions was strikingly low (25 per cent). This is perhaps the reason why the number of increased reaction-times is the same as the number of decreased. There are, however, only a few above 10 seconds (two new words: "dummy" and "mother"). This probably reflects the above-mentioned "exhibitionistic-pseudointellectual" tendency which often gives her new and rather unnecessary difficulties, although her ability to compensate is more or less adequate. Her problems appear to be the same as mentioned above.

Dorte

Many of her reaction-times were average or above average; there was only one instance where she failed to respond ("vagina"; after 32 seconds she said, she did not know the word) (?); there were many instances where she tended to block, covering several different subjects ("love-tenderness", "beer-enjoyment", "main-part of the body", "fight-violent/tired", "female friend-friendship"). Noteworthy were on the one hand her tendency to controlled reactions, and on the other, her emotional, evaluative responses.

When retested, most of the reaction-times decreased, although the number of repetitions was not more than 60 per cent. She was, however, still obviously provoked by the situation.

Summary and comparison of the test results

Both twins seemed to be above average in intelligence. Petrine was more self-assured and obtained slightly better results and seemed more ambitious in a "pseudo-intellectual" way. Differences between the results are almost solely present in the first examination; when Dorte was retested and was calmer, she was almost as efficient as Petrine. Both twins were labile, emotional in their attitude and tended to pose. Their demands upon themselves and their intellectual resources nevertheless lead to results. They are also

capable of reacting actively and aggressively, Dorthe perhaps more frequently than Petrine. Petrine seems to have greater intellectual deficit than Dorthe but it is difficult to decide whether this impression is due mainly to her emotional attitude. When one takes their age into consideration both seem to be emotionally lively and differentiated. Both are mainly extroverted, presumably rather domineering and make considerable demands on others. Their defences mainly comprise reaction-formation, repression and, particularly in Petrine, intellectualization. Both show clear ambivalence and there are exceptionally many areas where they have problems. Their intellectual and emotional resources are, however, so well developed that their effectiveness must be described as being exceptionally good. When confronted with difficulties, both react by retiring from contact and the threat of being disclosed. There is, however, some difference in their mode of compensation; Petrine is more self-assured, whereas Dorthe is less sure of herself and feels more bound by the demands of the test-situation. This means that she encounters difficulties in the test-situation, but at the same time she is able to manifest her originality and productivity. The most important of their problems are their relationships to parental images, men and sexual matters. This is probably only vaguely experienced in an emotional way. It is doubtful whether either of them can be said to be pathological, although one must classify them as rather neurotic and expect psychosomatic phenomena.

OTHER SPECIAL EXAMINATIONS

EEG. Alpha-frequency 9.5 hz, amplitude 0-50, distribution 35 per cent for Petrine, 15-25 per cent for Dorthe. No abnormal potentials. Flicker and hyperventilation not available. Conclusion: Normal in both cases.

ECG. In both cases slight, left-sided dominance and slight changes corresponding to hypertension, obesity and age, rather more pronounced for Petrine than for Dorthe. Conclusion: Slight abnormalities in both cases.

EPICRISIS

Petrine and Dorthe were the youngest of nine children from a butcher's home in a rural district on Zealand. Their birth was probably normal. They were breast-fed by their mother, probably for some months. Dorthe was probably somewhat retarded in her early development. When they were four months old their father died. On account of the many children and the poverty in the home they were separated when 12 months old.

They remained completely separated until they were 16 years, when they saw each other for one single day. They did not see each other again until they were 18, when they lived together for about six months. Since then

they had had some, but never close, contact with each other, and the course of their lives have run separately.

They were incorporated in the series when they were 72 years old, and were followed through a period of three years.

From a socio-economic, a cultural, as well as a psychological point of view, their upbringing has been markedly different, and differences have also been apparent in the subsequent course of their lives.

Petrine grew up as an only girl. She was adopted by a childless couple, who lived in a fisher-village on the West coast of Jutland. Her adoptive-parents were in easy circumstances and their social position lay at a considerably higher level than that of her twin sister's childhood environment. There have been undoubtedly psycho-traumatic circumstances in her childhood and in the whole of her psychological development. Her adoptive mother (who may have suffered from a Turner's disease) was severely pathological, probably psychopathic and periodically psychotic. Petrine's relation with the adoptive mother was very complicated and filled with conflict until Petrine during puberty and early adulthood succeeded in freeing herself from this influence.

Dorthe grew up with her own mother, a widow, and with older siblings. She was brought up in a rural district on Zealand. The home was poverty-stricken and humble, but had a secure and loving atmosphere. During the whole of her life she retained strong emotional ties to her mother.

There is a certain resemblance between the twins' childhood environments in the respect that in both cases their mother has been the central and domineering figure, but certainly they must have had very different personalities, and the twins' relationships with them were extremely different.

Both twins were married when relatively young, Petrine when 22 and Dorthe when 19 years old. Both had relatively many children, Petrine six, of whom one died in early infancy, Dorthe four, of whom she lost two when adults.

Apart from this, their later life differed. Petrine married a business man and since this her circumstances financially as well as socially, had always been easy. Dorthe married a shipmaster. Her life was rather lonely, and she was closely tied to her mother and her children. She became a widow at 48 and had not until a few years before our investigations had secure or easy socio-economic circumstances.

Physically, their development has been very similar. In the first place, both have enjoyed good health. Since their youth both had been allergic to primula; in Petrine's case, a severe allergic attack developed into a presumably psychogenic tendency to facial tics. Both have had slight gastric symptoms, both became moderately obese and both developed arthrosis of the knee joints, and possibly also a slight tendency to hypertension. Both have suffered from ischias symptoms and from uncharacteristic attacks of abdominal colics,

possibly of an allergic or vascular aetiology. Compared with the case histories of the twins' siblings, the similarities, or the lack of differences between the twins, is remarkable.

In accordance with the dissimilarities between the twins' childhood environments their personality development has run on different lines, although resemblances are apparent all the same. When Petrine's unusual childhood environment is taken into account, it is remarkable that her personality development and the neurotic symptoms she has presented when adult are so little different from Dorte's.

On the clinical and the psychometric examinations, both were found to be intelligent, without clear differences and without any special reduction considering their age.

Characterologically and emotionally both were very similar, predominately extroverted, with a bright and even temper, although Petrine was lacking self-confidence and showed traits which were clearly more neurotic than Dorte's. The differences would seem rather to be differences of degree.

Both must be classified as: Normal personalities, with slight neurotic traits.

CASE XI

ASTRID AND EDITH

The twins were 72 years old when they were investigated in 1956. They were registered in the files of the Institute of Human Genetics, and we approached them via Astrid's daughter-in-law, who had taken a special interest in the genealogy of the twins' family and their life-histories.

Astrid, who was married to a retired postmaster, lived in one of the suburbs of Copenhagen. She had been brought up by her mother, who was the widow of a staff sergeant in the Danish army. She grew up together with four sisters.

Edith, who was widow of a day-labourer, formerly a grocer, lived in another suburb of Copenhagen. She had been placed with strangers, a bookbinder and his wife. They were childless, had adopted her, and she grew up as an only child.

The twins were born in Copenhagen. They were the 6th and 7th of eight children. They had two brothers, who both died in early infancy, the remainder were all sisters. When the twins were four years old, their father died. Already six months before his death, Edith had been placed in her later foster-home because of the straitened circumstances in the twin's home.

The twins remained separated and were brought up in different quarters of Copenhagen. Although they had known that they were sisters ever since early childhood, they had little contact with each other during upbringing, and since they had become adults, they had led separated lives in the provinces. When 70, they both moved to the outskirts of Copenhagen and then resumed contact with each other.

Our investigation of the twins, who were very cooperative, lasted for about two years.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

The information available stems partly from Astrid and partly from Astrid's son and the above mentioned daughter-in-law, supplemented with some data from various official records.

The father

The paternal family came from Alsace-Lorraine, from where *the paternal grandfather*, who was a night watch-man and hatter in Copenhagen, had emigrated in the beginning of the 19th century. *The paternal grandmother* was the daughter of a smallholder in North Zealand. They had five children, the 3rd of which was the twins' father.

The twins' father participated in the war between Denmark and Germany in 1848 as a 14-year-old drummerboy and again in 1864 as a staff-sergeant in a cavalry regiment. According to the twins' statements, which were confirmed by the historical literature, he distinguished himself several times, was decorated and offered the possibility of being trained as an officer, which he, however, due to economic reasons was unable to receive. During action he was wounded in his right hand and later when he fell off his horse he injured his back severely, and this was said to have led to his becoming an invalid in later years.

He had married when 28 years old. His wife, daughter of a cabinet-maker in South Slesvig, died in childbed four years later. They had two children.

The twins' paternal half-siblings. 1) *Half-sisters*, married to a carpenter in South Slesvig. Healthy, died at the age of 72. Had several children, including twin boys, who died when infants. 2) *Half-brother*. As mentioned later he grew up in the twins' home. He died when 49 in a home for mentally defectives. The *case-records* state: Institutionalized when 32. No information about predisposition to mental illness. Objectively: Dark-haired with brownish-green eyes, asymmetrical skull and face, left-sided scrotal hernia and bilateral clumpfoot. Childish, very kind and easy to deal with, fond of dancing, singing and smoking, stammered a little, drawled, was able to read a little but had great difficulties in writing. He died suddenly from appendicitis complicated by a local abscess and a pulmonary embolus. Diagnosis: imbecilitas.

The twins' father married their mother when 35, and they settled down in Copenhagen. The twins did not remember much about their father apart from that he was an invalid in constant pain, "sitting in a silk dressing-gown in an easy chair".

They had received the following information about him: He was a tall, strong man, "an officer type", "a great personality and an excellent father". He was described as a lively man, fond of guests in his home, always somewhat "dashing", rather "posing". He especially took part in the Copenhagen theatrical life, had his own loge in the Royal Theatre, was an ardent amateur actor. He was apt to suggest that his family was "finer" than those of his friends and liked to pretend that there was an estate somewhere in France which his ancestors really ought to have inherited. He brought his children up according to definite principles and ideals and was particularly ensuring that they honoured their king, country and family. He was very proud of his daughters, but, apparently he was unable to overcome the lack of a son. The twins stressed that his relationship with their mother always had been

exemplary, harmonious and happy. After having retired from the army he was only given a small pension and therefore had to support his family by teaching "Swedish gymnastics" and "he was also a masseur for the Danish King". He died, after having been in hospital for nine months, at the age of 54. *Case record*: cancer recti.

The father's siblings. It was known that one of his sisters died of tuberculosis when quite young, and that one of his brothers was apparently a drunkard, who was said to have committed suicide. No other information was available.

The mother

Her family came from North Zealand where *the maternal grandfather* was a provision-dealer, said to have been in good health until he died when 80. *The maternal grandmother* was "a Slav", possibly Polish. According to family tradition an English ship stranded on the North Coast of Zealand in the 19th century. The ship carried political refugees, and the only person who survived was a newly-born girl, who, together with a chest containing a child's clothing, was washed ashore in a lifeboat. The child, the twins' grandmother, was taken care of by a farmer in the district. She is said to have been "very unusual" and "not a normal country girl". She married and had three children; the twins' mother was the eldest. She died when 57; the cause is not known.

The twins' mother was born and brought up in Copenhagen. When 25, she married the twins' father. From the age of 26 to 38 she had eight children. Two sons died at birth, and she is said to have had several abortions. She was 44 when widowed. She had only a small pension and therefore had to take in sewing. She was not as tall as the twins, more plump, and was described as "an exceptionally good, sacrificing and kind mother who mourned all her life over the loss of her husband". She was very hardworking, economic and devoted herself to ensuring her children's future and education. She was especially interested in ensuring that they were "properly" married, based their upbringing mainly on her husband's principles, had a considerable interest in literature, took part in the current cultural discussions and was socially ambitious. She was the central, integrating figure in the home, "built her own world for her daughters and herself", was of good intelligence, a "personality", and had an important influence on her children, for whom she was "an older friend". The family always felt very close to each other, and it was characteristic that they always talked of themselves as "we sisters" and that strangers were not easily accepted.

Until the twins' father died, the twins' half-brother was in the home. He was then placed in an institution for the mentally deficient. The twins' mother never forgave herself for this; the main reason for this disposition was the economic difficulties that occurred after her husband's death. These difficulties also were the reason why she placed Edith in a foster-home, but she also stressed that Edith's foster-parents had exerted considerable pressure to take Edith as they had no children of their own, and that she had let them

have her, primarily because Edith would be given a home in good circumstances.

Although the twins' mother had always been in good health, she became infirm after climacterium, had frequent attacks of "gall-stones", was operated but died shortly afterwards at the age of 62. *Case records*: cholelithiasis, pneumonia postoperativa.

The mother's siblings: No information available.

The twins' siblings

1) *Sister*, married to a vicar. As the oldest of the children she played an important role in the home, was her mother's "right hand", and not least influenced Astrid who, as mentioned later, stayed with her for some time. When young she was "only interested in entertainment", was disappointed in love and this was said to have been the reason why she was for a short time in a psychiatric clinic. (No information available). Her marriage was dominated by her husband's "tyrannic" ways and her life was therefore very unhappy. She died at the age of 68 of unknown cause. She had three children (one of which later became a surgeon with cancer of the rectum as his speciality). 2) *Brother*, died at birth of unknown cause. 3) *Brother*, died at birth of unknown cause. 4) *Sister*, married to a clergyman, domiciled in Jutland. For some reason this sister's relationships with her siblings was strained, and Astrid therefore never had close contact with her. She died when 51. *Case records*: Graves' disease, morbus mentalis acuta (psychosis?). (More detailed information was not available). She had five children; *one son*, a veterinary surgeon, was said to be a drunkard, *another son*, originally a lawyer and later a farmer, was described as a "spineless" person whose financial affairs were in great disorder. 5) *Sister*, unmarried, housekeeper. The most intelligent of the sisters, more tolerant and less bound to her childhood environment. She spent nearly all her life as housekeeper for a forest supervisor. She was a great source of help and support for her younger siblings, especially for Astrid. She is said to have been in good health until 72 when she was admitted to the local hospital. *Case records*: Climacterium when 47 without serious discomfort. Never pregnant. For some time periodical, slight vaginal haemorrhage. Abrasio mucosae was performed (microscopy: carcinoma adenomatosis corporis uteri). The tumour was about the size of a person's head and inoperable. Was given X-ray and radium, but died shortly afterwards at the age of 73. 8) *Sister*, 71 years old, the only sibling alive at the time of our investigation. Contrary to her siblings, she did not resemble her mother but her father; she was slim, "hard", realistic but also had very definite ideas and principles and was difficult to associate with. She had trained as a nurse and married an official in the customs, lived in Argentina

from 48 to 52 years of age. No children. Her feet were deformed from birth ("hammer toe and fallen arches") and had been operated upon several times. She developed severe climacterial symptoms, nervousness, attacks of giddiness, was hard of hearing, had tinnitus. Received estilbin, but her state declined gradually and after arriving in Denmark she was admitted to hospital. The *case records* state: Thin, asthenic. Diagnosis: Morbus Menière. Readmitted when 66: Diagnosis: fibroadenomatosis mammae dextra. Treated with hormones. When 69 vaginal haemorrhage. Abrasio was performed (Microscopy: cancer colli uteri). Treated with X-ray and radium. Re-examined when 70: no signs of propagation.

Summary of the supplementary information

A rather heterogenous predisposition was present in the twins' family. Their father, who seems to have been quite a personality died from cancer recti. Several members of the paternal family presented a somewhat deviating personality, but no obvious predisposition towards mental illness was disclosed.

Their mother had for the most part been healthy, but the information available concerning the maternal family was meagre.

The twins had four sisters; an unmarried sister died from cancer corporis uteri, another sister, who was married but also a nullipara, died from cancer colli uteri. A third sister had presumably Graves' disease and died in a psychosis-like state. The fourth sister had a reactive depression when young. The twins had two brothers, who both died at birth of unknown causes. Their paternal halfbrother was mentally deficient.

Cases of twins were registered in the paternal family.

THE SEPARATION

The twins were born at home after prolonged labour. There was "one common afterbirth". Astrid, who was born first, weighed 5 "pund" and Edith about $4\frac{1}{2}$ "pund". Edith was apparently asphyctic, had lost some blood, "had her umbilical cord wrapped round the neck three times and there were no sign of life for half an hour". Neither of the twins were suckled.

Throughout early infancy Edith was always smaller than Astrid and was treated as a weakly, ailing child. Their early psycho-motor development was otherwise normal. When three years old they both had diphtheria at the same time and were admitted to hospital; there were no complications. Apart from this, they seem to have been in good health.

The twins resembled each other closely, and even their mother found it difficult to distinguish them. For this reason they always had coloured ribbons on their wrists. Even so they were often "mixed up" and their identity

seems first to have become definitely established when they could say their names.

During the period they were together at home, their environmental conditions were marked by their father's illness and the poverty of the home, and a year after the twins' birth another sister was born.

They were separated when about three years and six months old.

ASTRID

During the *interviews* she stated that her childhood home was a good one, and she stressed the emotional bonds between herself and her mother and her four sisters, who were fifteen, seven and four years older and two years younger than Astrid, respectively. As regards the atmosphere of the home this has already been described.

She attended a private school from six to fourteen and did not encounter important problems there. She left school and home because she was convalescing after severe whooping-cough at her eldest sister's in Jutland, but she continued to keep in close touch with her family during adulthood.

She remained at the vicarage with her sister until she started to learn housekeeping when 17. She then wanted to be a nurse, but before commencing her training she stayed for about six months with her mother and then with another of her married sisters. When 18, she commenced training as a nurse in a hospital in East Jutland. After finishing her training she worked for some years as a nurse at the same hospital and then left for Zealand. Later she was a private nurse for the landowner, whose forest supervisor had employed one of her sisters as housekeeper. When 23, she met her later husband at the local post-office. They became engaged but did not feel that they had sufficient money to marry, and she therefore continued to work as a nurse at various hospitals in the provinces, at one time she spent three years at the hospital where she had trained.

When she was 30, they married as her fiancé had obtained a post as assistant postmaster in a market-town in East Jutland. They lived here for two years. Her life during these years seems to have formed itself according to the typical pattern for junior public servants with respectable ambitions, a good house but a small income. Due to the lack of opportunity for further promotion her husband applied for the position of postmaster at a fishing-port and holiday-centre in North Zealand. At this time their children had grown up. They remained here until her husband retired due to age a couple of years before our investigation commenced.

Since then they had lived a typical pensioner's life on the outskirts of Copenhagen. They had a three-roomed flat, a stable income and spent their time

in walking and reading, in visiting the theatre, and playing bridge with friends. The central content of their lives was their sons, who, as will be described below, had posed them problems.

Astrid's husband, to whom I talked once, was of the same age as Astrid. He was a pyknic, undoubtedly intelligent, sober-minded and realistic, efficient and presumably the ideal public servant. According to Astrid he previously seemed to have been cheerful, but in later years he had become reserved, without, however, showing pathological symptoms; apart from psoriasis he was in good health.

Concerning her medical history, Astrid said that, generally speaking, she had been physically healthy. She had, as mentioned above, had diphtheria while the twins were still together, and after being separated, she had diphtheria again when 10 and yet again at the age of 25, when she was nursing a child with diphtheria. There were no complications, especially no cardiac symptoms.

When 27, she had severe rheumatic fever and said that she at the same time also had "endocarditis". She was in hospital for several months (the case record was not available). No re-occurrence, and no cardiac complaints.

Menstruation commenced when she was 14, had always been regular, but previously there had been pronounced molimina. She had given birth to three children, when 32, 37 and 38 years old. The first and last pregnancies followed a normal course, but the second child was born prematurely and died soon after birth. She had suckled the children, but only a few weeks at most. Menopause occurred when she was 54 without distressing symptoms. Ever since her pregnancies she had had varicose veins and therefore used elastic stockings.

She had never had dyspeptic symptoms, and she had no tendency to obesity. She had used full dentures for 20 years and used spectacles for reading.

During the past ten years her physician had said that she had a tendency to hypertension (about 180 mm), and she was therefore treated with iodine, but apart from occasional giddiness there were no subjective symptoms.

On the whole, she considered that she had always been "in excellent health" but she admitted that since childhood, she had had a certain tendency to "nervousness" which primarily manifested itself in strenuous situations and she had always been apt to be anxious, insecure and dependent on others. On the other hand, she had never felt a need for medical assistance because of these symptoms.

Astrid's children. 1) Son, 38-year-old, married school-teacher. Two children, both girls. According to Astrid he resembled his father in mentality, "calm, even-tempered and harmonious, interested in theatre-life". I had a long talk with this son, and during the interview he provided information concerning the twins in a very instructive way. He appeared to be intelligent

but manifested slight neurotic symptoms in the form of a tendency to hypochondria and lack of self-confidence. Apart from a "polyradiculitis" he had been healthy until a couple of years earlier when he developed dyspeptic symptoms during a period when he was overworked, and he believed that X-ray had disclosed "a duodenal ulcer". His marriage seemed to be harmonious. As mentioned earlier, his wife also provided invaluable information about the twins' family.

2) *Son*, born prematurely after Astrid had fallen down stairs. Weighed 800 grams and lived only 11 days.

3) *Son*, 33-year-old, divorced draper. According to Astrid, he resembled her in appearance and to a certain degree also mentally. Ever since early childhood he had been closely attached to Astrid, who characterized him as "originally a lively, handsome and happy scout". He had always got along easily due to his charms and his ability "to walk right into people's heart". As opposed to his elder brother he did not matriculate but was apprenticed to a draper. He married a Norwegian girl when 19 because she was pregnant. There were two children, both girls and both healthy. During his wife's last pregnancy she passed a foetus which their physician stated was originally derived from a twin pregnancy.

He had always been in good physical health apart from psoriasis, but according to Astrid he started to have "nerves" during the War. He took active part in the underground resistance movement, "was in close contact with sabotage-groups" and was wanted by the Gestapo. He fled to Sweden and after the German capitulation returned as a member of the Danish Brigade. While in Sweden he became addicted to mecodrine and periodically apparently also to alcohol. Since he came back, he had not been able to settle down. He was restless, dissatisfied with everything, periodically depressed and occasionally he had had suicidal impulses and had once tried to gas himself. He was at times unemployed, and his wife left him because of their desperately poor circumstances and took the children with her. After this he had lived in Astrid's home.

His elder brother said about him that he had probably been "spoilt" during upbringing, that he was since childhood "abnormally optimistic, self-important, vacillating", and that in his opinion his younger brother had inherited the paternal family's tendency to let his imagination run away with him, "he is almost a pathological liar". It seems doubtful whether he ever had had much to do with the resistance movement, he had always wanted to distinguish himself and to be better than his surroundings but had a decided inclination to turn his back on "realities".

When 31, he had been examined at a psychiatric out-patient clinic. *Case records*: Complained of restlessness, difficulties in adjusting himself, declining confidence in himself. During a few interviews he seemed rather un-

trustworthy, vacillating and inclined to minimize his problems. Psychotherapy appeared to be hopeless, and he was advised to obtain a job and to put his life in order, primarily economically. Diagnosis: Character-neurosis.

EDITH

Edith's foster-parents were acquaintances of the twins' parents. She was formally adopted when seven years old.

The *adoption papers* state: The foster-father was 35 and the foster-mother 48 years old when Edith was given into their care at the age of three years and six months. They had been married for four years and had given up hope of having children of their own. Both foster-parents were born in Copenhagen. The foster-father was son of a janitor (at an anatomical institute) and had seven children. He became a bookbinder and had been employed by the firm in which he worked all his life. The foster-mother was a daughter of a provision-dealer. No further information was given.

During *the interviews* Edith said that she had only uncertain and vague memories about her earliest childhood because she had grown up as an only child. However, she clearly remembered the time when she was given into her foster-parents' care and also that she from her earliest childhood retained contact with her mother and siblings, especially Astrid.

While children, the twins did not, however, see much of each other, mainly because Edith's foster-mother was against their doing so. She was "jealous" and laid weight on stressing that Edith now was "her child", and she also in other ways dissociated herself from Edith's "shabby-genteel" family.

Edith described her home, which was situated in a rather typical worker's quarter, as earth-bound, a middle-class home, which lacked ambition and was marked by a rather materialistic attitude and "without any tendency to be snobbish". She had always been very fond of both her foster-parents, perhaps especially of her foster-father, a jolly, optimistic, quiet man who loved playing with her and making toys. Her foster-mother, who domineered the house, was stern, rather strict and exceptionally realistic. Edith continued to keep in touch with her foster-parents; her foster-father died when 84 and her foster-mother when 78, both after having been in good health, physically as well as mentally, throughout their lives.

Edith entered a private school at the age of six, had no special problems while there, and left school when 14, about six months after Astrid had finished schooling.

She started to learn domestic work, but her foster-mother soon placed her in a shop, and she later entered an office and studied commerce at an evening-school. She stayed at home until she, after a brief engagement, was married at the age of 23.

Her husband, who was three years older, had a small grocery in the City of Copenhagen. They lived in very straitened circumstances and had great difficulties in making both ends meet, and their housing conditions were also poor. It seems undoubtedly that it was Edith who managed things as her husband was impractical and also rather indolent; he had originally wanted to study for a university degree but his father had instead placed him in an apprenticeship. He was clearly not a particularly good business-man, in fact almost incapable, and he was often irritable and unpleasant to their customers. After 14 years they were forced to sell the grocery, and they then moved to a small village in East Jutland. They started a new grocery, apparently with help and financial assistance of the eldest of the twins' sisters. They kept it going for more than 30 years, but they did not earn much money and their life was always marked by worry and hard work in which Edith had to take the leading place. Finally, they had to sell the second grocery and then move to the nearby market-town. Astrid's husband obtained a job as a labourer at an oil factory, even though he suffered from cardiac symptoms. He retired on a pension when 70 and died two years later (*death-certificate*: chronic pancreatitis).

Edith was then 67, and as her two children had married and were living in Copenhagen, she decided to move and went to live in the same block as her son. She had a small two-roomed flat and received old-age pension. Her financial conditions were relatively poor, but she managed to make both ends meet, and was fond of living close to her children and grandchildren.

Concerning her medical history, Edith stated that she had on the whole been in good health. In early childhood she was perhaps somewhat underweight, but she developed normally both physically and mentally. As mentioned she had had diphtheria when three years old and she did not have a recidivation of this disease. When 10, she had a severe attack of whooping-cough, apparently similar to the attacks which Astrid had when 14.

She had twice had rheumatic fever, when 14 and 16 years old, and had both times been bedridden at home for a month. There were no cardiac symptoms.

Menstruation commenced at 14, had always been regular and natural without molimina. She had given birth to two children, when 26 and 30 years old. Both pregnancies followed a normal course, but since then she had suffered from varicose veins and used elastic stockings. She had not been able to suckle her children. Menopause occurred when she was 52, it was accompanied by mild hot flushes, perspiration and "nervous headache", which, however, disappeared after brief hormone therapy.

She had always had a large appetite, had never tried to restrict the amount she ate, and had been rather overweight since reaching adulthood.

During the past 10 years she had suffered from pain in her knees, diagnosed

by her physician as "arthrosis", and was treated with X-ray with some effect. She considered that these symptoms were due to her having stand up so much in the shop and to her overweight.

She had been hospitalized once, when 53. The *case records* state:

For some years bronchitis. Examination: no abnormalities apart from "influenza", slight bronchitis-symptoms and varicose veins of the right leg and a slight obesity (84 kg/159 cm). Blood-pressure: 133/85. Diagnosis: *bronchitis chronica*.

Since then she had occasionally had symptoms of bronchitis but never cardiac symptoms or subjective symptoms indicating hypertension. For about 20 years she had used full dentures. She used spectacles for reading.

She had never felt "nervous", but often slightly depressed and "worn out", but had never felt a need to seek medical advice for this reason.

Edith's children. 1) *Daughter*, 46 years old, married to an engineer. According to Edith she was healthy and had two healthy children, both girls. She was said to be "rather sullen and reserved, pessimistic like her father". 2) *Son*, 42, married gardener. He suffered from periodic dyspeptic symptoms and perhaps had "stomach ulcers". In appearance and mentality he resembled Edith, "optimistic, good-humoured", and he had always been her intimate. He first married a "hard and superior" woman, who divorced him. No children. He married again and this marriage was very happy. He had two daughters and a son, all healthy, a second son had been killed in a traffic accident.

THE TWIN RELATIONSHIP

The twins considered that their foster-homes had not resembled each other, on the contrary, both found that there had been obvious differences in socio-economic, cultural and psychological respects, and they appraised their homes very differently.

Astrid stressed that characteristic for her home had been: the traditions stemming from her father, her mother's personality, the lack of her father, the great family solidarity, and the fact that she had been brought up among her sisters to whom she remained closely attached throughout her life.

Edith said that the most important factors in her home were that she was brought up as an only child, that her foster-parents were much younger than her natural parents, and that they were "very, very natural and uncomplicated". During the interviews with Edith one gained the impression that she had always had an ambivalent attitude toward her natural mother and family. She had never fully accepted that she, especially, had been selected for adoption and that the youngest of the daughters had not been chosen instead. She considered it wrong to separate twins. Furthermore she had

early on felt "an outsider" when together with her siblings and had also later felt that she had been put in a lower-class environment, although she also realized that she had had various obvious advantages as an only child.

When children the twins only saw each other at important family parties. Their close resemblance always impressed others, but they were regarded as "cousins". They also resembled each other mentally, but differences were present from an early age. Astrid was very quiet, almost cowed and in Edith's opinion Astrid had been rather restless, "very superficial and less inclined to go in details". Edith was undoubtedly the happier and least inclined to worry, but emotionally she was perhaps less integrated as she partly felt attached to her adoptive home and partly to her natural family.

They did not think that there had been important differences in the schooling, but they found that they had had very different conditions when young. Astrid had been supported by her family and had married relatively late. Edith had remained at home until she married when quite young. While adults they rarely saw each other, primarily because they lived in different parts of Denmark. They continued to resemble each other so much in appearance that strangers still confused them and even their husbands had occasionally, for example when they saw them from the rear, misidentified them. They felt that they had previously resembled each other more closely but also that their similarity had again become more pronounced during the last couple of years prior to our investigation. "We seem to grow old in the same way".

Both stressed that in spite of their having been brought up in different homes, and having led different lives with very different husbands, they resembled each other more—in almost any respect—than they resembled any of their natural siblings. They considered that the most characteristic feature of them both was that they had always had a fundamental "optimistic attitude" toward life. "It is perhaps therefore, that we have the same thoughts and the same opinions about everything".

CLINICAL EXAMINATIONS

Our investigation comprised six interviews with each twin and two with both together. In addition, I talked with Astrid's husband, her eldest son and her daughter-in-law.

Both twins were very cooperative and in view of their age their cooperation was satisfactory. Astrid was the easiest to establish contact with, but she was also rather talkative, "conversational". Edith was more reserved and taciturn, kept to the matter in hand; during later interviews it was, however, possible to establish an excellent contact with her, and peculiarly enough it was often easier to obtain precise information from her about things which

Astrid ought to have known more about, for example concerning their medical histories, and she was also clearly better informed in general matters.

Their appearance and behaviour was strikingly similar, and especially their voices, their gait and gestures were alike. They dressed very much alike, were of the same height, 160,0 cm. Neither of them were definitely obese but both were comparatively strongly-built. Astrid weighed 70.0 and Edith 74.0 kg. Both were grey-haired (had earlier been light blonde), Astrid slightly more than Edith. Astrid parted her hair on the left. The whorls were clockwise. Their hair was of the same type and consistency. Their eyes were of the same shade of greyish-blue, both had slight arcus senilis. The shape of their skull and their faces, the individual facial features, especially their pronounced naso-labial grooves, were very similar. Their ears, the surroundings of their eyes were strikingly similar in all details. Both had a peculiar "short" right eyebrow. Their facial expressions showed great resemblance to each other, especially when they smiled.

Apart from the fact that Edith had slight xanthelasmata under both eyes, there were no obvious differences, and the remaining somatic examination did not disclose abnormalities apart from varicose veins of the legs. Blood-pressure: Astrid: 165/105—165/105, Edith: 145/80—145/65. Both were right-handed.

Both appeared to be of normal intelligence, probably above average, without obvious differences between them. Both seemed to be mentally well-preserved without intellectual reduction of importance and less than one would expect from their age.

As regards personality, they showed great resemblance but also some differences. Both seemed to be extroverted, syntonic, well-balanced and apart from slight anxiety features, neither of them were obviously neurotic. Generally speaking, Edith seemed more independent and efficient, and she reacted quicker, whereas Astrid often seemed to be rather unsure of herself, apt to be evasive without personal or definite viewpoints, but these patterns changed quickly and often tended to be reversed. When together they expressed mutual sympathy and understanding, rarely or never criticized each other. They behaved as equals and neither of them tried to be domineering.

On the clinical examinations they were both classified as normal personalities without obvious psychopathological traits.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Astrid

Attempted all 60 matrices in approximately 20 minutes. Score: $11+3+6+5+1=26$. Distribution: abnormal; discrepancies: 8. Group: 50–75 percentile. (Extrapolation). Conclusion: normal intelligence. (rather above the average).

Edith

Attempted all 60 matrices in 15 minutes. Worked comparatively quickly, but did not really accept the task. Score: $11+6+2+1+1=21$. Distribution: slightly abnormal; discrepancies: 6. Group: 50-75 percentile, closest to the 50th (extrapolation). Conclusion: normal intelligence, slightly above average.

Wechsler Bellevue

	Astrid				Edith			
	I		II		I		II	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	19	13	19	13	17	12	16	11
Comprehension	14	12	13	11	11	10	14	12
Digit Span	5+4 = 9	6	6+4 = 10	7	6+4 = 10	7	5+5 = 10	7
Arithmetic	5	6	6	7	7	9	5	6
Similarities	12	10	16	13	14	11	11	9
Vocabulary								
Verbal Points		47		51		49		45
Picture Arrangement	7	7	8	7	8	7	8	7
Picture Completion	11	10	11	10	11	10	8	7
Block Design	15+4 = 19	9	12	7	18+2 = 20	10	15+5 = 20	10
Object Assembly	15	7	18+1 = 19	11	18+2 = 20	12	17+2 = 19	11
Digit Symbol	25/27	6	24/26	6	35/35	8	39/40	9
Performance Points		39		41		47		44
Total Points		86		92		96		89
Verbal IQ	106+3 = 109		110+3 = 113		108+3 = 111		104+3 = 107	
Performance IQ	103+12 = 115		105+12 = 117		112+12 = 124		108+12 = 120	
Total IQ	107+4 = 111		110+5 = 115		113+4 = 117		106+5 = 111	

Astrid

Rather slow and uncertain, talked rather much about other things. The results show that she is of normal intelligence, perhaps above average, and still effective, although a few of the sub-tests seem to indicate intellectual reduction (Block Design, Similarities and perhaps also Object Assembly). When *retested* (8 months later) the total number of points was higher, but the "organic" tendency persisted.

Edith

Her acceptance of the test was excellent, but she was apt to talk about irrelevant subjects without really saying very much. On the whole she worked quickly and resolutely. The results show that she is of normal intelligence, perhaps above average, with only slight intellectual reduction for her age. There is an "organic" trend in Block Design and Digit Symbol, whereas her verbal abstraction (Similarities) seems to be good. On Information she mobilized previous knowledge without difficulty. Digit Span is normal and there was nothing striking about her performance on Arithmetic. On *retest* (9 months later) she seemed to be more careless in her scores. The results for Block Design and Arithmetic seem to be more "organic" but it is difficult to decide whether her intellectual reduction had increased.

Rorschach

		Astrid			
9 W	6 F+	1 H	4 P.	2-3 Orig	(- - / +)
3 DdW	2 F+/-	6 A	F+ 70	(extended 60)	
2 D	2 F-	5 Ad	F = 100	- L = 60	
4 Dd	1 M	4 Bt	A = 60		
Total: 18	1 FM	1 Fire	Affective ratio: 50		

2 FC	1 Other	RT: 1.5 min. (I-VII)
2 CF		1.3 min. (VIII-X)
1 C		Seq: indeterminable
1 FY		Ap: W! - (D) - Dd! - DdW!
		Exp: 1/4 1/2
		Colour shock (VII?)

Tendency to talkativeness, perseveration, symmetry, and use of central areas.

Seemed to be rather affected by the task, talked a lot, but in an unproductive way; obviously she thought that she had to discover what the cards "really" depicted. She felt that she had probably not done well on the first test and that it was her own fault, but she, nevertheless, tried to demonstrate her knowledge only occasionally. Generally speaking she thus did not seem to accept the task fully.

Psychogram: She is probably intelligent. Her responses were often quite lively and imaginative, almost original. She seemed to have a need to demonstrate herself both intellectually and emotionally; she often dared more than there was reason to do, however. When she encountered problems, she was apt to go into detail, vacillated between various possibilities, or gave responses which were only vaguely categorized. Seemed extroverted, relatively unbalanced, egocentric, and in fact one must assume that she manifests neurotic symptoms, presumably for the most part anxiety, possibly phobic. (There was an "oral" tendency, and certain subjects were apt to persist; sexual identification-problems?) The test manifested "organic" traits.

Double-blind test

Woman? age difficult to judge. It may be an elderly person, who presumably will seem to be younger than her age. She seems absolutely normal in intelligence, probably potentially of good ability, but presumably she uses her ability inconsistently. She seems very easily affected, probably is easily engaged by emotional situations, which normally do not provoke emotions, and will, when under the press of emotion probably experience things in a rather peculiar manner. She seems, however, to try to fight this tendency by adopting a realistic, concrete attitude, and her impulsiveness is probably controlled sufficiently to avoid rash actions except on rare occasions. When one takes her age into consideration she will probably be emotionally lively, but it seems doubtful whether she can express her emotions adequately (aggressive but inhibited?). There seems to be some fear of contact with others, which probably means that she will avoid deeper, intimate contact. ("Oral conflicts").

Retest: (8 months later).

10 W	4 F+	1 H	4 P. 1 Orig (-)
2 D	4 F+/-	5 A	F+ 80 (extended 70)
1 Ds	1 M	2 Ad	F = 100 - L = 65
1 DdD	1 FM	2 Bt	A = 50
<hr/>	1 FC	1 Crater	Affective ratio: 40
Total: 14	1 CF	1 Rock	RT: 1.0 min. (I-VII)
	1 FY		0.5 min. (VIII-X)
			Seq. indeterminable
			Ap: W! - (D) - Ds - DdD
			Exp: 1/2 1/2
			Colour shock, VI + VII

Concreteness, tendency to use central areas and to self-criticism.

As on the first test rather talkative, vacillating and vague in her responses, and at the same time rather ambitious. Generally, she seemed to be more integrated but her acceptance of the task was still not fully satisfactory, and she was still apt to "pose".

Psychogram: The number of responses was lower and at the same time more integrated. There were fewer imaginative and original responses. It is difficult to judge whether this corresponds to a real difference in her personality. There is otherwise considerable resemblance between the two examinations with regard to the major part of the qualitative features, and thus she is still mainly extroverted and emotional. Her egocentricity and poor tolerance of conflict also reappears. One may assume that she lives a rather protected life. She will probably find it difficult to establish contact intellectually and emotionally with others.

		Edith	
11 W	4 F+	3 Hand (H)	6 P. 1 Orig.
2 D	2 F+/-	3 A	F+ 70 (extended 60)
<hr/>	1 F-	1 Ad	F = 100 - L = 55
Total: 13	2 M	1 Bt	A = 30
	3 CF	2 Ls	Affective ratio: 30
		3 Fire	RT: 0.9 min. (I-VII)
			2.0 min. (VIII-X)
			Seq: indeterminable
			Ap: W (D)
			Exp: 2/3
			Colour shock.

Evaluative remarks and emotional exclamations, tendency to denied and descriptive answers, perplexity, low "interpretation-awareness".

Worked relatively quickly and resolutely, even when she had obvious difficulties. Talked quite a lot, mumbled to herself or made spontaneous remarks.

Psychogram: Comparatively few responses; the description of her personality cannot therefore go into detail. As in previous tests she seems to be intelligent, and still seems to work efficiently; there are only moderate signs of intellectual reduction. Seems to be mainly sthenic, and it is striking that she, when one takes her age into consideration, is still lively and emotional. There is probably only a slight tendency to introjection and no obvious signs of anxiety. Her aggressiveness is for the most part extroverted. She seems to have a considerable need to establish contact with others which she however expresses in a rather striking, almost egocentric way. There are no signs of long-lasting or serious dysphoria. Both the formal results and her behaviour during the test indicate good compensation. (Slightly infantile or imaginative features, feeling of rootlessness, "breaks").

Double-blind test

Woman, middle-aged (?). Approximately average in intelligence. She seems only to have short-sighted goals, and she seems to be superficial and naive. Her thoughts seem to be marked by easily stimulated feelings, but she seems anxious about her impulsiveness and lability and probably tries to inhibit her impulsiveness and control her emotions. She will, however, not quite succeed, and sporadic emotional outbursts are likely to occur. She seems to be rather egocentric and domineering and, as mentioned before, very labile; this lability may manifest itself in quickly-changing moods. One has the impression that there is only a minimum of neutral subjects and that a situation may for her quickly change from the light and pleasant to the dark and confusing. There seems to be manifest anxiety, some of it bound to phobic symptoms. There is a quite pronounced hysterical tinge about the test.

Retest (8 months later).

10 W	5 F+	1 (H)	7 P. Orig: 1
5 D	1 F+/-	7 A	F+ = 80 (extended 75)
Total: 15	1 F-	3 Ad	F = 100 - L = 50
	1 FH	2 Bt	A = 50
	1 M	1 Stone	Affective ratio: 40
	2 FC	1 Fire	RT: 0.7 min. (I-VII)
	2 CF		0.4 min. (VIII-X)
	2 FY		Seq: indeterminable
			Ap: W! - D
			Exp.: 1/3
			Colour shock, VII.

Perplexity and vagueness; tendency to evaluative and critical formulations and to denied and ambiguous answers.

Completed the test even more quickly than when first tested and especially in the beginning this seemed to be due to a conscious attitude. As before, her uncertainty for the most part manifested itself indirectly, she was still very talkative and her responses were still vague.

Psychogram: The number of responses was still low. The results closely resemble those from the first test. There is, however, a slight tendency to emotional fluctuations. This is probably partly due to the retest-situation itself and a change in attitude, partly to a real, but slight alteration in personality, probably due to increased intellectual reduction. The degree of deficit is, however, comparatively slight in view of her age, and thus she still seems to be intellectually and emotionally active with good compensation and defensive mechanisms.

Word Association Test (a. m. Rapaport)

Astrid

Rather restless and apparently provoked by the test, especially by certain words, although she in general managed the situation well and also responded to all words. The majority of the reaction-times were short or average, with a few long reaction times (over 10 seconds: "mouth", "stomach", "wound", "mother"). The most important problems seemed to be the interpersonal ("parents", "husband"), the sexual and bodily functions, especially oral subjects seemed to be prominent. Her compensation is on the whole reasonably good, her reactions were often quite lively and emotional.

When presented with the words for a second time, the majority of the reaction-times were reduced, but there were some that were prolonged. The percentage of repetitions was average (78 per cent).

Edith

Seemed to be rather restless, but she responded to all the words except one ("vagina"); said she did not know what the word meant. The reaction-times fluctuated considerably, varying from average to above-average (over 10 seconds: "dagger", "wound", "dance", "girlfriend"). Her generally good ability to compensate was particularly manifest in the fact that few of her reactions were striking; most of them consisted in concrete and neutral answers. This is, however, not to say that one cannot indirectly see that she has problems, especially connected to interpersonal and sexual subjects. In spite of the fact that she seems to be well-controlled as regards anxiety, one has the impression that she nevertheless is afraid of impulsiveness.

When presented with the words for the second time, her good compensation manifest itself, among other things in a reduced reaction-time for several words in spite of the fact that her percentage of repetitions was only moderate (65 per cent).

Summary and comparison of the test results

With reference to the intellectual functions, both seem to be normal, probably above average. Whereas Edith seemed to be better equipped intellectually than Astrid, the differences between the results for tests are quite small. Astrid is perhaps less sthenic and is probably more manifestly reduced intellectually, but this difference may be due to Astrid having a higher "Anspruchs-niveau" and thus reacting more easily to an intellectual deficit. Both are, however, only slightly reduced and on the whole less than one would expect from their age. Astrid seems to be uncertain of herself; but at the same time she is surprisingly lively and easily affected, although rather marked by disharmony. She is rather imaginative and immature in her contact with others, apt to pose and appeal, but she also seems to be inhibited and unsure of herself. She is apt to be concerned with details and be anxious, and it seems probable that she will manifest mild symptoms of anxiety, in the form of vague sensations of "lacks, irreality and danger". Her anxiety is probably based upon a complex, whereas her immaturity might well be due to an overprotective environment. Edith is likewise emotionally lively and easily affected, but seems better integrated and realizes her emotions better. She is more extroverted, perhaps especially with regard to aggressive impulses. Corresponding to this she is less apt to experience things and people in an anxious way, although she seems to be able to do so. Her ability to establish contact with others is correspondingly better; she seems to be more independent and mature, although also she is rather egocentric. Generally speaking, she seems to be less complicated than Astrid. Both are imaginative and "naive" in their basic attitude. They have problems with regard to controlling their emotions and sexual matters, and probably also with regard to their basic confidence; both have sexual problems. Both must be characterized as mainly extroverted. Astrid manifests a tendency to anxiety and sexual-neurotic phenomena, but none of the twins show definite psychopathological features.

OTHER SPECIAL EXAMINATIONS

EEG. Alpha-frequency 9–10 hz., amplitude 0–50, distribution 75 per cent. No abnormal potentials. Conclusion: normal in both cases.

ECG. In both cases slight left-sided dominance, slight negative T_1 , slight depression of ST_1 . Outstanding similarity and no differences. Conclusion: normal in both cases.

EPICRISIS

Astrid and Edith were the 4th and 5th of six children of a staff sergeant. Their birth was difficult, and Edith was apparently asphyctic and somewhat retarded in her early development. Neither of them were breast-fed.

When their father died, the twins were separated, and they were brought up apart from the age of three years and six months.

The contact they had with each other during childhood and also in later life had, on the whole, been slight.

They were incorporated in the series when they were 72. We were in contact with them for four years and they showed the most ready cooperation throughout.

Apart from their schooling, which can hardly have been very different, they grew up in environments that bore no resemblances to each other, neither socio-economically, culturally, nor psychologically. On the contrary, the differences were marked, as the twins themselves have experienced. This also applies to their later life histories, their training, their marriage, their social footing and to the whole course of the lives.

Astrid was brought up by the twins' mother together with four sisters. The home was stamped by there being no father, by the personality of the mother, the strong family ties, the family traditions and social ambitions, and by needy circumstances. Throughout her childhood her emotions were closely linked with her home and family on which she could always depend. She became a trained nurse and married when 30. Her life henceforward became that of the wife of an official. She had two sons, a respectable social footing, a comfortable house, a safe but small income, succeeded by a small retirement pension; on the whole a rather protected life.

Edith was put into a foster-home and was adopted by strangers, a book-binder and his wife. She grew up as an only child of comparatively young parents of a moderate social standing but in fairly easy circumstances. It was an environment that lacked special ambitions or impulses. She felt strongly tied to her adoptive home, but, at the same time, she apparently had to divide herself between it and the ties of her natural family during her upbringing. She was given a commercial training, was married comparatively young, when 23, to a grocer. She had led a life, that was hard-working and, in financial matters particularly, insecure. She had a son and a daughter. When 67 she was widowed and had since then lived in modest circumstances, partly supported by a son, partly by her old age pension.

Corresponding to the differences in the childhood environments and in their later lives, the development of the personalities of the twins had also run along primarily different lines.

Astrid has, undoubtedly, from childhood been a more clinging nature, uncertain, anxious with slight neurotic mechanisms, while Edith's development had made her become more independent and mature, but neither of them had presented definite psychopathological traits.

As regards their health they have showed marked resemblances, in the first

place they have both been well. Both have had rheumatic fever, Edith twice. Both had since their pregnancies suffered from varicose veins.

Astrid seemed to have developed a tendency to hypertension, which was not manifest in Edith, who, on the other hand, presented a slight tendency to overweight and symptoms of a static arthropathy in the knee joints which Astrid did not show.

On the clinical examinations as well as the psychometric testing, they both appeared to be intelligent, above average, slightly reduced, but hardly more than corresponding to their age and without clear differences in their intellectual abilities.

Both seemed to be predominately extroverted, realistically minded, emotionally lively with a bright and even temper, animated and versatile. Astrid was the more insecure, Edith more independent and, at all events, the less neurotic of them.

The outstanding similarity, or lack of differences, between the twins, regarding their physical as well as their mental development, contrast to the considerable differences in their childhood environments and in their later life and also to the massive and rather varied predisposition, which was disclosed in the case histories of various members of their natural family.

Neither of them manifested definite psychopathological traits.

They were classified as: Normal personalities.

CASE XII

VIGGO AND OLUF

The twins were 77 when investigated in 1957. They had been brought to our attention three years previously via the twin register at the Institute of Human Genetics. The twins' addresses were at that time obtained from the national register, but as it was stated that Viggo had died several years ago and as letters to the twins remained unanswered, the pair was excluded from the investigation.

A later more close search of the excluded twin cases led to our contacting *Oluf*, who was a pensioner, previously a gardener and a laboratory assistant, married and living on the outskirts of Copenhagen. He had been raised in a poor smallholder's home. He disclosed that his twin brother was also alive.

Viggo, previously a farmer, was a widower in a small harbour-town in North Zealand. He had been brought up in a farmer's home.

The twins were born in a small village in North Zealand as the 6th and 7th of nine children from a poverty-stricken day-labourer's home. When they were about four years old, their father died, and almost two years later their mother also died. All the children were then given foster-homes in the district, paid for by the parish.

The twins were thus separated when nearly six years old. They were brought up in neighbouring villages, a few miles apart in North Zealand, but they only rarely came into contact with each other, and when adults they had led separate lives.

The main reason, why Oluf had not answered our letters, was that his wife had been afraid that he would be "experimented upon", whereas he himself felt that he was "failing science" by not answering. He was therefore quite happy to place himself at our disposal, as also Viggo, and later Oluf's wife became more interested in the investigations than anyone else in the family.

Our examinations for the most part corresponded to those for the other twins, but they were restricted somewhat out of regard to the twins' age. They were followed over a period of three years.

SUPPLEMENTARY INFORMATION ON THE TWINS' BIOLOGICAL FAMILY

Information was sparse. The twins knew very little about their family, and they remembered very little about their original home apart from that it had been on fire immediately before they were separated.

They remembered nothing about their father, had only vague memories of their mother, and they had only been in sporadic contact with their siblings since they had been separated.

The father

The twins knew that he died at the age of 51 in a workhouse in North Zealand. He was possibly a drunkard, but very hard-working and had tried unsuccessfully to manage his family's problems—primarily poverty, too many children and illness. He was medium blond, relatively slightly built, and it was said that physically the twins resembled him closely. Nothing is known about the father's family.

The mother

She was 37 years old when the twins were born. Before and after her husband's death she had received public assistance. She died when 43 of pulmonary tuberculosis after having born nine children. The twins remembered her vaguely as "a frail, worn-out, weak-chested woman". They knew nothing about her family.

The twins' siblings

1) *Sister*, unmarried, died when 24 of pulmonary tuberculosis. 2) *Brother*, married, labourer, died 25 years old of pulmonary tuberculosis. Had four children; one daughter died of pulmonary tuberculosis when young. 3) *Sister*, died when 14 of typhoid fever. 4) *Brother*, married, market-gardener, died when 80, previously in good health. His only child, a son, died of pulmonary tuberculosis in adulthood. 5) *Sister*, 79, married to a bookseller, always in good health. No children. 8) *Sister*, 75, married to a farmer in Jutland, always in good health. Three children, all healthy. 9) *Sister*, unmarried, died 27 years old of pulmonary tuberculosis.

The twins' siblings all went out to work when still young, and the two youngest sisters were sent to an orphanage. All managed well socially. None had shown signs of mental abnormality, in particular there were no cases of addiction to alcohol. All were comparatively slightly built, mainly leptosome, with medium blond hair and blue eyes.

Summary of the supplementary information

The data available were sparse. There was massive predisposition to pulmonary tuberculosis, probably none to mental disease.

THE SEPARATION

The twins were born at home. According to short notes taken by *the midwife*: labour lasted about four hours and progressed normally. The twins were fully developed and alive, both were born in cephalic presentations. No information concerning the afterbirth.

It is uncertain which of the twins was born first; Viggo had always believed that he was born first and weighed most, but Oluf had never felt convinced that this was true. They did not know whether they had been suckled. There was no information about their early psychomotor development, apart from that both had been small, underweight and had been expected not to survive. Neither, as far as is known, suffered serious illness during early childhood.

They resembled each other closely and were often misidentified by strangers; even their siblings and their mother found it difficult to distinguish them, and did so mainly with the help of a birth-mark on Oluf's right cheek. The twins always kept together, played together and felt closely bound to each other. Viggo was the leader, the most active and talkative, whereas Oluf was very shy and taciturn toward strangers.

They were separated from each other for short periods already when four years old as they alternated in tending pigs during summer time for a smallholder in the neighbouring village. Oluf later had his foster-home there. They were misidentified when separated, as the smallholder had asked to have the "lively" Viggo, and first discovered this mistake after Oluf had been in the home for some weeks, but they did not, however, think it worth-while to effect an exchange. The twins remembered nothing about the separation itself or their reactions to it.

VIGGO

During *the interviews* Viggo stated that his foster-parents had a farm of 34 acres. Their agricultural methods were outdated, but by means of hard work and thrift they had become relatively prosperous. They already had a foster-daughter, seven years older than Viggo, for whom they received a subsistence-allowance as they also had for Viggo.

His foster-father was 45 and his foster-mother 38 years old when he entered their home. He had only depressing memories from his childhood, which he described as "one long treadmill". His foster-parents were "old and peculiar".

His foster-father in particular seems to have been an odd person, very reserved, melancholy, severely religious, rarely said anything and rarely anything directly to Viggo, whom he treated harshly and punished corporally.

His foster-mother was almost as taciturn as his foster-father, and neither of them ever gave expression for any fondness of him.

He quickly was put to work on the farm as a labourer, slept on a straw mattress in a musty room, and was given only Spartan food. He said that he still in his present age had nightmares when he dreamed about his foster-parents and the conditions he lived under. When a boy he was quiet, taciturn and cowed. He never played with other children and had in fact never felt that he was a child.

He attended the village school every other day, and the standards was neither worse nor better than the average.

His elder foster-sister was delicate, for most part bedridden, never went to school and died at the age of 16 from tuberculosis. When Viggo was 12 years old, his foster-parents took in another foster-child, a girl, two years older than Viggo. Viggo had never felt bound to his foster-sister and had never later been in contact with her.

After having been confirmed when 14, Viggo stayed on as a labourer in his foster-home. His whole life and horizon had been restricted to the farm and the near district, "one long, bitter drudgery". When he was about 30, his foster-parents began to be decrepit. During the later years they were almost constantly bedridden, and even though Viggo managed the farm, formally they still owned it. During these years he had many difficulties as the stock died and the harvests were poor. When he was 38, his foster-mother died, and he took over the farm on reasonable terms, using his savings to do so.

When 39, Viggo married a domestic servant of his own age. Their life was still a drudgery and they had to look after his foster-father, who was chronically bedridden until he died at the age of 86. Viggo was then nearly 50. As he had no children in his marriage, after some years they took in a foster-child, a girl aged 12, who had been in another foster-home, seemingly under poor conditions. Viggo's marriage, which lasted 22 years, was primarily marked by his wife's illness, she seems to have suffered from a chronic hepatic disorder. During the interviews he provided only little information in this connection and nothing about his wife's personality. Shortly before his wife's death the farm burned down. Viggo only said that these years were very difficult for him. He was a widower when 61, and even though he rebuilt the farm, he could no longer manage it properly. Neither could he feel at ease under these new conditions, and so he sold the farm after a few years and moved to the nearby harbour-town, where he lived with his foster-daughter, who had married in the meantime.

He still had many problems. His foster-daughter was married to a tailor who was apt to drink, she obtained a separation, but as she had three children it was difficult for her to manage and Viggo had to help her—which seems to have led him to using most of his money. According to the information available (mostly from the housekeeper mentioned below) Viggo was very disappointed by his foster-daughter, who had “bad nerves”, was egoistic and demanding. He decided to leave her, and moved to a two-roomed, old fashioned, but well-kept flat. A younger sister to Oluf’s wife acted as his housekeeper.

When visiting Viggo’s flat I often was able to talk to his housekeeper, a 60-year-old, slim, almost frail, white-haired woman, who resembled her sister, Oluf’s wife, closely. She received invalid pension for a “chronic infection”, was rather hypochondriac, but sensible and cooperative, and she provided supplementary information about Viggo’s mentality:

Viggo had never permitted himself any type of luxury. He neither smoked nor drank, rarely bought anything for his personal use, and apart from his work had never had any definite interests. During the later years he had acted as a gardener for various people, mostly for the sake of having something to do, as he rarely asked a reasonable wage for his work. He rose early, was active all day long, read the newspaper but never anything else. He wrote only with difficulty, but he had a good head for figures and his ability in money-matters had always been exceptional. He had always been an extraordinarily hardworking man, thrifty, conscientious and self-confident to a degree of stubbornness, but at the same time credulous and “naive”. On the whole, he seemed to be content in his present way of life, and he also stressed this himself.

Concerning his medical history, Viggo said that since childhood he had been slightly-built, underweight and “ailing”, and was therefore not accepted for military service. He had never suffered from serious illness, had never been ill at all, until he was admitted to hospital when 71.

The *case record* states: Previously healthy. Two weeks ago he noticed a tumour under his mandibular joint. Objectively: much younger in appearance than his age, healthy, redfaced. Weight: 62 kg., height: 161 cm. Loose dental stumps in the upper and lower jaw. A tumour, about the size of a walnut, was believed to be malignant and was therefore treated with X-ray, but there was no improvement. It was extirpated. (Microscopy: no signs of malignancy). Diagnosis: *sialoadenitis chronica submaxillaris dextra*.

Ever since childhood his teeth had been carious; he soon lost most of them and in the past few years had only had a few paradentotic remains left, which no one had been able to persuade him to have extracted.

Some years earlier he had been seriously injured when he fell off a wagon, and later he was run over by a motorcyclist. In both instances he was bed-

ridden at home for a long time with pain and a haematoma of the left hip. It was not quite clear whether he had fractured his femora or not, as he "would never call for a doctor for such small things". Since then he had noticed increasing stiffness of the hip, he limped on his left leg and had gradually become so deformed that he had to use a stick. His senses had declined, especially his hearing, since his accidents. He used spectacles for reading. His organ systems functioned normally, and he had in particular never had difficulties in urinating. On the whole, he considered that he had always been in good health. He did not smoke and had never liked alcohol.

OLUF

During *the interviews* Oluf stated that his foster-parents had a small-holding in the neighbouring village. They were very poor. His foster-father was 60 and his foster-mother 34 when they took him into their home. They had two adult children, a 29-year-old son and a 19-year-old daughter, but Oluf in fact grew up as an only child in the home.

He stated that he had been treated "well" in so far that they were kind to him and never scolded or punished him, but he was otherwise treated in the usual way for poor people's children, who were given foster-homes paid for by the parish. Primarily he had to "earn his food" and his childhood was dismal and joyless. He had to help on the farm and look after the livestock. Due to his slender built it was difficult for him to manage the hard work and he, on the whole, "only worked, slept and ate". The food was very Spartan, his foster-mother was close-fisted and he "only had half a portion of anything". His foster-father was stubborn and rather difficult, and it was he who dominated the family.

Oluf's education was poor because neither of his foster-parents considered it important that he attended school, and in addition the teacher was incompetent—thrashed the children and let the older pupils teach the younger ones—thus Oluf also during the later part of his schooling had to "teach" although his knowledge of writing, reading and arithmetic was rather poor.

At home he was "tolerated" and spent his time alone. He never received any form of tenderness from his foster-parents. "I have never had a real home". He had never played with other children or felt that he was a child. He was quiet, taciturn, felt lonely and "outside things", felt inferior and longed throughout his childhood to be an adult so that he could become independent. When he had been confirmed, he left his foster-home, and he had never since been in contact with it.

From the age of 14 he had to look after himself. He stressed that he was the "black sheep" of his family in that he, contrary to his natural siblings, had never been given any form of help. He first worked at various farms

as a labourer. At the age of 16 he was apprenticed as a bookbinder—seemingly influenced by his elder sister, who was married to a bookbinder. He finished his apprenticeship when 18 but shortly afterwards gave up this trade as a physician advised him to do so because of the family's "predisposition to tuberculosis". He did not particularly mind, as he had always preferred working in the open air and especially wanted to be a gardener. He worked as such at various places in Jutland and North Zealand.

When 25, he attended an agricultural college for about six months where he also improved his ability to read, write and do simple arithmetic. He was then gardener for a botanist, who had a large nursery on the outskirts of Copenhagen. When he was 34, he obtained another post as gardener for a factory-owner, who had a country house in North Zealand.

When 41, he was given a post as laboratory assistant at an agricultural institute in Copenhagen. He stayed here for almost 30 years, was engaged on a large number of experiments on plants' genetics and worked for various scientists in this field, and according to the information available he seems to have been appreciated as a very valuable assistant. He said that he had always had exceptionally pleasant seniors; they had all been "severe but had their hearts in the right place".

He retired on a pension at the age of 70 and had since lived on the outskirts of Copenhagen. He had been thrifty, had a reasonable amount of money, and he seemed to have a good bank-balance. Shortly after he married, bought a piece of ground, built a house himself and planted a large orchard, where he spent his retirement.

His wife, who was 64 years old, had always been "nervous", had suffered from "a descended stomach" for 40 years and had therefore used supporting corsets for 20 years. She had never been admitted to hospital but had been treated by various physicans and chiropractors. She was slim, white-haired, very asthenic, hypochondriac, hysterical, exceptionally circumstantial and talkative, and was probably tiring to be together with even for a short time. Like her sister, Viggo's housekeeper, she gave detailed information that supplemented the other data about Oluf:

She described Oluf as "different from others". Even since childhood he had been very hardworking and Spartan. Until he was 25, he had never used money or anything but absolute necessities. When she first became acquainted with him, he felt inferior to others. Her parents had a large farm, most of their children were still at home when Oluf first came there, and he became closely attached to her family; she thought this was because, he had never had a proper home and family of his own. They were engaged for some years and married rather late, when Oluf was 38, as he wanted to be sure that he could support his wife. He had always been very interested in his work, but had also been very absorbed in his family. His work had always

been appreciated and even though he had had to work hard, he had on the whole been content. He had always thought it important to be industrious and thrifty, and had never permitted himself much in the way of luxuries, although he smoked cheroots. He had never been fond of alcoholic drinks.

Concerning his medical history, Oluf said that he had been slightly-built and underweight since childhood, and he was therefore rejected for military service. He had never suffered from serious illness and had only once been in hospital at the age of 30 for typhoid fever, after which he lost "all hair". For some years after this he had had "stomach troubles", manifesting itself in atypical symptoms, primarily vomiting, but this gradually disappeared, and since he had had no dyspeptic symptoms. He had never had difficulty in urinating.

When he started as a laboratory assistant in his 40's, he had developed mild asthenopic disturbances, which he thought was due to the large amount of work with microscopes and protocols, and he had since used spectacles. After having had typhoid fever his teeth had developed caries and 2-3 years ago they had all been extracted, and he had used dentures since. Oluf considered that on the whole, he had always been in good health.

Oluf's son. He was 36 years old, dark blond, leptosome, healthy. He resembled his father physically and mentally. He was assistant in a large firm and was working for a diploma in commerce. He was married to a previous nurse and had a 4-year-old daughter. They lived on the ground floor of Oluf's house. Oluf and his wife had a three-roomed flat on the first floor. There seemed to be complete harmony between the two families. Oluf was very fond of his granddaughter, who followed him around in the garden.

THE TWIN RELATIONSHIP

Up to the age of six years when they were separated, the twins, as mentioned above, had been very closely attached to each other.

After having been separated they lived about four miles apart, but they only saw each other once a year, on their birthday, and they were otherwise not permitted to visit each other.

Since they had become adults, they had often not seen each other for several years. They still felt attached to each other, were happy to meet and had never disparaged each other. In spite of the fact that Oluf early grew a small moustache, they continued to be misidentified. Even their close relatives thought that they resembled each other closely and this was especially stressed by Oluf's wife and Viggo's housekeeper. The sisters stressed that the twins had both been "very hard working", exceptionally thrifty, conscientious, upright and modest, although they both were complacent about themselves.

Oluf was said to be more apt to lose his temper and was generally more

easily roused emotionally, whereas Viggo was calmer and more stubborn. Viggo had always been the "liveliest" of the twins, whereas Oluf was "slower".

These differences were, however, not pronounced and their points of resemblance were far more obvious. Despite the similarities of their childhood environments, there had, however, been pronounced differences between the two foster-homes, not only socially and economically, but also with regard to "how well they had been treated". Viggo's treatment had been "worst", and Oluf said that he at least would not have exchanged foster-homes. Oluf's education was worse than Viggo's, but he had compensated for this later on.

They stressed that there had been considerable differences during their later lives. Viggo had never "been among people", whereas Oluf had worked at many different places and "had travelled a lot"; while Viggo had stayed on in his foster-home, Oluf had been independent of his foster-parents.

Common to both had been their strong desire to be independent. Their basic attitude was, according both to the informants and the twins themselves, "the same in all important respects", which was assumed to be the reason why they had never quarrelled.

CLINICAL EXAMINATIONS

Oluf was interviewed five times and Viggo four, and both together once. I also visited each of them in their homes three times and talked to Oluf's wife and daughter-in-law, once a nurse at a psychiatric department, as well as Viggo's housekeeper. The twins were exceptionally cooperative and interested.

The differences between the twins' appearance were few, the main one being that Oluf wore spectacles and also had a small moustache. Viggo, due to his accident, was rather bent, and whereas Oluf was 161 cm, Viggo was only 157,5 cm. There was a corresponding difference in weight; they weighed 70.5 and 62.0 kg. respectively, but this difference was not particularly obvious in their appearance. Both twins were leptosome and slightly-built. Their hair was dark brown with slight greying at the temples. It was straight, rather thin and stiff; neither showed a tendency to baldness. The boundaries were identical, and both had parted their hair on the left. The hair-whorls were clockwise. Their eyes were of the same shade of light blue, both had mild arcus senilis. The shape of their heads, the position and details of their ears, the shape of their faces and the facial details as well as their expressions were strikingly similar. Oluf had full dentures and Viggo a few carious stumps. Examination of Viggo disclosed that the left hip was restricted in movement, shortened and there was slight atrophy and a compensatory scoliosis of the spine. Normal findings for Oluf. Both had very bent, stiff fingers, "labourer's hands". Neither showed objective signs of peripheral arteriosclerosis. Their

blood-pressure was slightly above normal. Viggo: 185/100–180/100, Oluf: 195/100–190/100. Routine cardiological examination disclosed nothing abnormal. Viggo was hard of hearing to a medium degree, whereas Oluf, as far as could be judged by means of a rough test, had only a slight reduction. Both were right-handed.

The twins' facial expressions and their energetic and quick movements were strikingly similar. They both talked with a slight North-Zealand accent, rather more pronounced for Viggo than for Oluf. Their voices were very similar indeed, but Viggo's was a little hoarser than Oluf's.

Their mental differences were clearly dominated by their similarities. Both seemed to be well-preserved, probably not more deteriorated intellectually than to be expected from their age, and there were no obvious differences between them.

They both appeared to be above average intelligence; at first one might have the impression that Oluf was the more intelligent, but this was easily explained by his general information due to his association with scientists and was mainly manifested by his being able to utilize his abilities more fruitfully.

They were both relatively easy to establish contact with; it was a little easier to do so with Oluf, but on the other hand Viggo seemed to be in warmer and more genuine rapport. They were strikingly similar in character and personality: reliable, upright, quiet and modest. They also possessed natural complacency and independence, and were both very sympathetic. Oluf was perhaps more often emotional and labile, as well as disharmonious than Viggo.

Neither seemed to be neurotic and neither manifested other psychopathological features.

PSYCHOMETRIC EXAMINATIONS

Raven's Progressive Matrices

Viggo

Attempted 52 matrices in 17 minutes (matrices D_{10-12} and E_{8-12} were excluded). Talked rather a lot and seemed to find it difficult to grasp the idea behind the test. Score: $9+6+3+2+0=20$. Distribution: normal; discrepancies: 2. Group: approximately the 50th percentile. (Extrapolation). Conclusion: normal intelligence.

Oluf

Attempted 52 matrices in 20 minutes (matrices D_{10-12} and E_{8-12} were excluded). Was rather talkative, especially when he seemed to feel uncertain. He altered his solutions several times. It seemed that although he often tried to use analogy-solutions, he nevertheless worked conscientiously. He was probably not capable of solving more, or more difficult, matrices. Score: $9+6+5+4+0=24$. Distribution: normal; discrepancies: 2. Group: 50–75th percentile. (Extrapolation). Conclusion: normal intelligence.

Wechsler-Bellevue

	Viggo				Oluf			
	I		II		I		I	
	RS	WS	RS	WS	RS	WS	RS	WS
Information	9	7	11	8	15	11	15	11
Comprehension	8	7	5	5	11	10	11	10
Digit Span	5+3 = 8	4	5+4 = 9	6	6+4 = 10	7	8	4
Arithmetic	9	12	10	12	7	9	7	9
Similarities	8	7	6	5	12	10	10	8
Vocabulary								
Verbal Points		37		37		47		42
Picture Arrangement	2	3	8	7	7	7	7	7
Picture Completion	6	4	9	8	9	8	11	10
Block Design	12+1 = 13	8	12	6	15+2 = 17	8	15+2 = 17	8
Object Assembly	15	7	14	7	16+2 = 18	10	18+2 = 20	12
Digit Symbol	20/20	5	19/19	4	21/21	5	22/22	5
Performance Points		26		32		38		42
Total Points		63		69		85		84
Verbal IQ	96+6 = 102		96+6 = 102		106+4 = 110		101+4 = 105	
Performance IQ	88+15 = 103		94+15 = 109		101+15 = 116		106+15 = 121	
Total IQ	93+6 = 99		96+6 = 102		106+6 = 112		106+6 = 112	

Viggo

Rather hard of hearing, but this did not seem to affect the trustworthiness of the results in any important respect. He was cooperative and with some encouragement he overcame his uncertainty. As one would expect from his age, his acceptance of the tasks was only moderate.

His best result was on Arithmetic; the solutions were convincing and definitely above average. There is probably nothing abnormal in his Digit Span and neither did his difficulty in hearing seem to influence the results. His results for Picture Arrangement and Picture Completion are striking: on the first test he did not really understand the idea of the test, and on the latter he had considerable difficulties. His results on Information were poor. His other results are irregular as regards which of the items he managed, especially Comprehension. Conclusion: normal intelligence (with slight to moderate signs of intellectual reduction, but hardly more than one would expect in a man of his age). When *retested* (9 months later) there were slight changes in the verbal tests and a small improvement on some of the performance tests (Picture Completion and Picture Arrangement), but the scores for the other subtests were a little below those for the first test. Conclusion: no significant change.

Oluf

Cooperated satisfactorily and showed no signs of uncertainty. He seems to be of good intelligence, self-confident and normal in his attitude toward the test. Considering his age the acceptance of the tasks is reasonably good. Talkative in the typical fashion of oldsters.

His results on Information were good but he had some difficulty in mobilizing his knowledge. The scores on the performance tests were rather uneven. It was difficult for him to remember the text of the arithmetical problems. Similarities showed moderate concreteness and there were difficulties in Block Design. Conclusion: normal intelligence. (Considering his age, only moderate signs of intellectual reduction).

When *retested* (8 months later) the scores on Similarities and Digit Span were somewhat poorer, but the results on Picture Completion and Object Assembly improved. The

reduction in the scores for the two verbal tests might reflect a progression in intellectual deficit, but this seems doubtful. Conclusion: no change.

Rorschach

		Viggo		
6 W	5 F+	2 H	3 P. 1 Orig. (+/-)	
1 W (S)	1 F+/-	4 A	F+ 92 (extended 85)	
1 D	2 M	1 Ad	F = 100 - L = 60	
2 Dd	1 CF	1 Bt	Affective ratio: 30	
<hr/> Total: 10	1 V	2 Ge	RT: 1.1 min. (I-VII)	
			0.7 min. (VIII-X)	
			Seq: indeterminable	
			Ap: W - (D) - Dd	
			Exp: 2/1	
			Shocks: doubtful.	

Tendency to impotence and concreteness.

His behaviour corresponded to his behaviour during the Wechsler-Bellevue testing. Rather unsure of himself and had some difficulty in managing the task, but his rather negative attitude toward the test and his moderate ambition, nevertheless, meant that he did not seem to be particularly oppressed by the situation.

Psychogram: Normal intelligence, marked by uncertainty in his attitude toward the tasks. He is possibly not particularly persevering. He is strikingly "global" in his viewpoints. His possibilities for empathy and self-insight seem to be good, but he presumably does not employ them well. His ability to establish contact and his interest in doing so are relatively good, especially when one takes his age into consideration. The results suggest deep-lying problems of long duration (anxiety toward authority?, experienced maternal failure?). It seems possible that there are variations in mood, and there are signs of emotional anxiety, and of emotional break-through. On the whole, he seems to be rather inactive, somewhat tense and on guard, and it is possible that this is the reason why he manifests fewer and less pronounced signs of dementia.

Double-blind test

Man, elderly. Seems to be intelligent, but is showing signs of some intellectual deficit. Appears rather unsure of himself, presumably finds it difficult to adjust to new tasks. He is rather vague and unprecise, apt to concreteness. His interests, relative to his age, are varied. He is not without self-insight. His imagination is not completely "clipped". He appears to be emotionally active and his ability to establish contact with others seems to be quite well preserved.

Retest (8 months later)

8 W	5 F+	1 H	2 P. 2 Orig. (+/-)
5 D	2 F+/-	8 A	F+ 70 (extended 69)
<hr/> Total: 13	3 F-	1 Ad	F = 100 - L = 77
	1 M	1 Ge	A = 69
	1 FC	1 Ls	Affective ratio: 46
	1 CF		RT: 1.7 min. (I-VII)
			0.9 min. (VIII-X)
			Seq: indeterminable
			Ap: W-D
			Exp: 1/1½
			Colour shock.

Tendency to impotence, perplexity, and concreteness.

Behaviour as described previously.

Psychogram: The number of responses is approximately the same as before. Six to eight of them are mainly repetitions; perhaps one underestimated his difficulties on the first test. There are clear signs of uncertainty and impotence. When encouraged he responded positively, and this perhaps explains why he sometimes goes too far where a vaguer response would have given better results. The results are rather ambiguous and comprise quite good, although rather banal, responses and uncritical and "forced" responses. The latter are presumably due to difficulties in conceptual and appropriate classification of the entities, corresponding to some degree of intellectual deficit. His potential possibilities of contact with others are presumably relatively good, but as mentioned before, there are signs of deep-lying, long-lived problems.

		Oluf			
6 W	9 F+	6 A	6 P. 0 Orig.		
6 D	1 F-	3 Ad	F+ 91 (extended 86)		
2 Ds	1 FM	1 Bt	F = 100 - L = 79		
<hr/>	1 FC	1 Ls	A = 64		
Total: 14	1 CF	1 Ge	Affective ratio: 36		
	1 FY	2 Obj/art	RT: 1.3 min. (I-VII)		
		Achrom. colours.	0.6 min. (VIII-X)		
			Seq: indeterminable		
			Ap: W - D - Ds!		
			Exp: 0/1 1/2		
			Colour shock.		

Concreteness, impotence, and perplexity.

Seemed to encounter quite serious difficulties on this test. This is among other things manifested by the relatively few responses and his tendency toward "Versagen". This was, nevertheless, overcome by encouragement and moderate pressure. Had difficulties in mobilizing words and concepts, and there were several "organic" traits in his behaviour; there were interrogative answers and denial, together with a tendency to "escape from the task". It was also noteworthy that he occasionally reacted actively and sthenically.

Psychogram: Normal intelligence; in spite of the pressure imposed by the situation and the difficulties he encountered, he functioned quite well. He seems to be in good contact with the more banal ideas and lines of thought, and also manifests possibilities for independent and active attitudes. Intuition and imagination are, on the other hand, only manifested to a slight degree—perhaps due to his age. He is but little interested in contact with others, but he is presumably well-compensated in these fields of long duration. During the test his mood was neutral, but variations are possible. Although his emotional control and suppression of anxiety are presumably strong, there is a certain degree of readiness for emotional reactions. Moderate signs of dementia.

Double-blind test

Sex? Elderly. Of average intelligence, rather reduced due to age with difficulties in word-mobilization; evasive, unsure of himself earth-bound, concrete, apparently due to age, but he sometimes surprises one by being able to look at things from a different point of view in quite an independent fashion. His imagination is, however, "clipped", and it seems that his interests have been reduced in extent. Emotionally he seems to have become rigid, and his ability to interest himself in and understand others does not seem to be particularly good. He will probably manage conventional contact, but the test suggests tendencies to opposition. Possible periodical mild depressions?

Retest (9 months later).

10 W	21 F+	3 Hd	5 P. 2 Orig. (— —/+)
21 D	4 F+/-	12 A	F+ 85 (extended 82)
2 Ds	2 F-	10 Ad	F = 100 - L = 79
1 Dd	2 FC	2 Bt	A = 65
Total: 34	1 CF	2 Obj	Affective ratio: 29
	3 FY	3 Ls	RT: 0.6 min. (I-VII)
	1 YF	2 Cl	0.7 min. (VIII-X)
		+ achrom. colour.	Seq: methodological?
			Ap: W - D! - Ds - Dd
			Exp: 0/2
			Colour shock.

Tendency to impotence, perseveration, and concreteness, denial, criticism, reformulation, and repetition of own answers.

Behaviour as described previously.

Psychogram: The number of responses increased considerably; only 7-9 of them were wholly or partly repetitions. There are more D, Dd and Y responses but all the percentages remain more or less unchanged. This result seems to make it necessary to expect more emotionally determined experiences and actions. His independence or his possible tendency to opposition is not more pronounced in the retest, but one should perhaps place more weight upon it. He also seems to be different in other ways, with more ixothymic traits: rigidity and perseveration. Either these traits have become more manifest or they are due to intellectual deficit—which is still moderate in degree. There are still signs of deep-lying, long lived problems, resulting among other things in inhibition of his ability to establish contact with others and maybe also of his imagination and introspection.

Word Association Test (a. m. Rapaport)

Viggo

Due to his pronounced deafness it was impossible to carry out this test.

Oluf

It was difficult to evaluate the degree to which he used his deafness as a defence-mechanism. The test was only administered once. Some words, sexual, anatomical, aggressive and interpersonal, seemed to be provocative. His defence was marked by aversion, denial and an almost suspicious attitude, but was otherwise so varied and effective that there are no specific symptoms of neurosis.

Summary and comparison of the test results

The twins differ somewhat intellectually in that Oluf seems to function better than Viggo, and he is somewhat above average, whereas Viggo is about average. Nevertheless, both are obviously normal in intelligence. When their age is taken into consideration they accepted the tasks relatively well. There is hardly a definite difference in their degree of intellectual reduction, and both show signs of moderate dementia. Oluf is, perhaps, more affected by his deficit because he attaches importance to it and is emotionally engaged.

Viggo seems to be less asthenic than Oluf, the latter appearing to be more tense and inhibited and has presumably greater need of defence-mechanisms in the form of isolation and dissociation of emotion. Both seemed to have compensated quite well, but both had deeper-lying problems. Viggo probably manifests himself as a "softer" type of person and is more open and interested in contact with others. He also seems to possess greater possibilities of having imaginative and emotional experiences and ideas. In both suppression of anxiety appears to be quite efficient, but their control of mood is not quite as effective. Tendency to depression seems most pronounced for Oluf and may be related to his impulsiveness and oppositional tendencies. Both show clear signs of anxiety toward authority and of problems in their relationship to maternal figures (experienced failure?). Their personalities are not particularly characteristic; their ixothymic traits are, perhaps, noteworthy, and likewise that Viggo is less sthenic and more introspective. Neither of them present definite psychopathological symptoms.

SPECIAL EXAMINATIONS

EEG, ECG (and *otological*) examinations were not available.

EPICRISIS

Viggo and Oluf were the 6th and 7th of nine children from a day-labourer's home in North Zealand. Their birth was probably normal. It is uncertain whether they were breast-fed.

They were separated, when they were nearly six years old, since then they had had little contact with each other. They were incorporated in the series when they were 77, and they were studied for the three years following.

The common environment of their early childhood was marked by illness and distress. At the death of their parents, the twins were put into separate foster-homes by the local authorities. Even then, before their separation, their personalities seem to have shown differences, particularly in their tendency to assign character roles to each other, although there was, at the same time, a strong feeling of mutual affinity, which had never been lost.

After their separation, their childhood environments bore outwardly certain resemblances. They were both brought up as foster-children with strangers, in the same part of North Zealand, in villages lying about four miles apart. The atmosphere in both homes was loveless, and there was little opportunity for establishing emotional contact with other people.

On the socio-economic level, there was a distinction. Viggo's foster-parents were well-to-do farmers, while Oluf's were poor smallholders. Viggo was brought up with foster-brothers and sisters, while Oluf was, to all intents and purposes, an only child. Oluf's life as a foster-child was, on the whole,

“neutral”, whereas Viggo’s environment was, undoubtedly, more difficult and more psycho-injurious. On the other hand, he remained tied to it for the rest of his life, while Oluf liberated himself from his home-ties as soon as he grew out of childhood.

They had little schooling. Oluf had, possibly, even less than Viggo, but he made up for this later. Both had always been prompted by an urge to get on the world, to become their own masters and to be financially independent.

They have both led hard-working lives, which ran a different course and which showed few resemblances. Viggo was a decided stay-at-home. He was a farmer all his life, and only a few years ago did he leave the farm on which he had been brought up. As a young man, Oluf led a roving life, being employed, for the most part, as a country gardener, but when he was 40, he obtained a post as a laboratory functionary. Both married comparatively late, Viggo when 39, and Oluf when 38.

Sufficient information is not forthcoming to throw light on the personality of Viggo’s wife, but it should be pointed out here that the twins’ lives ran a course in their later years that was strangely parallel as Oluf’s wife’s sister became Viggo’s housekeeper; these two sisters bore a striking resemblance to each other, not only in their outward appearance, but also in their hypochondriac personality.

Viggo’s home life had, undoubtedly, been filled with conflicts. He had an adoptive daughter but no children of his own. Oluf had a son, but his family life hardly ran more smoothly. On the whole, the ultimate socio-economic level of their lives seems to have been very similar, and, at any rate, on a level that was considerably higher than that of their starting points.

Both have enjoyed good health, and, at the time of our investigations, appeared physically well-preserved. The chief difference here lied in Viggo’s reduced power of hearing, which may be accounted for by the injuries to which he was subjected at a comparatively late age, but Oluf was slightly deaf also.

Mentally, the resemblance predominate. Both were of above average intelligence, only moderately reduced. The differences disclosed by the psychometric tests are readily explained by the differences in their education and the experiences of their adult lives. Viggo’s remarkable arithmetical powers may thus be attributed to his preoccupation with accounts and business problems connected with running the farm, and Oluf’s wider general knowledge must be due to the broader environments in which the greater part of his life had been spent.

Their personalities, in characterological respects particularly, seemed to have developed along parallel lines and were strikingly alike. Both were diligent, economical, ambitious, and conscientious. Both appeared modest and unobtrusive, but at the same time, their demeanor showed a natural

confidence and self-esteem. They were upright and likeable. Emotionally, Oluf may be said to be possibly more labile than Viggo, and this can, possibly, be attributed to problems of his married life. Both were marked by sthenic traits, perhaps more so in Viggo's case than in Oluf's, but here too, the differences were but slight, and can be designated as differences of degree only.

From our investigations, the twins were found to be without any certain psychopathological traits.

They were classified as: Normal personalities.

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PART III

FOLLOW-UP: TWENTY-FIVE YEARS LATER

Chapter 13

FOLLOW-UP: TWENTY-FIVE YEARS LATER

It is now 25 years since I started my initial investigation, and it is about 20 years since I last was in contact with all of my probands.

In the intervening years I have occasionally had personal contact with some of them. I have also automatically received information about those who have been involved in the twin investigations carried out from the Danish Twin Register, directed by Professor *Mogens Hauge* of the University of Odense.

During 1978-1979 I have carried out a systematic follow-up of all twin pairs with the aim of collecting information on: 1) *the course of their lives*, 2) *their mental and physical health*, and 3) *causes of death*.

Of the original 24 individuals involved, 11 are now dead and the remaining are between 45 and 93 years of age.

The main results of the follow-up are given in the following brief case histories.

CASE I

PALLE AND PETER

They are now 45 years old and are both living in the Copenhagen area. In the intervening years, since they met accidentally when 22, they have maintained their close contact.

Palle has supplemented his rather poor schooling with a course in theoretical commerce and for a time he considered training to become an accountant. He has now given up this idea and is a book-keeper in a private firm. He lives in rather comfortable circumstances, is married, and has three children. He has suffered no physical or mental illnesses.

Peter had great difficulty in completing his university studies but is now a practising veterinary surgeon. He is comfortably off, married, and has two children. He has continued to dissociate himself from his childhood environment in several ways, e.g. by resigning from the Roman Catholic Church. He has been fit both physically and mentally.

CASE II

OLGA AND INGRID

They are now 60 years of age. *Olga* lives in Copenhagen while *Ingrid* has stayed in the provincial town in East Jutland in which she has spent most of her life. They have not had any contact with one another for the past twenty years.

Olga still lives alone, is divorced, and has had a rather unsettled working life, e.g. working as a housekeeper and as unskilled help in factories and shops.

She has at times had symptoms of a "gall bladder" disease but otherwise remained fit until the age of 58. At this time, while on stay in the United States, left-sided *cancer mammae* was diagnosed and treated by mastectomy. Since her return to Denmark, she has been admitted to the hospital several times where widespread metastases from the tumor were found. She is now in a nursing home.

Ingrid is still married and lives under favorable, stable social and economic conditions. As far as can be ascertained, she has enjoyed good health both physically and mentally.

CASE III

MAREN AND JENSINE

Maren remained unmarried and continued to work as a nurse in North Slesvig.

At age 52 she underwent menopause with pronounced climacterial symptoms, hot flushes, sweating periods, and depression. These symptoms were treated with oestrogen hormones. The available hospital records indicate that she for many years suffered from *periodic depressions*, and in this connection she developed such a large alcohol consumption that the diagnosis *chronic alcoholism* was made.

At the age of 54 she was admitted to the hospital suffering from fatigue, diarrhoea, and weight loss. Gynaecological examination showed an enlarged uterus and a suspect cervical erosion which on microscopy proved to be an anaplastic carcinoma. The following explorative laparotomy showed an inoperable *cancer uteri* (stad. IV) with widespread metastases. She died at the age of 55.

Jensine is still alive, aged 60 years. She is married and works as a nurse in North Zealand. On the whole she has been fit both physically and mentally.

CASE IV

INGEGERD AND MONIKA

They are now 65 years old and have kept up rather superficial contact with each other. They rarely meet because they live in different parts of Jutland.

Ingegerd is still married and a housewife, but she has an extra job for a local sports club. In the past years she has frequently been in the hospital because of gynaecological symptoms that were treated by several curettages and at the age of 52 by hysterectomy and removal of the left ovary. She has also had symptoms from *degeneration of the lumbar intervertebral discs* and with increasing age she has become rather overweight.

During the intervening years she has had *periodic depressions* which have caused rather frequent admittance to a psychiatric hospital, where she has been treated with antidepressives. According to hospital records and a statement from the chief physician, she is considered neurotic and a diagnosis of manic-depressive psychosis cannot be substantiated. She has not received psychiatric care or treatment within the last five years. Her family life and marital life is most disharmonious.

Monika is still married, a housewife with no part time job. She has a rather disharmonious life with her husband and family.

She has been admitted to the hospital on a few occasions because of *degenerative changes of the lumbar intervertebral discs*, and because of concussion following a motor accident. She emphasises that she has managed better than her twin sister because she "does not smoke and because her keen interest and participation in folk dancing keeps her good humoured and her weight down."

CASE V

KAJ AND ROBERT

Kaj, now age 68, is still a salesman and is living in a coastal town in North Zealand with his wife who is a medical secretary.

In the intervening years he has been healthy apart from a tendency to lumbar pain. At the age of 52 he had fairly acute cardiac symptoms with substernal discomfort and pains radiating down his left arm. These symptoms have recurred since that time in varying degrees of intensity induced by exertion and cold weather and have been diagnosed and treated by his G.P. as *angina pectoris*.

At the age of 54 he was admitted to the hospital for further examination. EKG, blood pressure and the usual routine of laboratory tests were normal. Coronary arteriography showed marked atheromatous changes in the left coronary artery 1 cm. from the aorta, perhaps total occlusion of ramus circumflexus, in any case with a delayed and insufficient filling of the ramus and of r. descendus anterior. The right coronary artery only showed slight

changes. An X-ray of the spine showed lumbal cyphosis and degeneration of the intervertebral discs.

The diagnoses were *sclerosis aa. coronariae* and *degeneratio disci intervertebralis lumborum*.

His mental status has remained unchanged. He still has a very moderate alcohol consumption and has reduced the number of cigarettes he smokes daily to about ten, plus a pipe or two of tobacco.

He had had very sporadic contact with Robert and informed us rather laconically of his twin brother's sudden death.

Robert had still been employed as a cartographer and his wife as a clerk.

He had generally been fit apart from a tendency to lumbal pain. In the later years he had slight attacks of *angina pectoris* which were not serious enough to necessitate admission to the hospital. He drank and smoked very moderately, about 10 cigarettes a day plus a pipe or two of tobacco.

He died suddenly at age 65 at his home in a provincial town on South Zealand. According to the death certificate cause of death was: *infarctus cordis, mb. cordis arterioscleroticus, hypertensio arterialis*. No autopsy was performed.

CASE VI

MARTHA AND MARIE

Martha is now aged 71, a pensioner, and continues to live in her earlier environment, a farm in West Jutland, with her husband. For the last few years her husband has received invalid pension and has handed over the running of the farm to one of their sons.

She has in the intervening years been both physically and mentally fit, and has been especially free of any particular neurotic symptoms. Her tendency to headaches—of a migraine character—has decreased and she has, therefore, not sought medical advice. She takes no medicine regularly and is still very opposed to alcohol and tobacco. She is still overweight (75 kg) with a tendency to constipation and hemorrhoids.

Martha was admitted to the hospital at the age of 59 for a Colles' fracture, at the age of 62 for a *prolapsus uterovaginalis* which was operated upon, and finally at the age of 68 for *chronic constipation*. During each admission a *slight arterial hypertension* was ascertained for which there had been no objective or subjective complaints.

Marie was a pensioner and had remained unmarried. She has suffered from bad health, both mentally and somatically, and had for the past 20 years been admitted to the hospital on numerous times. She continued to suffer from *migraine* attacks, with headaches that eventually became constant with periodic nausea, vomiting, and dizziness.

She received many different medicines, e.g. valium and sleeping pills. At the age of 54 she was admitted to a neurological ward for *asthenia constitutionalis* and *abusus medicamentalis*, and at age 57 she entered the local hospital for observation because she seemed to be suffering from medicine toxication. Again at age 60 she was admitted for recidive lumbal pain resulting from myoses in the gluteal musculature (weight 59 kg). At age 62 she was admitted for *hypertensio arterialis* and age 64 for acute tonsillitis.

At the age of 65 she went into an Old People's Home and from there, at the age of 66, she came to the hospital because of *arthritus* in her left knee and for *pronounced arterial hypertension*, and later in the same year for a Colles' fracture. The following year, after repeated falls out of bed, she was admitted and a costal fracture plus a fissure in the left occipital region were found. She was confused, neurological changes were found, and after an epileptic-type convulsion she was moved to a neurological ward. There her EEG proved to be abnormal but there was no indication for taking arteriography. When removed back again to the local hospital, she failed quickly and died three months later after the above-mentioned accidents at the age of 68.

Autopsy: intracerebral bleeding.

CASE VII

KAMMA AND ELLA

Kamma had continued living in her old environment, a small village in Central Jutland, where her husband kept working as a motor mechanic until they both received their old age pensions at the age of 67.

At the age of 50 she began to show increasing cardiac symptoms, such as substernal discomfort, functional dyspnoea, and a tendency to ankle oedema which was treated with diuretica. She remained able, however, to go on devoting herself to her hobby in the local rifle club.

At the age of 59 she was hospitalized, being unconscious due to coronary occlusion. She recovered quickly, had a similar, but minor, attack the following year, and remained in good health until she was admitted again at the age of 68, when a right-sided *mamma carcinoma* was diagnosed. Mastectomy was performed and radium treatment given; there was no sign of metastases.

Approximately a year later she was again admitted because of acute abdominal pains and rapid dehydration. Explorative laparotomy was performed, but she died within 24 hours at the age of 69.

Autopsy: a massive haemorrhage of the pancreas and widespread necroses in the abdominal cavity. No metastases of the earlier *mamma carcinoma*, but a small, soft, homogeneous, clearly defined reddish-grey tumour was found in the right thyroideal lobe. The autopsy also showed *massive atheromatosis of the*

coronary arteries, an old heart infarct, and advanced fatty degeneration of the liver and gallstones.

Ella is still alive, aged 73. She lives with her husband on their small-holding in Central Jutland; both now receive their old age pensions.

Her health has been generally good and she has never been admitted to a hospital. Occasionally she has shown *slight cardiac symptoms*, such as substernal discomfort and functional dyspnoea and her own physician has diagnosed a *slight arterial hypertension* and mild symptoms of *diabetes mellitus* but no medical treatment has been prescribed.

The twins used to keep in close contact and the death of *Kamma* came as a virtual shock to *Ella*, not least because most of their siblings have died from cardiac diseases or thromboses.

CASE VIII

SIGNE AND HANNE

They are now 79 years old. *Signe* is still married and lives as an old age pensioner in a coastal town in East Jutland. *Hanne* is still a widow and lives on her old age pension in a small coastal town on the island of Funen.

Signe has continued to consult her physician because of various psychosomatic complaints: headaches, lumbal pains, gastrointestinal symptoms and "bad nerves."

She was sent to the hospital at the age of 75. Diagnosis: *ectasia ductus choledochus, obs. causa*. Cholecystectomy and a choledochoduodenostomy were performed. There was no biliary calculi or other findings, apart from a chronic cholecystitis which could explain her symptoms. She had gained a little weight compared with earlier.

Hanne was hospitalized when she was 61 years old. Diagnosis: *neurosis neurasthenica*. At the age of 64 she again went to the hospital with complaints of abdominal pains, constipation, frequent micturition, headaches, lack of appetite, and loss of weight. On admittance she was found to be very neurotic, but further examinations show a dilated ductus choledochus with normal liver function. An explorative laparotomy was performed. This showed an *ectasia ductus choledochus*, but no calculi and no other findings which could explain her symptoms were found. A choledochoduodenostomy was performed.

When she was sent to the hospital in the following year with the same complaints, she was examined by a psychiatrist who concluded that she had an "inveterate neurosis" which was out of the reach of any therapy.

Three years later she was again sent to the hospital due to weight loss, but otherwise with the same symptoms as earlier. She was afraid of suffering

from cancer. Diagnosis: *neurosis neurasthenica (cancrofobia), colon irritabile*. She was readmitted at the ages of 71, 75, and 78. Diagnoses were the same as before. Her neurotic symptoms during the last admissions seemed to be accentuated because she was lonely and depressed; her youngest son, who had visited her almost daily, had died suddenly from a coronary occlusion.

The contact between the sisters had been rare in the past. They only exchanged short letters once or twice a year. As before, Signe still expresses her annoyance that her sister claims to have the same kind of ailments as she has.

CASE IX

KARIN AND KRISTINE

Karin was a widow and an old age pensioner. She had maintained some contact with her sister.

Apart from intermittent biliary colics, which ceased at the age of 70, and pneumonia at age 72, she was in general good health and in good condition mentally until the age of 77. She then suddenly began to have fits of dry coughing, increasing functional dyspnoea, combined with tiredness and extreme loss of weight and was admitted to the hospital with congestion of the lungs and decompensated cardiac disease. She deteriorated quickly and died within three weeks at the age of 77. *Autopsy: bronchiectasia diffusae bilateralis m.gr., fibrosis pulmonis, mb. cordis arteriosclerotica, incompenstia cordis and cholecystolithiasis.*

Kristine was married and received her old age pension.

She had enjoyed good health generally, physically and mentally, until she was admitted to the hospital at the age of 79 due to anemia and dehydration. Examinations showed an inoperable *cancer (scirrhous) ventriculi* and ascites. She died within two months. No autopsy was performed.

CASE X

PETRINE AND DORTE

Petrine is still alive, aged 93. She lost her husband about a year ago and is now in a nursing home on Zealand. She has been in good health, both physically and mentally, and is still in good condition apart from slightly impaired vision and hearing and some difficulty in walking. She still remembers the interviewer from the time of the original study.

Dorte died at the age of 75 shortly after the conclusion of our initial investigation. *Death certificate: cancer ventriculi* with metastases in the lungs.

CASE XI

ASTRID AND EDITH

Astrid and her husband, both pensioners, had led a quiet life in a Copenhagen suburb. She had kept in close contact with her twin sister.

Her health was generally good until, at the age of 75, she began to have slight stenocardiac attacks, which were treated successfully with nitroglycerin. She was admitted to the hospital at age 76 due to a severe attack of *angina pectoris*. There were changes in the EKG and an increase in the transaminasal values. Diagnoses: *Mb. cordis (occlusio coronariae)*, *hypercholesterolaemia*. She received anti-coagulation treatment. At 77 years, she was admitted again in acute condition. Diagnosis: *veneficium medicamentale acutum* (Ismelin), *Mb. cordis arteriosclerotica*, *cataracta o.u.* During the admission her blood pressure was *elevated* but there was no indication for continuing the anti-hypertension treatment. She was transferred to an Old People's Home where she died at the age of 83. *Death certificate: apoplexia cerebri*. No autopsy was performed.

Edith remained a widow and lived alone as an old age pensioner in a small flat in Greater Copenhagen.

At the age of 80 she was hospitalized in an acute condition due to lung oedema and died a few hours later. *Autopsy: hypertrophy and degeneration of the myocardium of the left heart ventricle, widespread atheromatosis of the coronary arteries and the aorta, advanced lung oedema, stasis of the liver, gallstones, chronic cholecystitis, and carcinoma mammae sinistra* (Paget's disease obs. pro.) without metastases.

CASE XII

VIGGO AND OLUF

Viggo died at the age of 92 and *Oluf* at the age of 96. Both were widowers and had been placed in different nursing homes. The twins had kept in close contact throughout their lives. They were both in quite good condition, physically and mentally, until shortly before their deaths. In both cases the death certificate states *pneumonia* and *a decompensated arteriosclerotic cardiac condition*. No autopsies were performed.

COMMENTS

The follow-up was not carried out with the same intensity as the primary study of twins and the collected information varies from case to case.

However, information was obtained on each of the 24 persons concerned that illustrates how their life courses have generally worked out during the preceding years. Some supplementary information has also been included.

Some of the results of the follow-up require commentary.

Apart from the fact that the subjects are monozygotic twins reared apart from early life in different environments, the course of their lives cannot be termed unusual, if the many aspects of life and destiny which human existence contains are taken into consideration.

The lives of the twins have taken place within the framework of cultural, social, psychological, and additional factors that have characterised Danish society during a period extending from the end of the last century to the present day. The courses of their lives have been influenced by situational differences emanating from childhood and later life, and the pattern that was apparent earlier seems unchanged.

In contrast to the conditions that usually characterise monozygotic twins brought up together, there has been a significant variation regarding the way in which these twins brought up separately have experienced their psychic and biological affinity, as reflected, for example, in the way they have kept in contact.

In some cases, e.g., I, VII, and XI, the twins have established and maintained a close and positive relationship throughout their lives. In other cases, e.g., II, V, and partly VIII, the relationship has been negative and has led to a complete termination of any contact. The remaining pairs have had a certain rather superficial or ambivalent contact which can be compared to the relationship that usually characterises brothers and sisters brought up together.

The differences between twins remaining in contact and those who were separated in childhood are undoubtedly related to the social and psychological differences in their social environment; but it cannot be overlooked that certain possibly hereditary personality characteristics may be reflected in another way in the relationship between twins who meet as adults after having grown up separately.

With regard to the general health of the participants in the study, it can be noted, as mentioned earlier, that 11 out of the 24 were deceased at the time of the follow-up and the remainder were aged from 45 to 93 years.

GENERAL HEALTH

In only four cases (I, II, IV, and VIII) are both twins still alive. In five cases (II, V, VI, VII, and X) one of the twins is dead and in the remaining three cases both are dead.

The supposition that *length of life* is determined by hereditary factors is supported by the observation that in the last group, both twins died within two to four years of each other at an advanced age (77/79, 80/83, and 92/96). Case

XII is noteworthy because there the twins were considered "bad risks" at birth and furthermore have had physically and mentally difficult lives, though remaining healthy and well conserved up to extreme old age. In the pairs where one twin was dead at the time of the follow-up, the contrary can be seen in case X where one twin died at age 75 (cancer ventriculi) whereas the other is still alive at age 93, and considering her age, is still healthy. With the four last pairs in question, the time elapsed since the death of one twin is at present only from three to five years.

Causes of death fall chiefly into two categories: 1) *Malignant neoplasm*, and 2) *Diseases of the heart*. These are two of the most frequent causes of death in the Danish population.

The first group included cases III, IX, X, and XI who were all *discordant* for *cancer in the gastrointestinal or reproductive system* at the time of the follow-up.

Cancer ventriculi. In *case IX* one twin died of a scirrhus cancer at age 79 and the other of an arteriosclerotic heart disease at age 77. In *case X* one died from a cancer at age 75 and the other is still alive at age 93.

Cancer mammae. In *case VII* one twin died at age 69 because of cancer with complicated haemorrhages of the pancreas and the other is still alive at age 73. In *case XI* one of the twins died at age 83 of an arteriosclerotic heart disease (no autopsy was performed) and the other died at age 80 of an arteriosclerotic heart disease. The autopsy also showed carcinoma mammae (Paget's disease obs. pro.) To this group we should add *case II* where one twin has a cancer mammae with metastases. She is 60 years old and is not expected to live much longer. Her twin sister is healthy.

Cancer uteri. In *case III* one twin died at age 55 with an inoperable cancer uteri, whereas the other is fit and still living at age 60.

The second group, with *arteriosclerotic causes of death*, includes *cases V, VI, VII, XI, and XII*.

In *case V* both twins developed *arteriosclerotic heart diseases*. The one died at age 65 of an acute coronary occlusion and the other, who has been admitted to the hospital for a similar attack, is still alive at 68 years. In *case VI* both twins have had arterial hypertension. The one died at age 68 of intracerebral bleeding; the other is still alive at age 71. In *case VII*, one twin died at age 69 from haemorrhage of the pancreas, as previously described, due to metastases from a mammae cancer. At age 59 she had a *coronary occlusion* and the autopsy showed a massive atheromatosis of the coronary arteries. The other is still alive at age 73, but has *slight cardiovascular symptoms*. In the twins' family there is a strong disposition for arteriosclerotic diseases. In *case XI* both twins died, at ages 80 and 83 respectively, as a result of *arteriosclerotic heart disease*. The cause of death was the same in *case XII* where the twins were 92 and 96 years old.

Psychosomatic and psychiatric disorders

In *case VI* there was a family disposition for *migraine*, but from 15-16 years of age the development was more pronounced in one twin than in the other. The first twin developed a complicated medicine abuse, an arterial hypertension was diagnosed, and she died from intracerebral bleeding after a fall. Her twin sister, who during childhood and later as an adult lived under much better social, family, and psychological conditions, has suffered very little from migraine in the latter years. A slight hypertension has been diagnosed, but there has been no subjective or objective complaints and she is now 71 years old.

In *case VII*, where there was also a family disposition for *migraine*, both twins developed migraine from 10-12 years of age. In both cases this tendency has lessened with age. The one twin had a coronary occlusion when she was 59 years old and died ten years later as a result of metastases from a cancer mammae. She also had a massive atheromatosis of the coronary arteries. The other twin, who is still alive at age 73, has slight cardiovascular symptoms and mild diabetes mellitus.

In *cases IV* and *VII* there were many psychosomatic symptoms both in the primary and the follow-up studies. These will be discussed below.

In the primary investigation either one or both of the twins in *cases IV*, *V*, *VI*, and *VIII* were classified as showing symptoms of *psychiatric* disorders, and these pairs will be discussed further.

Case IV. The striking resemblance between the medical histories of these twins has been further proved in the follow-up. Their life long neurosis, characterised by their pronounced psychosomatic symptoms, anxiety, and hysterical and periodic depressive symptoms have had a very similar course. The onset of symptoms was rather earlier with one twin than with the other, but at the time of the follow-up, both now age 65, seemed to have stabilised somewhat with a decrease in the need for hospitalisation. The supposition that one twin of this pair had a manic-depressive illness could not be substantiated by the follow-up.

Case V. In the original study both twins were regarded as deviating in personality. Both twins have stabilised somewhat in social and mental functioning in conformity with the usual impression that the problems of such personalities tend to fade with the years.

Case VI. These twins have been mentioned several times earlier. There was a marked difference between them.

The one had a neurosis with asthenic, hypochondriacal, and psychosomatic symptoms, while the other had only mild neurotic, especially obsessional, characteristics and mild psychosomatic symptoms within an otherwise

normal personality structure. Both twins, as previously mentioned, suffered from migraine. At the time of the follow-up there were even greater differences between them. The one had developed a medicine abuse which, in connection with her pronounced arterial hypertension, probably contributed to her death due to intracerebral bleeding at 68 years of age.

The other has only shown mild psychosomatic symptoms and cannot be said to present a definite psychiatric disorder. The difference between the twins can, without difficulty, be traced back to the social and psychological differences in their childhood environments and later differences in the courses of their lives.

Case VIII. Both the twins appear, as earlier, very neurotic with pronounced hypochondriacal (cancerphobe) and periodic depressive symptoms. In both cases, these symptoms have led to numerous hospital admittances. In passing it can be noted that both twins have been examined and have undergone surgery for biliary illnesses (ectasia ductus choledochus), for which no certain etiology could be demonstrated.

Case III. Within the group of twins with psychiatric disorders, *case III* requires special comment. One twin developed periodic depressions in connection with menopause that led to chronic alcohol abuse until she died of cancer uteri when she was 55. The other twin is still alive at age 60 and has not shown any symptoms of psychiatric illness.

In their biological family there were several depressive diseases, but it cannot be sufficiently substantiated from the available material that we are dealing with a case of manic-depressive illness. If such a discordance is present, it should be noted that the clinical assessment of this particular twin pair gave rise to some doubt about monozygosity.

FINAL COMMENTS

The aim of my work has been to increase our knowledge of the interaction of the individual and his environment. The theoretical framework of my investigation has been based on the assumption that differences between monozygotic twin partners reared apart from early life are conditioned by differences in their surroundings, and that similarities between them must be taken as expressions of their common genotype.

The initial investigation aimed at an intensive analysis of each pair of twins over as long a period as was practically possible. The follow-up has increased the total observation period, which now comprises a quarter of a century.

Some supplementary information of interest, consisting of life histories and a record of the physical and mental development of the twins during the intervening period, has been collected, but the general conclusions which can

be drawn about the problem of heredity and environment are still the same as those that emerged from the primary investigation.

It is apparent that twin research has limitations as well as special possibilities. This also applies as well to the method of twin research that is theoretically the most satisfactory: the investigation of monozygotic twins who have grown up apart from early childhood. To the difficulties of collecting and investigating sufficiently comprehensive materials of such twins, limitations and difficulties must be added that pertain not so much to the twin method itself as to methods of investigation that typify general clinical work in psychiatry and psychology.

Newman, Freeman and Holzinger (1937), who made the first systematic investigation of separated twins, have in their conclusion formulated the following passage to which I, on the basis of the present investigation, can fully agree:

If, at the inception of this research project over ten years ago, the authors entertained any hope of reaching a definitive solution of the general nature-nurture problem or even of any large section of the subordinate problems involved, in terms of a single formula, they were destined to be rather disillusioned. The farther one penetrates into the intricacies of the complex of genetic and environmental factors that together determine the development of individuals, the more one is compelled to admit that there is not one problem but a multiplicity of minor problems—that there is no general solution of the major nor even of any of the minor problems.

The prime value of the existing published investigations of monozygotic twins reared apart lies in the necessary presentation of comprehensive materials that can form the basis for discussion of the theoretical and practical problems associated with every interplay of individual and environment. In this spirit, *Newman et al.* observed in the very last sentence of their book: “The data themselves have been presented in sufficient detail to enable workers in the field to evaluate our own interpretation and to seek for more inclusive interpretations of their own. We shall be satisfied if we have succeeded in tracing a few of the threads in the tangled web which constitutes the organism we call man.”

If this quotation can be said to apply to the present investigation, the chief aim of this work has been attained.

EPILOGUE

When re-reading the case histories of these monozygotic twins reared apart from early life, I have quite often been reminded of the novel “The Bridge of San Luis Rey,” published in 1927 by the American author *Thorton Niven Wilder*.

The principal character in the novel is an Italian Franciscan, *Brother*

Juniper, who happened to witness a special accident: the collapse of the bridge of San Luis Rey in Peru in 1714.

A coach was crossing the bridge at the very moment when it collapsed and the five passengers in the coach were killed. While observing this accident, Brother Juniper asked himself: "Why did this happen to those five?" He continued: "If there were any plan in the universe at all, if there were any pattern in human life, surely it could be discovered mysteriously latent in those lives so suddenly cut off. Either we live by accident or die by accident, or we live by plan or die by plan."

Being a religious man, Brother Juniper knew the answer beforehand: this collapse of the bridge was a "sheer Act of God." At that moment he resolved to inquire into the secret lives of those five persons. It seemed to him high time that theology took its place among the exact sciences. What he had lacked hitherto was a laboratory—a proper control. The accident afforded a perfect opportunity to prove his point. He merely wanted to prove his conclusion, historically and mathematically.

He carried out a very careful investigation for the next six years, asking thousands of questions and filling scores of notebooks in his effort to establish the fact that each of the five lives was a perfect whole.

One of Brother Juniper's probands was a young man, Esteban, who had a twin brother, Manuel. Not only were they alike in appearance, but they also had the psychological characteristics of being monozygotic twins. Emotionally they were strongly attached; they shared a common identity toward other people and they had also developed their own language.

The harmonious twin relationship was not disturbed until Manuel fell in love with a girl. Esteban reacted by feeling intensely lonely and he tried to leave his brother. When Manuel realized this, he gave up the girl, preferring to retain the twin relationship. Some psychoanalysts would probably surmise that each twin represented one side of a conflict between conscious, unconscious, homosexual, and heterosexual wishes.

Then Manuel suddenly fell very ill. Becoming delirious he accused Esteban of separating him from his love. The struggle between his feelings ended when he died, but the conflict continued in Esteban, who tried to reunite both twins' personalities in one, viz. by taking over the name of his twin brother. He was finally driven to attempt suicide. He was prevented from actually committing suicide, but then fate provided a solution for him: he became one of the victims of the bridge of San Luis Rey.

To this description of the development of the individuality of monozygotic twins and their separation, it should be added that Wilder himself was a twin and thus a more competent contributor to our knowledge of the psychological aspects of twins brought up together than most twin researchers who, like

myself, are singletons.

Wilder's novel deals with a problem that has occupied mankind from time immemorial: the possibility that the life and death of the human individual is determined by some mysterious power called *destiny* or *fate*. The concept of fatalism has always had a prominent position in the history of religion and has influenced the thinking of philosophers, psychologists, and even natural scientists.

Almost every discussion of the nature-nurture interaction will eventually raise the philosophical problem: is there such a thing as freedom of the will. *Max Born* (who won the Nobel Prize in Physics in 1955) states: "Only two possibilities exist: Either one must believe in determinism and regard free will as a subjective illusion, or one must become a mystic and regard the discovery of natural laws as a meaningless intellectual game." *Samuel Johnson* gives us more consolation when he says: "All theory is against the freedom of will; all experience for it."

The research of Brother Juniper ended with an enormous amount of information on the five probands he studied. Wilder wrote:

In compiling his book about these people, Brother Juniper seemed to be pursued by the fear that in omitting the slightest detail he might lose some guiding hint. The longer he worked the more he felt that he was stumbling among great dim intimations. He was forever being cheated by details that looked as though they were significant if only he could find their setting. So he put everything down on the notion perhaps that if he (or a keener head) re-read the book 20 times the countless facts would suddenly start to move, to assemble, and betray their secret.

Brother Juniper's dilemma is a precise description of the problem I confronted in my investigation of the interaction of the individual and his environment. *Karl Jaspers* (1965) has termed the problem "*Überwältigung durch die Endlosigkeit*" (the conquest over endlessness). [*Karl Jaspers: General Psychopathology*. The University of Chicago Press, 1968.]

"If I write my *case-histories* on the principle that I must lay judgment aside and describe everything, put down all that the patient says, collect everything that can be known, my case-histories will soon become nothing but endless description and if I am too conscientious, they will grow into fat tomes which nobody reads. The mass of irrelevant data cannot be justified by saying that later research workers may look at it from some fresh point of view. Very few facts can be well described without there being some intuitive awareness of their possible meaning. We can only avoid pointless activity of this sort if we start with a vision of what is essential and if we formulate some ideas to govern the collection of our data and its presentation. It is no help to cut the process short with some schema of popular appeal."

"Every true discovery is a conquest over endlessness."

As some researchers do, Brother Juniper started his research with a conclusion and tried to substantiate this conclusion from his material. Wilder hints that some premises were lacking, because he "never knew the central

passion'' of the human individuals he studied.

Like my predecessors who investigated monozygotic twins reared apart, I never reached any general conclusion or definitive solution to the nature-nurture problem.

There is one more difference between Brother Juniper and myself. I have been fortunate so far, whereas Brother Juniper's book fell under the eyes of some judges, was pronounced heretical, and was burned along with its author.